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Editorial Message from the Head of Scientific Committee

Welcome to the Proceedings of the 2nd IPB International Conference on Nutrition and Food 2022 (ICNF 2022) which is published by the Malaysian Journal of Medicine and Health Sciences. Amidst the current global pandemic situation, the conference was successfully organized fully online by the Department of Community Nutrition, Faculty of Human Ecology, IPB University, Bogor, Indonesia on 17 – 18 November 2022.

This conference was aimed to be a platform where academia, researchers, the private sector, and the general audience could get updates on the latest issues in nutrition and food. Recognizing the importance of promoting research and innovation in nutrition and food, we have chosen to focus on "Nutrition and Food Innovation for Better Life" as the theme of the conference this year. The conference speakers, oral presenters, poster presenters, and participants of this conference came from a variety of countries, such as Australia, Indonesia, Malaysia, the Philippines, Thailand, the UK, and the USA.

On behalf of the scientific committee of ICNF 2022, I would like to congratulate all participants who submitted their research papers to the conference, and 90 of them are featured in this issue. The articles covered four main areas: clinical nutrition, community nutrition, food innovation, and sports nutrition. Each of those articles underwent three cycles of a thorough review by two reviewers, to ensure their academic merit and quality. The significant research presented at this conference represents the importance of nutrition and food in improving our quality of life.

I would like to thank the team of reviewers from the Department of Community Nutrition, IPB University, and the Department of Nutrition, Universiti Putra Malaysia for their hard work and commitment to providing valuable input for the authors. Moreover, I would also like to thank the organizing committee of ICNF 2022 and all their supporting partners for ensuring the success of the conference. Finally, I hope that these proceedings serve the need for high-quality research articles in the area of nutrition and food.

Head of the Scientific Committee of ICNF 2022,
Prof. Dr. Ir. Ali Khomsan, MS

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EXTENDED ABSTRACT

Antihypertensive Activity of *Moringa oleifera* Leaves: A Preliminary Meta-Analysis

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SUMMARY

Moringa oleifera (MO) is a popular medicinal plant with a wide range of health benefits. This preliminary meta-analysis aimed to quantitatively summarize the effect of MO leaves on blood pressure (BP). A literature search using several major databases was conducted to find studies evaluating the effect of MO leaves on BP. Five included studies were obtained in humans and animals, respectively. The meta-analysis showed that both in animals and humans MO leaves significantly reduced systolic BP (-1.39 mmHg; -0.81 mmHg, respectively) and diastolic BP (-0.09 mmHg; -1.10 mmHg, respectively). Hence, MO leaves might provide a beneficial effect to prevent hypertension.

Keywords: Blood pressure, Hypertension, Meta-analysis, *Moringa oleifera* leaves

INTRODUCTION

A global report showed that the prevalence of hypertension among men and women was 34% and 32%, respectively (1). Indonesian Basic Health Research 2018 found that 34.1% of adults have hypertension. Hypertension has been reported as the major risk factor for many non-communicable diseases and is responsible for more than 7 million annual deaths (2). American Heart Association recommends dietary intervention as an essential non-pharmacological therapy to control blood pressure (BP). *Moringa oleifera* (MO) leaves are a dietary product rich in flavonoids and a wide range of biological activities (3). Niazinin B, niazimicin and niaziminin A+B isolated from MO have been reported to show hypotensive effect (4). Several experimental evidences have been recently obtained to show the antihypertensive effect of MO. However, some others found lack of effectiveness. Therefore, this study aimed to summarize the effect of MO leaves on BP in experimental studies.

MATERIALS AND METHODS

A literature search (2011-2021) was performed using several major databases including PubMed, Springer, ScienceDirect, Hindawi, ResearchGate, Elsevier, and MDPI to identify all relevant trials assessing the effect of MO leaves on BP. The keywords used included "Effect of *Moringa oleifera* leaves on blood pressure', 'Effect of *Moringa oleifera* leaves on hypertension', 'antioxidant', and 'bioactive component'. The inclusion criteria were that the articles are in English, they provide data of mean and standard deviation of systolic and/or diastolic BP, and MO leaves were used as the only treatment. Two investigators independently screened the studies by evaluating the title and abstract for inclusion. Non-experimental studies and duplications were excluded. Two investigators autonomously completed deep examination to obtain the included studies for meta-analysis. Data were extracted and tabulated following categories: experimental object, preparation, dosage, duration, and origin. The effect size was determined separately between animal and human studies by calculating a Hedges' d effect size.

RESULTS AND DISCUSSION

The literature search initially identified 187 potential studies. A total of 103 literatures were excluded due to duplication, not in full-text, and irrelevant to the present meta-analysis. The remaining 84 literatures were analyzed carefully and then a total of 74 literatures were excluded for some reasons, including irrelevant study design, missing data, and MO leaves not as a single treatment. Thus, 10 articles were ultimately selected for meta-analysis. The results demonstrated a high variation of the selected studies. A total of 10 studies were included (Table I). From the included studies, 5 studies were performed on humans, 4 studies on rats and 1 study on rabbits. We found various types of MO preparation, including juice, aqueous extract, methanol extract, capsule, powder and boiled. Wide variation in dosage and duration of intervention were also found, where the shortest duration was 1 day and the longest was 30 days.

Table I: List of included studies

Study Code	Design	Object	Preparation	N treatment/ control	Dose/day	Duration [day(s)]	Country
1	-	Rabbits	Ae.	3/3	300 mg/ bw.	21	Nigeria
2	Non-RCT	Humans	Juice	20/20	150 ml	30	India
3	Non-RCT	Humans	Ae.	30/15	57 mg/ bw.	1	Nigeria
4	-	Rats	Ae.	6/6	0.3 mg/ kg (i.v)	1	Thailand
5	RCT	Humans	Capsule	16/16	8 g	28	Thailand
6	-	Rats	Me.	6/6	25 mg	1	Philippine
7	-	Rats	Ee.	7/7	40 mg	7	China
8	Single-blind RCT	Humans	Boiled	23/18	120 g	1	Mauritius
9	-	Rats	Me.	6/6	4% of diet	21	Nigeria
10	RCT	Humans	Powder	16/16	30 mg/ bw.	14	Nigeria

N : number of human subjects or experimental animals
A, M, E, e : aqueous, methanol, ethanol extract
RCT : randomized controlled trial

Despite the wide variation of selected studies, we successfully found that both in animal and human studies there was a significant reduction in systolic (d_(++) ± 95% CI, -1.39 ± 0.38, - 0.81 ± 0.34, respectively) and diastolic BP (d_(++) ± 95% CI; - 0.09 ± 0.53; - 1.10 ± 0.41, respectively) compared to the control group (Table II). However, the effect of MO leaves on diastolic BP in animal studies was less remarkable. The BP-lowering action might be associated with the bioactive components of MO leaves, through antioxidant activity, inhibition of angiotensin-converting enzyme (ACE) and arginase activities, and up-regulation of endothelial nitric oxide synthase expression (5). Our literature review also found that MO contains high content of nutrients, including 29.4 g protein, 12.5 g fiber, 15.8 mg vitamin C, 2185 mg calcium, 1236 mg phosphorus, and 25.6 mg iron per 100 g.

Table II: Cumulative effect size of *Moringa oleifera* leaves on controlling blood pressure

Trial code	Effect size	
	SBP (mmHg)	DBP (mmHg)
Animal		
1	- 34.77 ± 5.40	-
4	- 0.80 ± 0.38	- 2.94 ± 0.47
6	-	- 1.65 ± 0.46
7	- 0.91 ± 0.47	2.29 ± 0.57
9	- 2.76 ± 0.37	9.10 ± 0.85
Cumulative effect size () ± 95% CI	- 1.39 ± 0.38	- 0.09 ± 0.53
Human		
2	- 2.03 ± 0.55	- 1.61 ± 0.53
3	- 0.80 ± 0.51	- 0.75 ± 0.51
5	- 0.33 ± 0.35	- 0.60 ± 0.36
8	- 0.82 ± 0.32	- 1.54 ± 0.35
10	- 0.77 ± 0.36	-
Cumulative effect size (d_{++}) ± 95% CI	- 0.81 ± 0.34	- 1.10 ± 0.41

SBP : Systolic blood pressure; DBP : Diastolic blood pressure

CONCLUSION

This preliminary meta-analysis indicates that *Moringa oleifera* leaves significantly reduce blood pressure both in animal and human studies. However, further meta-analysis involving larger evidence with standardized preparation and rigorous design is strongly recommended. Additionally, the present study suggests that *Moringa oleifera* leaves are a great source of fiber, calcium, and iron.

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EXTENDED ABSTRACT

Comparing the Effects of Standard RUTF and Modified RUTF on the Nutritional Status of Severe Acute Malnutrition Children: A Meta-Analysis

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SUMMARY

Ready-to-Use Therapeutic Food (RUTF) is used as one of the therapies used in Severe Acute Malnutrition (SAM) children. RUTF, apart from being available in the WHO Standards, has also been modified according to a country's preferences and local food. This study compares the impact of standard RUTF and modified RUTF on the nutritional status of SAM. In this meta-analysis, out of 3,554 SAM studies, accessed from Science Direct, Google Scholar, PubMed, and Cochrane, 25 studies met the selection criteria. The result indicated that modified RUTF significantly increases of rate weight, height, and MUAC per day of children with SAM.

Keywords: Meta-analysis, Nutritional status, Ready-to-use Therapeutic food, Severe acute malnutrition children

INTRODUCTION

Malnutrition in children U5 years is a global health problem. At least 60 million children in the world experience SAM. SAM refers to children with very low weight-for-height (≤3 SD z-scores of the WHO median growth standard). In fact, SAM is the most common disease found in maternal and child hospitals. Ironically, 25-30% of children under five die from SAM while hospitalized in many developing countries. Ready-to-use therapeutic Food (RUTF) is a therapeutic food designed for the rehabilitation of SAM toddlers who do not have complications. Currently, RUTF is available in several types: WHO standard RUTF, modified RUTF, and RUTF from local food. In general, the purpose of this systematic review is to find out whether the modified RUTF has the same impact as the standard RUTF from WHO.

MATERIALS AND METHODS

The method used in the meta-analysis study refers to the standard PRISMA guidelines (1). Four websites were used to search related journals, namely: www.sciencedirect.com; www.ncbi.nlm.nih.gov/; www.cochranelibrary.com/; and www.scholar.google.com. The list of search results was then identified and adjusted according to the study criteria.

Study criteria: The selected studies are studies that have subjects aged from 6 to 59 months with SAM status, have good taste, and are not suffering from an illness (complications); published in English; the journal used the peer-reviewed stage; directly compare standard RUTF and Modified RUTF. Children under five are categorized as SAM if they have at least 1 criterion (2), namely: 1) having a Z score of weight-for-height <-3; 2) Upper Arm Circumference (MUAC) <115 mm; 3) maximal edema nutritional status. Out of 3,554 studies on SAM obtained from the sites, 25 studies met the selection criteria considered for meta-analysis with Hedges'd effect size method (3).

RESULTS AND DISCUSSION

The search for related journals was carried out using the following keywords: Malnutrition; Severe Acute Malnutrition; SAM; RUTF; Ready-to-use therapeutic food. There were two main outcome categories of interest for this study to assess the efficacy of RUTF on the indicator Weight gain recovery (rate of weight gain) and anthropometry indicator (WHZ, MUAC, WAZ, and HAZ).

The database search on 9 March 2022 yielded 3,554 abstracts, which were narrowed down to 3,515 abstracts after matched abstracts were drop out (figure 1). Overall, the study analyzed 25 studies from 18 selected journals. There are several journals that collect efficacy data in several stages (eg 2 weeks, 4, weeks, and 8 weeks), so

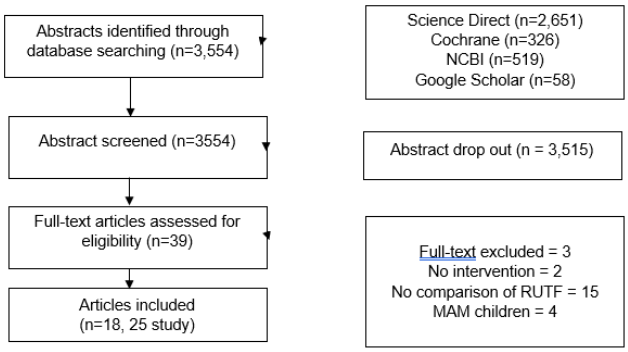

Fig. 1: Flow chart diagram of articles included and excluded in this systematic review of RUTF; SAM

that it can be made into several studies, with a different studies code (4). Of the 9 anthropometric indicators, it is known that the provision of RUTF on 6 of them does not have a significant impact. The other results, Modified RUTF significantly increases Rate of Weight, rate of Height/Length, and rate of MUAC per day, in children with SAM. The variable rate of weight was found in 24 studies with an SMD (Standardized Mean Differences) value of 0.110 (CI 0.048; 0.172) (Figure 2). The variable length/high was found in 5 studies with an SMD value of -0.115 (CI -0.205; -0.025) (Figure 2). The MUAC/day variable was found in 10 studies with an SMD value of -0.173 (CI -0.256; -0.090) (Figure 2). The variable rate

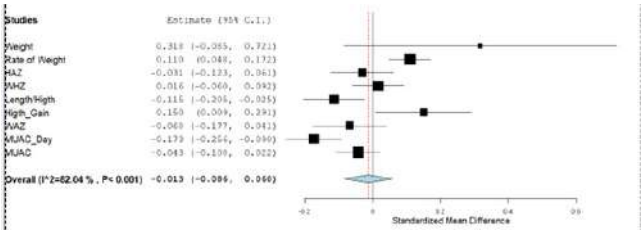

Fig. 2: SMD Value of Meta-analysis of RUTF efficacy of Anthropometry outgrowth

of weight, length/height, and MUAC are anthropometric indicators that are quite sensitive to short-term growth (5). Rate of weight and anthropometry are representative indicators of more significant outcomes such as child health and development (5).

CONCLUSION

Modified RUTF and standard RUTF are proven to improve nutritional status in SAM. Modified RUTF tends to improve the nutritional status of SAM based on the weight, length, and MUAC indicators. We suggest for future RUTF studies to highlight not only anthropometric measurements but also child development.

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EXTENDED ABSTRACT

The Effect of Powdered Young Coconut Drink on Organ Weight and Lipid Profile of Experimental Diabetic Rats

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SUMMARY

Powdered young coconut drink (PYCD) contains bioactive compounds that may improve diabetes mellitus (DM). This research assessed the effect of PYCD on organ weight and lipid profile in 50 mg/kg *streptozotocin*-induced diabetic rats. Thirty *Sprague-Dawley* male rats were separated into normal control; diabetic control; and diabetic treated with 0.6 mg/kg glibenclamide, 3.5 g/kg PYCD, and 7 g/kg PYCD. Administration of 3.5 and 7 g/kg PYCD for 45 days significantly increased liver and pancreas weight. Furthermore, it tended to decrease cholesterol and VLDL levels and increased HDL levels. Therefore, PYCD could improve organ weight and lipid profile in DM.

Keywords: Diabetes mellitus, Lipid profile, Organ weight, Powdered young coconut drink, *Streptozotocin*

INTRODUCTION

The International Diabetes Federation (2021) reported that 537 million people suffered from diabetes mellitus (DM). Coconut is potential for DM management. Unfortunately, coconut water and flesh are highly perishable and need to be processed to prolong their shelf life as well as maintain their composition (1) and health effects. This study utilizes a new product, powdered young coconut drink (PYCD) from a combination of young coconut water and coconut flesh processed by freeze-drying (1,2). Our preliminary study showed that the PYCD has a hypoglycemic effect and could maintain the body weight of diabetic rats (unpublished). Improvement of DM conditions is not only shown by blood glucose, it should also be proven by improvement in organ weight and lipid profile since the enhanced catabolic process in DM affects these two parameters (3,4). Therefore, this study assessed the effect of PYCD on organ weight and lipid profile in *streptozotocin* (STZ)-induced diabetic *Sprague Dawley* rats.

MATERIALS AND METHODS

The PYCD was made from water and flesh of 6 month-old hybrid coconut by freeze drying (1). The experiment used 30 adult Sprague-Dawley male rats 3-4 months (250-300 g) that were divided into five groups (normal control (NC), diabetic control (DC), diabetic treated with glibenclamide (0.6 mg/kg) (DG), diabetic treated with PYCD 3.5 g/kg (DPC3.5), and diabetic treated with PYCD 7 g/kg (DPC7). PYCD was given in solid form by voluntary feed intake. Intraperitoneal injection of 50 mg/kg STZ induced diabetic condition after 72 h (fasting blood glucose (FBG) >200 mg/dL). The organ weight (liver, kidney, pancreas) and lipid profile (cholesterol (CHO), triglyceride (TAG), high-density lipoprotein (HDL), very low-density lipoprotein (VLDL)) were determined at Day 45. The protocol was approved by the Institute for Research and Community Services IPB University, No. 184-2020 IPB. Data analysis was performed using ANOVA followed by Duncan's test ($P < 0.05$).

RESULTS AND DISCUSSION

A previous study showed that the FBG level of DC rats significantly increased (332.67 ± 26.91 mg/dL) after 45 days as compared with the NC rats (91.20 ± 2.13 mg/dL) (unpublished). Hyperglycemia ameliorated the organ weight and lipid profile (3). A significant decrease ($P < 0.05$) in liver and pancreas weight was observed in DC rats when compared with NC rats, in line with a previous study (3). Treatment of diabetic rats with PYCD significantly prevented the reduced weight of the liver and pancreas and was comparable with glibenclamide

Table I: Effect of powdered young coconut drink on organ weight

Group	Organ (g)			
	Liver	Left kidney	Right kidney	Pancreas
NC	10.25 ± 0.55[a]	1.25 ± 0.06[a]	1.25 ± 0.11[a]	1.65 ± 0.39[a]
DC	8.09 ± 0.34[b]	1.05 ± 0.05[a]	1.06 ± 0.05[a]	0.80 ± 0.10[b]
DG	10.15 ± 0.71[a]	1.26 ± 0.097[a]	1.23 ± 0.12[a]	1.14 ± 0.24[ab]
DPC3.5	9.91 ± 0.14[a]	1.15 ± 0.21[a]	1.07 ± 0.06[a]	1.33 ± 0.19[ab]
DPC7	9.82 ± 0.06[a]	1.21 ± 0.07[a]	1.20 ± 0.07[a]	1.16 ± 0.07[ab]

Notes: Values with different superscript letters within a column are significantly different ($P < 0.05$). NC = normal control group; DC = diabetic control group; DG = diabetic group treated with glibenclamide (0.6 mg/kg); DPC3.5 = diabetic group treated with powdered young coconut drink 3.5 g/kg; DPC7 = diabetic group treated with powdered young coconut drink 7 g/kg.

(Table I). However, the treatments did not significantly affect kidney weight ($P > 0.05$). It was assumed that the bioactive compounds in PYCD could prevent necrosis/apoptosis of liver and pancreatic cells caused by STZ toxicity (3,4).

In this study, there were no significant differences in the serum lipid profile among all the groups ($P > 0.05$) (Table II). This could be attributed to the short experimental period. However, the DC rats showed a trend of higher CHO and VLDL concentrations and a reduced HDL level compared with NC rats. During the treatment of 45 days, there was no significant reduction in cholesterol and VLDL as well as an increased level of HDL in treated diabetic rats ($P > 0.05$) (Table II). Lipid profile abnormalities are one of the most typical DM consequences (4). Higher serum total CHO and TGA concentrations in DM may be attributed to impaired CHO catabolism or insufficient insulin and lipolysis-induced mobilization of fatty acids from adipose tissue. (5). The PYCD administration in this study had a positive trend in the general lipid profile and was thought to be caused by the bioactive compounds to prevent lipid catabolism.

Table II: Effect of powdered young coconut drink on lipid profile in diabetic rats

Group	Lipid profile (mg/dL)			
	CHO	TAG	HDL	VLDL
NC	50.92 ± 3.99[a]	86.23 ± 6.03[a]	40.25 ± 5.26[a]	17.74 ± 1.52[a]
DC	66.14 ± 6.22[a]	79.67 ± 1.43[a]	38.50 ± 1.32[a]	18.11 ± 2.75[a]
DG	56.34 ± 6.09[a]	70.84 ± 1.21[a]	44.20 ± 5.56[a]	13.93 ± 2.43[a]
DPC3.5	55.72 ± 3.37[a]	86.70 ± 3.34[a]	41.20 ± 1.74[a]	17.93 ± 1.58[a]
DPC7	57.33 ± 5.54[a]	65.15 ± 1.28[a]	42.80 ± 3.44[a]	12.92 ± 2.51[a]

Notes: Values with different superscript letters within a column are significantly different ($P < 0.05$). NC = normal control group; DC = diabetic control group; DG = diabetic group treated with glibenclamide (0.6 mg/kg); DPC3.5 = diabetic group treated with powdered young coconut drink 3.5 g/kg; DPC7 = diabetic group treated with powdered young coconut drink 7 g/kg.

CONCLUSION

The PYCD could prevent the reduction of liver and pancreas weight and show a generally positive trend in lipid profile of diabetic rats. These effects were comparable to glibenclamide as a standard drug for DM. Furthermore, studies with histopathological analysis would be beneficial to observe the protective effect of PYCD.

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EXTENDED ABSTRACT

Lifestyle Factors Associated with Blood Glucose Level of Type 2 Diabetes Mellitus Patients in Pekanbaru City, Riau Province, Indonesia

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SUMMARY

Identifying the risk factors of type 2 diabetes mellitus (T2DM) is essential for prevention. A cross-sectional study was conducted to analyse the correlation of lifestyle, nutritional status, and blood pressure with blood glucose of T2DM patients in Pekanbaru City. Forty T2DM patients with no complications were enrolled from two Community Health Centres. Energy and carbohydrate adequacy levels and blood pressure were positively correlated with blood glucose level. There was no significant correlation between other lifestyle factors and nutritional status with blood glucose level. Energy and carbohydrate intake should be monitored carefully in T2DM patients. Implementation of a healthy lifestyle should be emphasised.

Keywords: Blood glucose, Consumption pattern, Lifestyle, Nutritional status, T2DM

INTRODUCTION

As a result of an unhealthy lifestyle, the prevalence of type 2 diabetes mellitus (T2DM) has increased over the last three decades (1). The prevalence of T2DM in Riau Province (1.9%) is comparable to the national prevalence (2%) (2). Identifying risk factors for T2DM is critical for developing preventative measures. This study aimed to analyse the correlation of lifestyle, nutritional status, and blood pressure with blood glucose levels in T2DM patients in Pekanbaru City.

MATERIALS AND METHODS

A cross-sectional study involving 40 T2DM patients was conducted in March-May 2018 in Simpang Tiga and Harapan Raya Community Health Centres. Subjects were selected purposively with the following inclusion criteria: patients diagnosed with T2DM, age ≤60 years, no complications, and willing to participate in the study. Pregnant and lactating women were excluded. Lifestyle factors included smoking, alcohol and caffeine consumption, physical activity, and food consumption. Semi-quantitative food frequency questionnaire and one-day 24-hour recall were used to assess food consumption. Weight, height, and waist circumference were measured for nutritional status. Physical activity was determined by physical activity level questionnaire. Random blood glucose was measured using test strips, while blood pressure was measured by a digital sphygmomanometer. Data were analysed using descriptive statistics and Spearman correlation test.

RESULTS AND DISCUSSION

Most subjects were ≥45 years old (92.5%), female (65%), and housewives (45%). They had education more than high school (62.5%) and monthly wages more than the city's standard (IDR 2,352,577 or ~USD 160) (62.5%). Based on BMI calculation, 52.5% were obese, while 85% had central obesity. Most subjects had uncontrolled T2DM (85%) as their random blood glucose was ≥200 mg/dL. More than half of the subjects had hypertension (55%). Two-thirds of the subjects never smoke (65%). Almost all subjects consumed caffeine (92.5%), but only one subject had ever consumed alcohol. Half of the subjects (50%) had light physical activity. Most subjects had deficit energy (55%), protein (70%), fat (50%), carbohydrate (50%), and fibre (95%).

Table I shows that energy (p=0.032, r=0.340) and carbohydrate adequacy levels (p=0.043, r=0.321) were positively correlated with blood glucose level. Blood glucose regulation is significantly and clinically affected by dietary components. Dietary carbohydrates had an effect on glucose metabolism, which was related to the amount of carbohydrate ingested and the type of carbohydrate (3).

A positive correlation was observed between blood

Table I: The correlation of lifestyle factors, nutritional status, and blood pressure with random blood glucose level

Variables	p	r
Smoking	0.125	-0.247
Alcohol consumption	0.680	-0.067
Caffeine consumption	0.462	-0.121
Physical activity level	0.576	-0.910
Exercise frequency	0.142	-0.236
Adequacy level of energy	0.032*	0.340
Adequacy level of protein	0.122	0.249
Adequacy level of fat	0.063	0.297
Adequacy level of carbohydrate	0.043*	0.321
Adequacy level of fibre	0.278	0.176
BMI	0.911	0.018
Waist circumference	0.985	-0.030
Blood pressure	0.024*	0.356

*) Spearman Correlation Test, p<0.05.

pressure and blood glucose level (p=0.024, r=0.356). A study in a rural Nigerian community also found that blood pressure indices were positively correlated to random blood glucose (4).

However, no significant correlation was found between the other lifestyle factors and nutritional status with blood glucose level (p>0.05). In general, subjects in this study had similar lifestyle habits and nutritional status. Lifestyle modification remains to be one of the first-line approaches for T2DM management (1).

CONCLUSION

Energy and carbohydrate adequacy levels and blood pressure were positively correlated with blood glucose level. Energy and carbohydrate intake should be monitored carefully in T2DM patients. Implementation of a healthy lifestyle such as healthy eating habits, regular exercise, and maintenance of normal nutritional status and blood pressure should also be emphasised.

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EXTENDED ABSTRACT

Interactions of Lipoprotein Lipase and Cholesteryl Ester Transfer Protein Gene Polymorphisms-Dietary Intake on Lipid Traits: A Review of Nutrigenetic Studies on Asian Indians

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SUMMARY

Asian Indians have a dramatically high prevalence of multifactorial diseases that are influenced by the interplay of genetics and diet, which leads to abnormal lipoprotein metabolism. Lipoprotein lipase (LPL) and cholesteryl ester transfer protein (CETP) polymorphisms have been reportedly linked to lipid-related outcomes. In this review, the interaction of such genes-diet in lipid profiles among Asian Indians is examined. The reviewed published studies were obtained from online databases (PubMed and Google Scholar). Three studies (2 cross-sectionals and 1 population-based) showed a significant interaction of LPL and CETP genes with lipid traits in different quantities of dietary fat among Asian Indians.

Keywords: Asian Indians, Cholesteryl ester transfer protein, Dietary fat, Lipoprotein lipase, SNPs

INTRODUCTION

Asian Indians are susceptible to heart diseases and type 2 diabetes mellitus (T2DM) owing to the 'Asian Indian phenotype,' distinguished by higher insulin resistance, dyslipidaemia, and central obesity. The onset of those diseases is linked to abnormal lipid metabolism. CETP is primarily expressed in adipose tissue and facilitates the movement of triglycerides (TG) and cholesteryl esters between apolipoprotein B-containing lipoproteins and high-density lipoprotein (HDL), while LPL is involved in the genesis of dyslipidaemia and obesity by distributing lipids across various tissues. Consequently, single nucleotide polymorphisms (SNPs) in the CETP and LPL genes interacting with dietary patterns affect lipid concentrations (1,2). This review aimed to examine the LPL and CETP genes associated with lipid traits and the interaction of those genes with dietary factors in the Asian Indian population, a subgroup population which is inadequately investigated.

MATERIALS AND METHODS

PubMed and Google Scholar databases were used for the literature search by combining MeSH phrases, truncation, and Boolean operators. The inclusion criteria were gene-diet interaction studies, including the LPL and CETP genes as the exposure, lipid traits and types of nutrients as the outcomes, Asian Indian descents (all ages and both genders), and study designs on human observation and nutritional intervention. Additionally, only original studies published in English from the earliest indexing date until March 2022 were evaluated.

RESULTS AND DISCUSSION

The search identification yielded 139 records, of which 92 were excluded in the screening phase. According to the criteria for inclusion and exclusion, the removal of 44 records due to in vivo and in vitro analysis, T2DM- and obesity-related outcomes, other than LPL and CETP genes, resulted in three gene-diet interaction studies. According to Table I, a cross-sectional study as part of the Chennai Urban Rural Epidemiology Study (CURES) with 1,057 controls and 788 T2DM (aged >20 years) showed a significant interaction between LPL rs1121923 and fat intake modulating HDL level ($P_{interaction}$=0.003). Particularly, minor 'T' allele carriers who had a high-fat diet (28.4±2.5%energy) exhibited higher HDL concentration ($p = 2.0 \times 10^{-4}$) (3). Another cross-sectional

Table I: Interaction studies between LPL and CETP SNPs and dietary fat on lipid traits in Asian Indians

Study type	Sample size	Gene & SNPs	Dietary intake	Trait	β (mmol/L)	Effect (mmol/L)	References
Cross-sectional study	1,845 Asian Indians	LPL rs1121923	High fat	HDL	-	1.2 ± 0.3	(3)
Cross-sectional study	3,342 Indians	CETP rs3764261	High fat	TC LDL	0.085±0.041 0.097±0.041	-	(4)
Population-based study	588 Asian Indians, 761 Malays, and 2,858 Chinese	CETP rs708272	Low cholesterol	HDL	1.218±0.036	-	(5)

investigation on 1,671 Indians sibling pairs (mean age of 39.99 years) from Indian Migration Study (IMS) revealed a significant interaction of CETP rs3764261 'A' allele and high-fat diet (≥76.98 g/day) in elevating low-density lipoprotein (LDL) ($P_{interaction}$=0.042) and total cholesterol (TC) level ($P_{interaction}$=0.018) (4). Furthermore, the National Health Survey (NHS) population-based study in three ethnic groups (aged 18-69 years) reported a substantial interaction of CETP TaqIB among 'A' allele and cholesterol intake (men and women of 103 and 91 mg/day/1,000 kcal, respectively) in raising HDL level (Pinteraction=0.023) (5).

CONCLUSION

Despite the limited numbers, nutrigenetic studies among Asian Indians showed a significant interaction between LPL and CETP SNPs-dietary fat. Larger Asian Indian studies that consider different types of fat and total energy intake are essential, particularly for genetically susceptible individuals with adverse lipid responses to diet before establishing personalised dietary recommendations.

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EXTENDED ABSTRACT

The Effect of Probiotic Intake on Metabolic Syndrome: A Meta-Analysis

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SUMMARY

This meta-analysis aimed to assess the effect of probiotic intake on individuals with metabolic syndrome. The articles were obtained from the PubMed database. From 526 identified articles, 11 studies were selected for further data analysis using Hedges effect size. The result revealed that probiotics intake is significantly associated with reduced body mass index (MD: -0.546, 95% CI -0.824 to -0.268, p<0.001), and blood pressure. Probiotic intake was found to have no effect on glucose, insulin sensitivity, HDL, LDL, and total cholesterol. This study suggests that probiotics may have a beneficial effect in lowering our BMI.

Keywords: Body mass index, Meta-analysis, Metabolic syndrome, Probiotic

INTRODUCTION

Metabolic abnormalities, which include central obesity, low HDL-cholesterol, high LDL-cholesterol, blood pressure, and insulin resistance, are the characteristics of metabolic syndrome which might lead to the development of various non-communicable diseases. Several studies have described the beneficial effect of probiotics on controlling the blood glucose and regulating the insulin hormone. Lactobacillus and Bifidobacterium are effective in changes of gut microbiota, improving insulin signaling, and modulating chronic inflammation(1). Gut microbiota prevents obesity, insulin resistance, hyperlipidemia, hypercholesterolemia, and nonalcoholic fatty liver disease (2). However, the recommendation of probiotic intake has not yet been promoted since robust evidence on the role of probiotics in metabolic syndrome prevention is not yet available. The purpose of this meta-analysis was to determine the effect of probiotic intake on individuals with metabolic syndrome.

MATERIALS AND METHODS

The criteria for study inclusion are based on PICOS (population, intervention, comparison, study design). The population encompasses adults between 18-65 years old, including men and women who had metabolic syndrome. An intervention group received a probiotic, which included a kind of lactic acid bacteria or mixed bacteria. For the group for comparison, the participants received a placebo intake. The study design of meta-analysis is RCTs, which were published between 2017 and 2021. A study selection was conducted to screen the titles and abstracts of the retrieved articles for possible inclusion. The authors extracted data from the full-text articles by the mean and standard deviation of the relevant outcome category. The primary outcome contains at least one variable involving waist circumference, BMI, fasting glucose level, total cholesterol, LDL-cholesterol, HDL-cholesterol, blood pressure, and insulin. The risk of bias was assessed for methodology quality through CochraneRoB2.0 including five domains. Furthermore, data analysis used Hedges' effect size.

RESULTS AND DISCUSSION

The criteria for study inclusion are based on PICOS (population, intervention, comparison, study design). The population encompasses adults between 18-65 years old, including men and women who had metabolic syndrome. An intervention group received a probiotic, which included a kind of lactic acid bacteria or mixed bacteria. For the group for comparison, the participants received a placebo intake. The study design of meta-analysis is RCTs, which were published between 2017

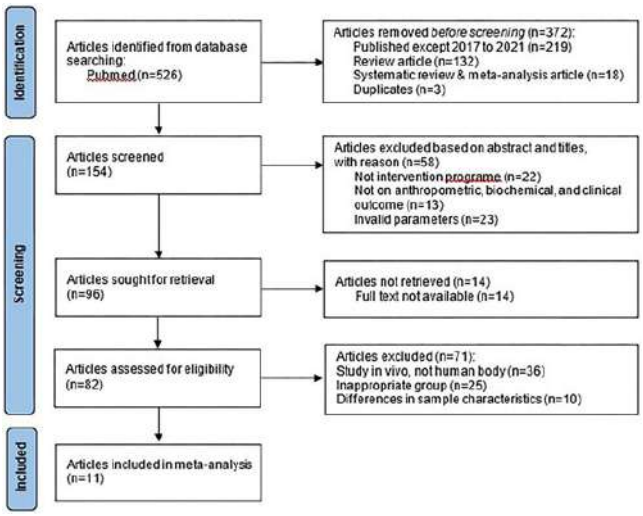

Fig.1: PRISMA diagram of the study search

and 2021. A study selection was conducted to screen the titles and abstracts of the retrieved articles for possible inclusion. The authors extracted data from the full-text articles by the mean and standard deviation of the relevant outcome category. The primary outcome contains at least one variable involving waist circumference, BMI, fasting glucose level, total cholesterol, LDL-cholesterol, HDL-cholesterol, blood pressure, and insulin. The risk of bias was assessed for methodology quality through CochraneRoB2.0 including five domains. Furthermore, data analysis used Hedges' effect size.

The eleven studies comprised 8 randomized double-blind, 1 study was randomized triple-blind, and 2 studies were not blinded specifically. The duration of intervention in the studies was between 4 to 30 weeks. The number of participants was 630 adults with metabolic syndrome, insulin resistance, overweight, hypertension, and schizophrenia or bipolar disorder. The studies intervened probiotics in the form of capsules or fermented. Placebo varied in the studies, the majority being maltodextrin. Their strain of probiotics included Lactobacillus, Bifidobacterium, Streptococcus, and Enterococcus. Doses of probiotics ranged from 10^6 to 10^9cfu/day, equally fermented milk doses 300ml.

There was significant reduction in BMI (MD: -0.546 kg/m^2; 95% CI: -0.824 to 0.268 kg/m^2), systolic blood pressure (MD: -1.669 mmHg; 95% CI: -3.158 to -0.179 mmHg), and diastolic blood pressure (MD: -0.610 mmHg; 95% CI: -1.177 to -0.043 mmHg). Probiotic intake could reduce weight gain associated with positive regulation of the gut microbiota, which produces the

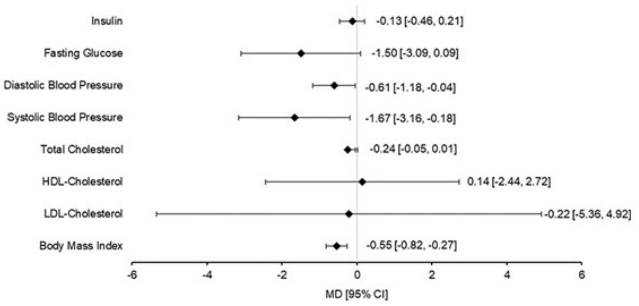

Fig.2: Forest plot of effect size and 95% confidence intervals for the effect of probiotic intake on parameters

metabolites and the inflammatory control processes related to obesity(3). Overall, the meta-analysis showed that there was no significant effect of the probiotic intake on LDL-cholesterol, HDL-cholesterol, total cholesterol, fasting glucose, and insulin compared to the placebo (Fig.2).

CONCLUSION

Our findings suggest that probiotic intake is related to a reduction in BMI and blood pressure. Probiotic treatment might reduce body weight gain, including decreasing adiposity. Future therapeutic approaches are needed to confirm the effect of probiotics on the improvement of glucose intolerance and blood lipid abnormalities.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Weight Loss in COVID-19 Patients and its Relationship with Appetite Level and Energy Intake during Hospitalization

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SUMMARY

COVID-19 patients tend to experience significant weight loss and a decrease of 'appetite which can result in weight loss. This study evaluates the relationship between energy intake, macronutrients, and appetite with changes in the body weight of COVID-19 patients. The study employed the cross-sectional approach. Data on nutrient intake were collected using 24-hour recall; appetite levels were measured using the Simplified Nutritional Appetite Questionnaire (SNAQ). There was a significant relationship between weight loss and energy intake during hospitalization. Weight loss was caused by a decrease in the level of appetite, resulting in a deficit of energy intake.

Keywords: Appetite level, COVID-19, Energy intake, Weight loss

INTRODUCTION

Weight loss in COVID-19 patients is likely to occur due to several factors. First, in critical and severe COVID-19 patients, SARS-CoV-2 infection can cause significant inflammation. (1). Second, decreased food intake will lead to malnutrition and diseases contributing to tissue wasting (2). In addition, dyspnea, dysgeusia, anosmia, anorexia, dysphagia, nausea, vomiting, and diarrhea may contribute to cachexia in COVID-19 patients. Third, immobilization may contribute significantly to muscle wasting and sarcopenia in COVID-19 patients (3). Patients with COVID-19 who suffer from nutritional and metabolic problems can experience weight loss (4). Providing the needed nutritional intake is one of the efforts to handle COVID-19 patients. However, little is known regarding the impact of COVID-19 on body weight changes and the causative factors. This study aimed to examine the relationship between appetite levels and energy intake with body weight changes in COVID-19 patients during hospitalization.

MATERIALS AND METHODS

The study employed the cross-sectional approach. The study was conducted at Pulmonary Hospital Karawang Regency from November to December 2021. The sample in this study included 25 samples. Inclusion criteria were hospitalized patients diagnosed with COVID-19 without comorbidities, willing to be a respondent, and cooperative. The exclusion criteria were that the patient had a physical disorder or was in a weak condition. The respondents were monitored during hospitalization (7-10 days). Data on nutrient intake were collected through 24-hour recall every day; appetite levels were measured using the Simplified Nutritional Appetite Questionnaire (SNAQ). Body weight was measured twice, before and after hospitalization. Adequate levels of energy, protein, carbohydrates, and fat were grouped into two groups, namely adequate (≥90% RDA) and inadequate (<90% RDA). Data analysis was performed with chi-square analysis.

RESULTS AND DISCUSSION

The distribution of the respondents' characteristics is shown in Table I; more than half of the respondents were male (64%), and the age g was between 46 and 55 years (60%). The length of stay of the respondents in the hospital for seven days was approximately 76%.

Table II shows that 88% of the respondents had weight loss. Table III shows a significant relationship between the level of energy adequacy and appetite level with weight loss ($p<0.05$).

Weight loss and the risk of malnutrition are prevalent in COVID-19 patients. Weight loss that occurs in patients is caused by a decrease in appetite, which results in decreased energy intake. Decreased appetite can be caused by loss of taste. In addition, the patients experienced fear and sadness which reduce their desire

Table I: Distribution of respondents' characteristics

Variables	n	Percentage (%)
Gender		
Male	16	64
Female	9	36
Age		
18-35 years	8	32
36-45 years	2	8
46-65 years	15	60
Length Stay		
7 Days	19	76
10 Days	6	24

Table II: Body weight of respondents

Body weight	n	Percentage (%)
Body weight		
Weight loss	22	88
No weight loss	3	12

Table III: Relationship between energy intake, macronutrients, and appetite with weight loss

Intake	Weight loss		No Weight Loss		p
	n	%	n	%	
Energy					
Inadequate	22	88	2	8	0.006*
Adequate	0	0	1	4	
Protein					
Inadequate	21	84	2	8	0.085
Adequate	1	4	1	4	
Fat					
Inadequate	21	84	2	8	0.085
Adequate	1	4	1	4	
Carbohydrate					
Inadequate	21	84	3	12	0.706
Adequate	1	4	0	0	
Appetite					
Decreased	22	88	2	8	0.006*
Normal	0	0	1	4	

to eat (2,4).

CONCLUSION

Weight loss in COVID-19 patients is associated with lower appetite levels and leads to decreased energy intake. Strategies to increase nutrient intake in COVID-19 patients are needed during hospitalization to prevent weight loss. Further studies regarding nutritional intake interventions in COVID-19 patients are needed.

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EXTENDED ABSTRACT

Malnutrition as an Associated Factor of the Sarcopenia Risk using SARC-Calf and SARC-Calf 31 in Oncology Patients Undergoing Chemotherapy

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SUMMARY

Cancer-related sarcopenia is a common condition for cancer patients during chemotherapy. However, studies regarding sarcopenia risk prevalence and associated factors in Indonesia are scarce. This study aims to analyze the prevalence and factors associated with sarcopenia risk. A cross-sectional study involving 267 adult patients with cancer receiving IV chemotherapy at Kariadi General Hospital, Indonesia, was conducted. Malnutrition had a relationship with SARC-Calf (p=0.001) and SARC-Calf 31 (p=0.003). This study concludes that malnutrition strongly correlates with the sarcopenia risk. Therefore, screening for sarcopenia is vital in this population.

Keywords: Cancer, Chemotherapy, Malnutrition, Sarcopenia risk

INTRODUCTION

Sarcopenia is defined as the loss of muscle mass and strength influencing physical performance (1). As the loss of muscle mass is also indicates malnutrition, malnutrition can be linked to sarcopenia risk. Moreover, the negative impacts of malnutrition and sarcopenia in cancer patients are almost similar, including increased morbidity, mortality, and decreased quality of life (1, 2). Despite the importance of screening, diagnosing, and treating sarcopenia in cancer patients, studies regarding sarcopenia are scarce in Indonesia. Therefore, the objective of this study is to determine the prevalence of sarcopenia risk, the agreement between sarcopenia screening tools, and factors related to sarcopenia risk in cancer patients undergoing chemotherapy in Indonesia.

MATERIALS AND METHODS

An observational study with a cross-sectional design was performed at Kariadi General Hospital, Semarang, Indonesia, from March to April 2022. A total of 267 patients aged 19 years or older undergoing intravenous chemotherapy were recruited as subjects and assessed within the first 24 hours of admission. Nutritional status and physical activity were based on PG-SGA (Patient-Generated Subjective Global Assessment). Screening of sarcopenia was performed utilizing SARC-Calf, SARC-Calf 31, and SARC-F screening tools. The cut-off points of Calf Circumference (CC) used in the SARC-Calf was a value under 34 cm for men and 33 cm for women, while SARC-Calf 31 of CC value was below 31 cm for both genders. The variables that showed p-value equal to less than 0.25 in the Chi-squared test were included in the Binary Logistic regression.

RESULTS AND DISCUSSION

This is the first study to evaluate factors related to sarcopenia risk and agreement between sarcopenia screening tools for cancer patients with chemotherapy in Indonesia. About 58.1%, 18.7%, and 85.1% of the participants were female, elderly and malnourished, respectively. According to SARC-F, SARC-Calf 31, and SARC-Calf (33 and 34), 18.4%, 33.3%, and 44.2% of the patients were identified with sarcopenia risk, as described in figure 1. There is a difference in sarcopenia risk between the three tools in this study, whereas SARC-Calf is found to have the greater risk of sarcopenia, followed by SARC-Calf 31. As expected, SARC-Calf is a more sensitive instrument than the others two (2, 3). Moreover, this instrument has been validated in cancer populations (2). Although there is a substantial agreement between SARC-Calf with different cut-off points of CC in this study, the cut-off point of CC as a sarcopenia screening tool in the Indonesian oncology population has not yet been established.

The bivariate analysis is described in Table II. In multivariate analysis, factors independently associated with sarcopenia risk by SARC-Calf 31 were malnutrition (OR=9.079, 95 % CI=2.08–36.6, p=0.003), elderly (OR= 2.075, 95 % CI=1.054 - 4.08, p=0.035) and female (OR= 2.12, 95 % CI=1.2 – 3.75, p = 0.01). Malnutrition (OR

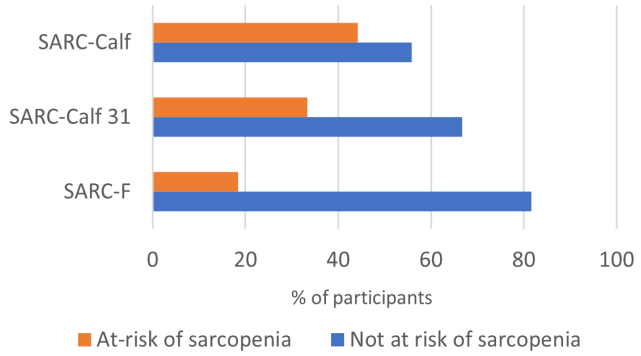

Fig. 1: The Comparison of Sarcopenia Risk Prevalence utilizing SARCCalf, SARC Calf 31 and SARC-F

Table I: Bivariate relationship between gender, age, nutrition status, chemotherapy regimens, activity, tumor location, metastasis status with sarcopenia risk using three tools.

	Patients at risk using SARC-Calf 31	*P-value*	Patients at risk using SARC-Calf	*P-value*	Patients at risk using SARC-F	*P-value*
Gender						
Female	62 (40%)	0.007*	77 (49.7%)	0.034*	30 (19.4%)	0.619
Male	27 (24.1%)		41 (36.6%)		19 (17%)	
Age						
Adult (19-59 years)	66 (30.4%)	0.035*	90 (41.5 %)	0.062	35 (16.1%)	0.051
Elderly (≥ 60 years)	23 (46%)		28 (56 %)		14 (28%)	
Nutrition Status						
Well-nourished	2 (5%)	0.000*	5 (12.5 %)	0.000*	0 (0%)	0.001*
Malnourished	87 (38.3 %)		113 (49.8%)		49(21.6%)	
Chemotherapy Regimens						
Regimen containing ≥ 3 drugs	10 (40%)	0.458	106 (43.8%)	0.687	5 (20%)	0.823
Regimen containing <3 drugs	79 (32.6%)		12 (48%)		44 (18.2%)	
Activity						
Normal	2 (6.9%)	0.001*	2 (6.9 %)	0.000*	0 (0%)	0.007*
low	87 (36.6%)		116 (48.7%)		49 (20.6%)	
Tumour location						
Head and neck cancer	18 (40.9%)	0.243	23 (52.3 %)	0.238	9 (20.5 %)	0.693
Others	71 (31.8%)		95 (42.6%)		40 (17.9 %)	
Metastasis						
Metastasis	29 (35.8%)	0.572	38 (46.9%)	0.555	17 (21%)	0.463
Not metastasis	60 (32.3%)		80 (43%)		32 (17.2%)	

*Associated with sarcopenia risk, *p-value* < 0.05

=5.057, 95 % CI = 1.85-13.8, p=0.001) and activity (OR =8.49, 95 % CI = 1.92–37.5, p=0.005) were significantly associated with sarcopenia risk using SARC-Calf (33 and 34), whilst SARC-F had no association with any factors. Malnutrition is the only variable associated with two screening tools. Ideally, as international guidelines, sarcopenia screening should be incorporated into the standard care of patients with cancer. However, this practice is uncommon in Indonesia. At least, Indonesian Dietitians can screen cancer patients at risk of malnutrition or already malnourished for sarcopenia risk.

Table II: Strength of agreement between sarcopenia screening tools

Sarcopenia screening tools	Kappa statistics	Strength of agreement
SARC-Calf 31 and SARC-Calf	0.77[a]	Substantial Agreement
SARC-Calf 31 and SARC-F	0.28 [a]	Fair Agreement
SARC-Calf and SARC-F	0.31 [a]	Fair Agreement

CONCLUSION

In conclusion, malnutrition is strongly correlated with sarcopenia risk using SARC-Calf and SARC-Calf 31. Thus, screening for sarcopenia in oncology patients undergoing chemotherapy, particularly malnourished patients, should be incorporated into the clinical routine. However, there is a need to validate screening tools for sarcopenia in the Indonesian oncology population.

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EXTENDED ABSTRACT

Lowering Cholesterol Levels by Intervention with the Mixture of Milk Yogurt and Temulawak

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SUMMARY

Milk yogurt and *temulawak* have anti-hypercholesterol potentials. The purpose of this study was to determine the effect of milk yogurt and *temulawak* intervention on total cholesterol levels in hypercholesterolemic rats. The randomized control trial with pre- and post-test design was carried out for 21 days involving four groups of treatment. K0 as control, K1 (50:50), K2 (50: 25), and K3 (25:50). The result shows a significant decrease in cholesterol levels in all groups. This study highlights the potential of mixed milk yogurt and *temulawak* as formulas for lowering cholesterol levels.

Keywords: Lowering cholesterol level, Milk yogurt, Rats, *Temulawak*

INTRODUCTION

RISKESDAS data in 2018 shows that the prevalence of heart disease in Indonesia is 1.5% as the first deadly disease in Indonesia(1). According to WHO data in 2015, the coronary heart disease (CHD) was the most dominant cause of deaths, counting for 44%(2). *Temulawak* contains curcumin as an anti-inflammatory, antioxidant, and antihypercholesterolemic (3). Yogurt contains lactic acid bacteria that have the potential to reduce cholesterol levels because they decrease the β-hydroxy-β-methylglutaryl coenzyme A reductase and increase bile acid and cholesterol excretion.(4) This study aimed to determine the effect of giving milk yogurt and *temulawak* on total cholesterol levels in hypercholesterolemic rats.

MATERIALS AND METHODS

This research is analytical research with experimental design and has a randomized pre-test and post-test with control group design. Approval for this study was obtained from the Commission of the Unimus Faculty of Public Health with the number 588/KEPK-FKM/UNIMUS/2021. This research used 24 rats, which was fed a high fat diet (HF) before divided into 4 treatments for 21 days:

- K0 was given standard feed, namely CP594 with the ad libitum method
- K1 was given the Yosuwak formula at a dose of 50:50 or (2 ml milk yogurt + 20 mg *temulawak* flour)
- K2 was given yosuwak formula at a dose of 50:25 or (2 ml milk yogurt + 10 mg *temulawak* flour)
- K3 was given yosuwak formula at a dose of 25:50 or (1 ml milk yogurt + 20 mg *temulawak* flour

RESULTS AND DISCUSSION

Based on table I, the total cholesterol levels of rats before high-fat feeding were in the normal category, namely 10-54 mg/dL(5). Before the intervention, all groups had hyperolesterolemia. However, after the intervention,

Table I: Description of average and different test results for cholesterol levels

Intervention	Pre HF	Pre Intervention	Post Intervention	Δ	P value**
	Mean±SD	Mean±SD	Mean±SD		
KO	51.07±2.3	80.71±8.86	73.31±10.5	-7.4	0.016
K1	49.19±3.63	74.06±12.8	46.75±9.23	-27.31	0.004
K2	48.06±3.5	69.67±8.78	50.20±6.45	-19.47	0.005
K3	47.16±3.85	72.02±9.18	49.19±8.51	-22.83	0.002
p Value *		0.276		0.015	

* *Anova test* (<0,05 Significant) , ** *Paired t-test* (<0,05 Significant)

the total cholesterol levels of rats decreased. There was a significant difference in the average decrease in cholesterol levels between the 4 treatments with p=0.015 and there was a significant difference in the average cholesterol levels before and after each treatment including in the control group at K0, K1, K2, K3 (p=0.016, p= 0.04, p=0.05, p=0.02). Lactic acid and curcumin can reduce cholesterol levels by increasing the mechanism of the enzyme HMG CoA reductase which competes with HMG CoA whose function is to increase cholesterol synthesis; indirectly, cholesterol synthesis will be inhibited.

CONCLUSION

There was a significant decrease in cholesterol levels in each group. The best dose was at K1 with a dose of 50:50 (2 ml milk yogurt + 20 mg *temulawak* flour) which could reduce 27.31 mg/dl cholesterol levels.

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EXTENDED ABSTRACT

Selection of Extraction Methods for Determination of Total Faecal Bile Acids in Malaysian Adults on a Palm Oil Diet

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SUMMARY

Bile acids are closely related to gut health. Variations in faecal total bile acid (TBA) extraction methods and reporting units convoluted the comparison between studies. This study was conducted to evaluate the effect of different faecal TBA extraction methods, including mechanical, heating, and sequential refluxing using organic solvents, in healthy adults who consume a standard Malaysian diet. The TBA was quantified using an enzyme-spectrophotometric method, and the TBA yield was reported in different units. The sequential reflux method demonstrated the highest TBA yield. However, more attention is needed when comparing the TBA values reported in different units.

Keywords: Enzyme-spectrophotometric method, Palm oil diet, Solvent extraction, Sonication, Total bile acids

INTRODUCTION

Bile acids are crucial metabolites in the regulation of intestinal health, as the accumulation of bile acids alters colonic digestive functions. A high animal fat diet increases the concentration of faecal bile acids, while a vegan diet with high dietary fibre but lower fat shows reverse correlation (1). Data on faecal TBA of healthy adults fed a standard Malaysian diet cooked with palm oil are little. Faecal TBA analysis is tedious and laborious. While researchers focus on cost-effective TBA quantification, less attention is paid to the effects of simplified extraction methods and variations in reporting TBA yield units. We evaluated TBA extraction methods using different solvents, heat, and mechanical processes by varying the weight and incubation period of the assay samples in faecal samples collected from healthy adults who consume a standard Malaysian diet.

MATERIALS AND METHODS

Faecal samples were collected from 12 healthy adults fed a standard Malaysian diet for 2 weeks after approval of the ethics committee (4.16/ JCM-168/2018 (MPOB)). The samples were homogenized, frozen dried, ground, and stored at -80°C, until analysis. Faecal TBA was extracted using methods: (A) 30 min sonication followed by 45 min sequential reflux with solvents (2) on 0.2 g and B) 0.1 g of lyophilized sample, (C) 2-hour incubation of 0.05 g and (D) 1-hour 0.2 g sample in 75% (w/v) ethanol at 50°C (3) and (E) sonication of the 0.1 g sample with solvents for 45 min and (F) 20 min, respectively. The faecal TBA was quantified using the enzyme-spectrophotometric method according to the manufacturer's instructions, and the yield was reported in different units. Non-normal distributed datasets were transformed into normal using the Johnson transformation function prior one-way ANOVA analysis (MINITABTM, Version 21.1).

RESULTS AND DISCUSSION

The TBA of faecal samples from 12 healthy volunteers (mean body mass index, 22.72±SD 2.2 kg/m^2; mean age, 29±SD 6 years old) were extracted and analysed. Healthy volunteers consumed a standard Malaysian diet prepared by a central kitchen that contained 30% energy fat with at least ⅔ of this energy from palm oil. Volunteers were requested to record the amount and items of food consumed in a food daily. Each volunteer consumed a total average energy of approximately 2188 kilojoules daily analysed using NutriPro® software. The TBA yield ranged from 211.72 to 455.21 µM/L, equivalent to 1.89 to 8.42 µmol/g wet weight depending on the extraction methods (Fig. 1).

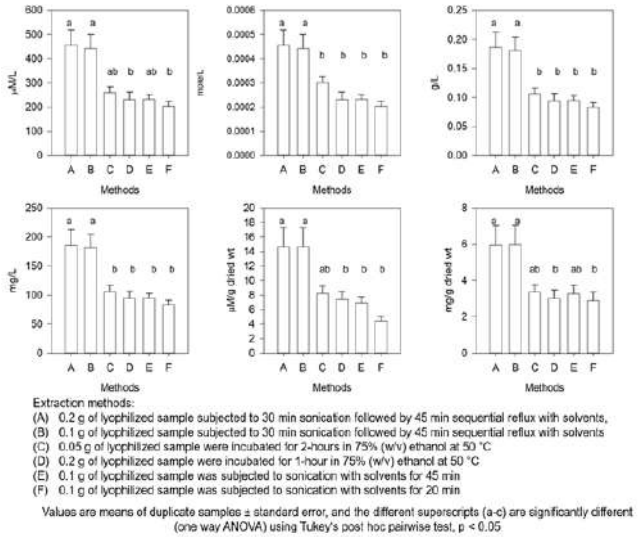

Fig.1: Effects of different extraction methods on total TBA yields reported in different units

These values are within the TBA range of healthy volunteers on a western diet (4). Considerable variations were observed in the data, but A is the most prominent TBA extraction method, as it constantly demonstrated an approximately one-time higher TBA yield in all reported units (Fig. 1). In Method A, TBA was extracted using a combination of mechanical sonication, heating, and sequential refluxing in ethanol, and TBA was extracted using chloroform and methanol compared to other methods in which only mild heating, mechanical disruption and solvent extraction were used.

Generally, Methods A, C and E with a longer incubation time increase the TBA yield because they allow a longer contact period of solvents and mechanical disturbance in the samples (Fig. 1), although the differences in TBA yield were not statistically significant ($p<0.05$). TBA yields followed the same trend when reported in µM/L, mole/L, g/L, (µM/g) and (mg/g) dried weights µM/L, mole/L, g/L, (µM/g) and (mg/g) dried weights, with an exception on (µM/g) wet weight (Fig 1). A wide variation in the moisture content could result in differences in reading (5).

CONCLUSION

In conclusion, Method A is the most comprehensive method for extracting TBA for enzymatic and spectrophotometric detection and the estimated TBA of healthy Malaysian adults was 455.21 µM/L. However, extra attention is needed when comparing the TBA values reported in different units in volunteers who consume different diets.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Multi-Level Texture Modified Diets for Elderly South-Asian Population with Oropharyngeal Dysphagia Based on Home Cooking

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SUMMARY

In this study, six representative South-Asian dishes were modified to obtain three different levels of texture-modified diets (i.e., liquidized, pureed, and minced and moist) as described by International Dysphagia Diet Standardization Initiative (IDDSI). Six texture-modified dishes with the energy density of 1.12-1.78 kcal/gm were developed into three levels of IDDSI. The liquidized diets had comparatively lowest energy content (286.94-355.08 kcal/serving) followed by pureed diets (310.99-381.29 kcal/serving). Minced and moist had the highest energy (346.31-398.60 kcal/serving). All the texture-modified diets complied with IDDSI tests specific to each level.

Keywords: Energy density, International dysphagia diet standardization initiative (IDDSI), Oropharyngeal dysphagia, Texture-modified diets

INTRODUCTION

Oropharyngeal dysphagia (OD) is a clinical condition involving difficulties in moving bolus from mouth to the esophagus. This is highly prevalent in older adults and often coexists with malnutrition. In the context of South Asia, the increasing ageing population poses dysphagia as a residing challenge. So, the development of reproducible, nutritious and native diets with textural alterations would be an effective management for elderly with OD. This study aimed to develop texture-modified diets for the elderly population with OD, based on home cooking. Traditional diets of South Asia usually comprise dishes prepared using rice, cereals, pulses, legumes, and vegetables (1). In this study, South-Asian dishes prepared from combinations of rice, cereals, pulses, vegetables, meats, nuts, and spices, such as *pulao, khichdi, kheer*, etc. were modified with ingredients in the right proportions to provide desired texture and nutrition.

MATERIALS AND METHODS

Six representative South-Asian dishes including main dishes and desserts were selected for modification. For texture modification, the proportion of solid and liquid ingredients was adjusted in such a way that liquidized level had lowest amount of solid ingredients, followed by pureed and minced and moist diets. Whereas, liquidized level had the highest amount of liquids (milk/water) followed by pureed and minced and moist diets. The total energy content and nutritive contents were adjusted by altering the amount of ingredients for each recipe. The total energy content and nutritive values of texture-modified diets were determined using Indian Food Composition Tables. Calorie density of each menu was calculated by dividing total calorie provided in a serving with its weight. The suitability of the texture-modified diets as levels from IDDSI framework was determined by conducting fork-drip test, spoon-tilt test, and fork-pressure test described by Cichero et al. (2). All the tests were carried out in triplicate.

RESULTS AND DISCUSSION

In total, eighteen texture-modified dishes were developed, six dishes each in liquidized, pureed, and minced and moist level. In terms of energy density, liquidized diets had the lowest energy density i.e., 1.12-1.33 kcal/g among all the levels, pureed diets had higher energy density (1.37-1.64 kcal/g) followed by minced and moist diets with 1.49-1.78 kcal/g (Table I). Energy dense meals are prescribed to individuals with OD to increase their energy intakes (3). Pritchard (4) reported that enriched texture-modified meals with energy density of 1.4 kcal/g significantly provided higher energy intake compared to a standard meal (1.0 kcal/g). The texture-modified diets in our study had relatively higher

Table I: Total energy content and calorie distribution of texture-modified diets in a serving

Dish Name	IDDSI Levels	Nutritive value per serving				Calorie Distribution C: P: F[1]	Calorie Density[2] (kcal/g)
		Energy (kcal)	Carbohydrate (g)	Protein (g)	Fat (g)		
Milk and rice pudding	Liquidized	355.08	35.22	9.96	19.64	54:16:30	1.30
	Pureed	351.39	38.10	9.85	17.82	58:15:27	1.37
	Minced and Moist	351.23	37.97	9.97	17.71	58:15:27	1.66
Carrot and sago pudding	Liquidized	330.48	32.18	8.69	18.15	55:15:30	1.33
	Pureed	348.36	36.80	8.83	18.15	58:14:28	1.64
	Minced and Moist	355.00	38.46	8.83	18.15	59:13:28	1.70
Mung-bean and rice porridge	Liquidized	288.49	31.43	8.75	14.01	58:16:26	1.29
	Pureed	310.99	31.43	8.75	16.10	56:16:29	1.40
	Minced and Moist	346.31	35.34	9.15	18.54	56:16:29	1.49
Bulgur-wheat porridge	Liquidized	316.89	34.26	9.51	14.45	59:16:25	1.37
	Pureed	355.76	33.99	10.82	18.91	53:17:30	1.42
	Minced and Moist	372.05	36.62	12.01	18.98	54:18:28	1.70
Five-grains porridge	Liquidized	286.94	28.53	7.69	14.45	56:15:29	1.12
	Pureed	357.73	32.80	9.94	19.18	53:16:30	1.45
	Minced and Moist	375.05	36.71	12.59	19.20	54:18:28	1.58
Spiced chicken rice	Liquidized	289.87	23.32	8.81	11.97	53:20:27	1.13
	Pureed	381.29	31.15	12.12	16.95	52:20:28	1.60
	Minced and Moist	398.60	35.06	12.52	16.98	54:19:26	1.78

C: P: F: Calorie distribution of texture-modified diets; carbohydrates%: protein%: fat%
[2]Energy density of texture-modifies diets per serving in kcal/gm

energy density which could be beneficial for improving the nutritional status of elderly with OD. The average energy distribution were 52-59% from carbohydrates, 14-20% from proteins, and 26-30% from fats and it was similar to texture-modified diet for elderly population from a previous study (5).

IDDSI tests were carried out on all texture-modified diets. The first test was the spoon-tilt test that generally determines the adhesiveness and cohesiveness of foods. All the diets from pureed and minced and moist level compiled with this test and held its shape in the spoon and when tilted, they slided off the spoon leaving few residues of food. While the liquidized diets could be easily poured from spoon. For determining consistency, fork-drip test was carried out for all three levels of diets and all of them showed appropriate consistencies; liquidized diets dripped slowly, pureed diets dripped discontinuously, and minced and moist diets did not drip through prongs of fork. Fork-pressure test was carried out on pureed and minced and moist diets. It was observed that they could be easily mashed with a fork using a little pressure. This adherence to fork-pressure refers that diets had suitable hardness for oral processing.

CONCLUSION

In this study, we designed multilevel texture-modified diets by altering textural properties and adjusting the nutritional contents of a few dishes commonly consumed in South Asia. The findings from this study suggest how modification of indigenous dishes could be done to achieve dysphagia diet with optimal nutrient content.

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EXTENDED ABSTRACT

Design and Development of DietCARE: An Online Nutritional Care Database Management System – An Initiative Model Proposal

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SUMMARY

The delivery of dietetic services at Klinik Diet, Universiti Malaysia Terengganu (UMT) still uses the conventional method of keeping its clients' records in files since its opening in 2018. Therefore, we proposed to develop our own online nutritional database management system, namely DietCARE, to deliver high-quality dietetic services to clients. This article aims to describe the flow process of designing DietCARE and its features. The process included observations, interviews, discussion, reviewing the past paper-based medical records, and conducting a literature review. The DietCARE features consist of two main modules: the Patient Management Module and the Dietitian Module.

Keywords: DietCARE, Design and development, Nutrition, Nutrition care process model, Online database

INTRODUCTION

Over the past decades, electronic medical records (EMR) and electronic health records (EHR) have been widely used in healthcare settings. In fact, the primary health care at the Ministry of Health (MOH) facilities in Malaysia has its own EMR system known as Teleprimary Care and Oral Health Clinical Information System (TPC-OHCIS). However, it is only implemented in several pioneer locations, not optimally used in small or independent healthcare facilities (1). Meanwhile, Klinik Diet, UMT still uses the paper-based method to record their clients' data, hence limiting clients profiling, comprehensive monitoring and continuous research. As such, this article aims to describe the flow process of designing DietCARE and its features. By implementing EMR, access to sensitive patients' personal clinical information is highly restricted, providing resilient security whereby only authorized users are allowed to access the patients' information (2).

MATERIALS AND METHODS

The design and development process of the DietCARE was specially drafted to meet the standard of practice for nutrition and dietetics based on the Nutrition Care Process Model (NCPM) (3). Three steps of the flow process included i) observations, interviews, and discussion with the clinical staff, dietitians and information technology (IT) experts, ii) reviewing the patients' medical records, and iii) conducting a literature review. This study was conducted from April 2021 to April 2022. Observations, interviews and discussions are essential in identifying the workflows and management at the Klinik Diet, UMT. It is a counseling center offering both dietetic and nutrition services to clients.

RESULTS AND DISCUSSION

The 3 steps in the flow process are essential in designing the modules for DietCARE by identifying the management, workflows and characteristics of patients at Klinik Diet as well as identifying the parameters/ elements in the DietCARE (Fig. 1). There are two main modules for DietCARE; Patient Management Module and Dietitian Module (Fig. 2). The Patients Management Module is designed to manage information related to registrations, socio-demographic data of the patients, and appointments which will be administered by nurses or staffs at Klinik Diet. Meanwhile, the Dietitian Module is designed based on NCPM which consists of Nutrition Assessment, Nutrition Diagnosis, Nutrition Intervention and Nutrition Monitoring & Evaluation.

CONCLUSION

The flow process of designing the DietCARE was briefly outlined and its features module has been initiated. It is

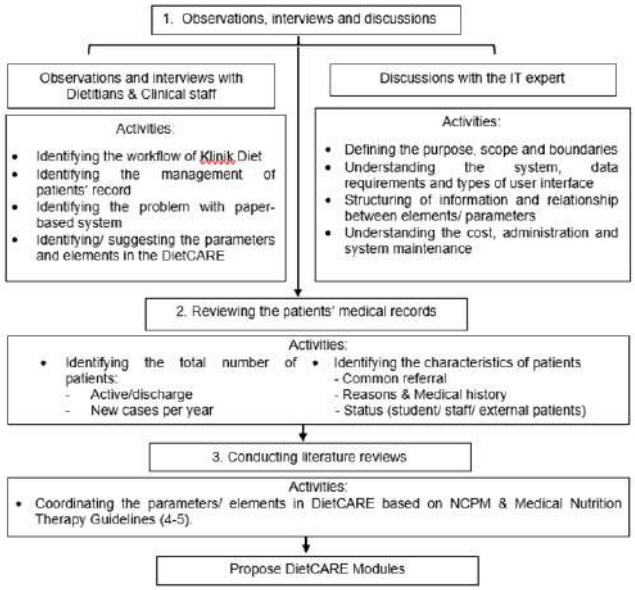

Fig.1: The 3 steps of the flow process in designing the Diet-CARE

hoped that this system could be used to introduce new services or workflows in our healthcare setting, hence enabling our healthcare practitioners in providing good quality nutritional care to their clients.

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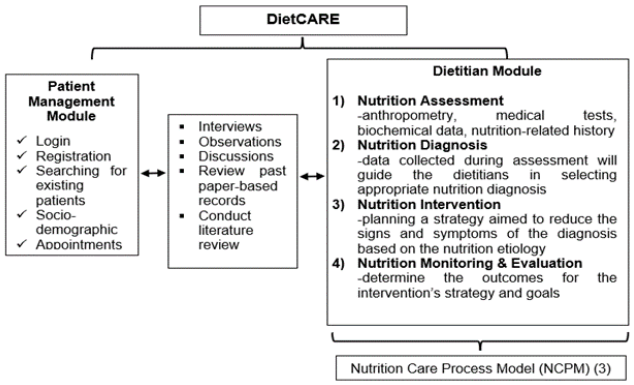

Fig.2: Modules of DietCARE

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EXTENDED ABSTRACT

Development of Myanmar Protein and Calorie Counting Booklet for Chronic Kidney Disease Patients

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SUMMARY

A validated food list for protein counting tool is a basic step in nutrition education for chronic kidney disease (CKD) patients. In this study, a common Myanmar foods list is developed to count energy (kcal) and protein (g) per portion with some highlights of important minerals such as potassium, and sodium. From the Myanmar food composition database (FCD), 12 food groups are selected, and nutrient profiles are recalculated to the nearest values by referencing from Myanmar, ASEAN, and some on India FCD. More than half of common fruits contain a moderate amount of 100-200mg of potassium per serving.

Keywords: Chronic kidney disease, Nutrient data on Burmese foods, Protein counting booklet, Renal food lists

INTRODUCTION

Chronic kidney disease (CKD) is a major health burden making up 9.1% of global prevalence (1). Dietary management of CKD is complex, and requirements are varied depending on the stage of CKD. When CKD stage is above stage 3b, specific restrictions in protein and sodium are required, whereas, on dialysis, dietary intake of high protein and high energy is crucial. To counsel with patients, healthcare staffs need a simple tool on Myanmar foods, which displays illustration and sample portion sizes. No such lists of Burmese foods were previously developed and this study aims to develop an illustrated Myanmar protein and calorie counting booklet for kidney impaired patients. According to Su-Lin's study, conducted in Singapore, in 2012, intervention with protein counting tool have significant improvements in nutritional status indicators (2).

MATERIALS AND METHODS

The proposed booklet has two parts; the first is nutrition tips in renal disease, referenced from KDOQI guideline (3), and the second is a pictorial display of Myanmar common foods. Food items were extracted from Myanmar's common foods book (4). Nutrient data of calorie, protein, phosphorous, sodium, and potassium were recalculated from FCD of Myanmar, Thailand, ASEAN, and India, and INMUCAL-Nutrients V.4.0 software into the usually consumed serving size as common household measures shown in Fig.1 and Fig.2. Then, they were sub-grouped according to potassium content in fruits and vegetable groups. Literature in the booklet was written at a 6th-grade level with a font size of 12 points, published in Myanmar and English languages. Recipes of 10 local common menus were collected from 3 reliable cookbooks, average recipes are inputted in INMU-Cal software to get nutrient data of carbohydrate, fat, protein, energy, sodium, potassium, and phosphorous within +2SD.

RESULTS AND DISCUSSION

Foods are grouped into 12 food groups, each containing 10-25 items, recalculated and common numbers as the countable unit of energy and protein are set as described in Table I. Warning cut-offs for phosphorous, sodium, potassium are as follows: inorganic phosphate containing displayed as danger P sign at the top right corner of food photos, high sodium as >600 mg/menu/meal and as >200 mg for snacks in saltshaker sign. High potassium was set at >200 mg/serving in "KK" sign in red, comprising 40% of fruits and 40% of vegetables. Moderate potassium was set at 100-200 mg per serving in yellow "K" sign, comprising 36% of common fruits and 22% of vegetables. In sauces, spices, and pastes group, sodium contents were 225 mg in 1 tablespoon of dipping sauces, 250-400 mg in 1 teaspoon of seasoning

Table I: Counting units of food groups per serving size

Food group name	Serving size	Energy (Kcal)	Protein (gram)
Cereals, Grains, Staple food	1 ladle cooked, 2 ladles uncooked, 1/2 cup cooked	70	2
Starchy vegetable, Tubers, Protein free starch	1 ladle, 4 table-spoons, cubes in cup	70	0
Vegetables	1 ladle of cooked, 2 ladles of raw	25	1
Fruits	varied, 1 big pc to 3 small pc of fruits	70	0.5
Milk and dairy products, Plant based on milky juices	1 cup/8 oz/240 ml	130	8
Poultry, Fish, Seafood, Meat and meat derivatives	2 tablespoons, 30 g cooked	70	7
Legumes	½ cup cooked	110	7
Nuts, Seeds	8 g, 2 teaspoons without covers	45	2
Fats and Oils	1 teaspoon	45	0
Oral Nutrition Supplement, Beverages	1 cup, 1 ready to drink bottle	varied	varied
Sauces, Pastes, Spices* (High Sodium Content)	1 teaspoon, 1 tablespoon	0	0
Common menu (Comprises signature ethnic menus)	1 serving =1 bowl of household measure/ 1 pack of selling size.		
-Soup based type		180-430	11-19.3
-Salad in infused oil		440-735	10.5-14.1
-Rice based menu		430±5	9.7-13.5
-Indian fusion menu		276-400	5.5-12

*although sauces group contain zero calorie, average sodium content will be displayed

sauces, 600 to 2000mg in 1 teaspoon of seasoning powders. Energy of 10 common menus ranges from 130 to 730 Cal, and protein ranges from 5.5 to19.3 grams/ serving.

Counting values of calorie and protein were in alignment with "Thai Renal Food Exchange System" due to common characteristics in foods. Preliminary content validation was qualitatively done by 3 experts in the renal dietetic field. Commonly used plates, bowls, ladles and spoons are shown in fig. 1 and 2.

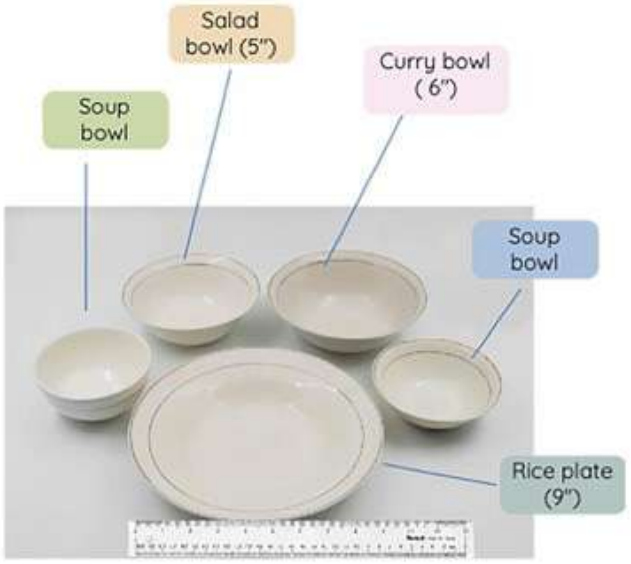

Fig.1: Examples of common plates and bowls used in Myanmar

Fig.2: Commonly used ladles and spoons as household measure

CONCLUSION

Myanmar protein and calorie counting booklet for chronic kidney disease patients was developed including a total of 260 items divided into 12 food groups. Further study testing with Myanmar CKD patients is required to evaluate the understanding and acceptability of the developed booklet.

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EXTENDED ABSTRACT

Parental Feeding Practice and Micronutrient Intake of Children in North Jakarta, Indonesia

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SUMMARY

Indonesian toddlers consume less micronutrients than RDA, and parental involvement is crucial because parents may control food and provide an example. This study examined children's iron and vitamin C intake in North Jakarta with a total sample of 191 caregivers and children. The children's iron and vitamin C intake was assessed using 2x24h food recall interviews. The Child Feeding Questionnaire evaluated parental feeding patterns. The research studied the correlation between child feeding behaviours with iron and vitamin C intakes. Monitoring were the only variable correlated to iron and vitamin C Sumptionion ($p<0.01$).

Keywords: Feeding practice, Iron intake, Monitoring, Toddler, Vitamin C intake

INTRODUCTION

Inadequate nutrition has been linked to two-thirds of infant mortality (1). The majority of iron deficiency cases, often known as ID, occur in children under the age of three. In Indonesia, one in three toddlers under the age of five has anaemia, and the prevalence is increasing (2). Parental influence on children's food preferences, dietary objectives, and healthy eating practices is significant (3). Restrictions, being forced to eat, rewarding behaviour, and modelling are the most popular feeding practices (5). This study aimed to determine if the feeding practices of children between the ages of 2 and 6 years were correlated with their intake of iron and vitamin C.

MATERIALS AND METHODS

This study was conducted at Pejagalan, Jakarta. The intake of children was analysed using a 2x24 hour food recall. The research areas included North Jakarta's Pejagalan and four Posyandu randomly selected. We created a list of children based on the number of registered children and family registration certificates in Posyandu. 191 samples were used after cleaning. Parental feeding practice was analysed using The Child Feeding Questionnaire (CFQ) (4). Restriction (8 questions) and monitoring (3 questions) are two topics related to parental feeding behaviors on this questionnaire. On a Likert scale, parents were asked to rank the ways in which they feed their children. The Spearman correlation were carried out with SPSS Version 20.

RESULTS AND DISCUSSION

A total of 191 subjects were included in the research. Over half of the respondents were 4 to 6 years old, and 56% were males. Most parents have only secondary educations and are unemployed. Most fathers work. The majority of the children who took part in this study came from families with incomes above the estimated poverty line of Rp2.2 million. The subject's parents earn more than the poverty threshold. According to our findings, parents, particularly mothers, were more likely to monitor and pay attention to the types of food their children eat than to restrict their children's diet, as measured by the median score for monitoring and restriction practice (Table I). A 2x24-hour meal recall questionnaire determined the children's diet. The median iron intake is 6.7 mg, less than the Indonesian RDI, which is 7 mg for 2-3 years old and 10 mg for 4-6 years old. Poor micronutrient intakes in toddlers are still widespread, according to the results of national surveys carried out in Brazil, Germany, Russia, and the United States of America (5). The median vitamin C intake is 20.3 mg, half the RDI. Spearman Rank test found that monitoring feeding patterns correlates with iron and vitamin C intake (Table II). Parents have a significant impact on how their children establish healthy eating habits, nutritional ideals, and food preferences. Numerous studies have demonstrated that when parents

Table I: Caregiver feeding practice score and micronutrient intake

Variables	Median(Q1-Q3)
Caregiver feeding practice	
Restriction (range: 1-5)	3.0 (2.5-3.5)
Monitoring (range: 1-5)	4.0 (3.0-4.3)
Micronutrient Intake (mg)	
Iron	6.7 (4.5-10.9)
Vitamin C	20.3 (8.2-79.5)

Table II: Correlation between caregiver feeding practice score and micronutrient intake

Variables	R	
	Iron intake	Vitamin C intake
Restriction feeding practices	0.137	0.067
Monitoring feeding practices	0.163*	0.153*

*Significance level at P-value <0.01

provide positive role models for their children, this has a favourable impact on their eating habits. The majority of individuals receive their vitamin C through consuming fruits and vegetables on a regular basis. Children whose mothers monitored and restricted their intake more regularly consumed less as adults.

CONCLUSION

Iron and vitamin C intake were below recommendations. Only monitoring feeding behaviour was linked to iron and vitamin C intake. This entails monitoring children's eating habits to boost their micronutrient intake. Parents must be involved in their children's feeding, especially during the toddler years, to ensure they eat enough.

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EXTENDED ABSTRACT

Nutrition Behaviors of Mothers and Preschool Teachers and Their Supporting and Inhibiting Factors: Qualitative Research

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SUMMARY

The nutritional behaviors of mothers and preschool teachers influence the nutritional status of children. This research aims to analyze the nutritional behaviors of mothers and preschool teachers and their supporting and inhibiting factors through focus group discussions method. It involved mothers and teachers groups consisting of 8 people in each group. The results showed that mothers still have low nutritional knowledge because they only understand the concept of 4 healthy 5 perfect nutrition, not balanced nutrition. The supporting factor is the provision of nutrition education in school. The cooperation of mothers and teachers in implementing good nutrition in children will increase their nutritional intake and health.

Keywords: Inhibiting factors, Focus group discussion, Nutrition behavior, Preschool children, Supporting factors

INTRODUCTION

Improving children's food intake will improve their nutritional status and health. Children in preschool are more likely to exhibit picky eating when their mothers have poor feeding habits. Furthermore, 56% of children will have low nutritional status due to inadequate feeding practices (1). In preschool children, apart from parental factors, teacher factors at school also influence their food consumption. According to the research carried out by Liu (2), only 31.3% of teachers are satisfied with their nutritional knowledge. Therefore, the cooperation of mothers and teachers in providing good nutrition for children will increase their food intake and health. This research aims to analyze the nutritional behaviors of mothers and preschool teachers, including knowledge, attitudes, and practices, as well as factors that support and inhibit these behaviors.

MATERIALS AND METHODS

In this research, a qualitative descriptive design using the Focus Group Discussion (FGD) method was used. It was conducted on March 18, 2022, at Genus Preschool/Kindergarten, East Purwokerto. FGD was held twice in separate rooms, moderated by an expert facilitator from Jenderal Soedirman University. The FGD lasted for approximately 2 hours for each. The participants were divided into 2 groups: the mother and preschool teacher groups consisting of 8 people in each group. All data from the FGD results were audio-recorded and transcribed word for word (verbatim). The first step of analysis was coding. The next step was integrating the codes into the matrix based on pre-determined themes, namely knowledge, attitudes, nutritional practices, as well as supporting and inhibiting factors. This research has been approved by the Ethics Commission of the Health Faculty, Jenderal Sudirman University, Purwokerto, Indonesia, under approval number 698/EC/KEPK/IV/2022.

RESULTS AND DISCUSSION

Mother's knowledge about nutrition is still low. In general, they still think that the concept of good nutrition is 4 healthy 5 perfect, which is a concept that is no longer recommended as a nutritional guide in Indonesia. This shows that socialization and public knowledge about balanced nutrition programs still need to be improved. Mothers and teachers believe that good nutrition is important for preschool children. Nutrition practices performed by most mothers include variations in menus, food processing, and its presentation (Table I).

"*I put it in nice plates. They asked, what is this mom? This is a dragon fruit. Every day, ma'am, it has been practiced and succeeded.*" (Mrs. RK, 30 years old)

Table II shows that the inhibiting factor of nutrition practice of mothers is the child's snacking habit. The

Table I: Nutritional practices of mothers and preschool teachers

Mother	Preschool Teacher
Menu variations Variety of food processing Variety of places to serve meals	Nutrition education through fairy tales, pictures, and film screenings Supplementary feeding Cooking together (cooking class) Picking vegetables together Introducing real food samples Introducing Market

Table II: Supporting and inhibiting factors in mothers and preschool teachers

Variable	Mother	Preschool Teacher
Inhibitor	Snack habit	Differences in the application of nutrition at school and at home (parents tend to give fast food)
Supporter	Nutrition education in schools	Nutrition education materials are included in the school curriculum

supporting factor for the practice of nutrition in mothers is the provision of nutrition education at schools. Children will exhibit positive behavior when their teachers show positive behaviors engage in it themselves, such as eating healthily and exercising (3). For teachers, the nutrition practice includes nutrition education through pictures, fairy tales, cooking classes, picking vegetables together, and introducing children to the market. The inhibiting factor is the difference in the application of healthy eating habits at school and at home. At school, teachers have tried to implement healthy eating habits, but parents give their children fast food such as nuggets and sausages.

"*The challenges, habits at home and school, are different. Parents like giving fast food.*" (Mrs LS,School Teacher, 39 years old)

The supporting factor for teachers is institutional support by including nutrition material in the school curriculum. School nutrition education can improve 20% of children's nutritional status. Moreover, nutrition education through schools plays a vital role in shaping children's healthy dietary habits (4).

CONCLUSION

The inhibiting factor is the difference in the application of healthy eating habits at school and at home, meanwhile the supporting factor is the provision of nutrition education in school. The cooperation of mothers and teachers in implementing good nutrition in children will increase their nutritional intake and health in providing.

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EXTENDED ABSTRACT

Acceptance of Risk Management Plan for Indonesian School Food Environment and its Related Factors

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SUMMARY

This study aims to develop a risk management plan for the Indonesian school food environment and to explore factors that might influence parents' acceptance of the plan. An online survey was conducted on the parents of children from public and private schools in Indonesia through various online community groups in 2018. The proposed plan assigned a certain safe zone area around the school. Most of the subjects agreed that the plan should be implemented. The factors correlated to the subjects' acceptance to the plan are negatively correlated with parents' trust in food seller and perception of nutritional benefit.

Keywords: Food safety, Risk management plan, School food environment, Street food

INTRODUCTION

The Indonesian school food environment includes all type of food that is available for children during school time including the food sold beyond school gate such as street foods. The food selected often has high fat and energy produced with poor hygiene and sanitation practice. While children of older age have some knowledge on how to choose healthy food, elementary school children tend to choose food that is easily accessible. It is important to create an ideal food environment for children to provide healthy food within school vicinity by creating a risk management plan to be implemented by schools. This study aims to develop a risk management plan for the Indonesian school food environment by adapting school food environment regulations from several countries and to explore factors that might influence parents' acceptance of the proposed plan.

MATERIALS AND METHODS

The subjects of the study were 574 parents of elementary school children in Greater Jakarta and West Java. The data was collected using Google Forms survey distributed to the parents' online community group in September 2018. The risk management plan was developed through literature study by comparing guidelines and regulations on school food environments in several countries. Subjects' acceptance to the proposed plan was measured using a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree' to a sentence stating their opinion on the implementation of the proposed risk management plan. The factors that might influence acceptance of the proposed plan were tested using Pearson Correlation Test using the variables that were developed in other studies on SPSS 23.0 (1). This study and the survey questionnaire content were approved by Ewha Womans University Institutional Review Board (IRB No. 164-20).

RESULTS AND DISCUSSION

The risk management plan was adapted from the Ministry of Health guideline (2) and other countries' regulations of school food environment, such as the United States (3) and Spain (4) which regulate the type of foods that can be sold at school according to the school characteristics, and Korea (5) which reinforces a Green Food Zone around school region where fast foods are not accessible. It is expected that the proposed plan is implemented in the Indonesian school food environment, particularly on food sellers around the school neighbourhood. Assigning a certain safe zone area around school grounds allows the school management to intervene with the type and quality of foods sold to the children, while maintaining the already existing school food environment. The proposed plan is shown in Figure 1.

Fig.1: Food Risk Management Plan for Indonesian School

The majority of subjects agreed to the implementation of the plan into the existing food environment in Indonesian schools (4.19 ± 0.89). Most of the factors showed correlation to parents' acceptance of the plan (Table I). The correlation indicates that in order to get parents to support the plan, it is important that parents understand the risks of street food consumption in school areas so that they can realize the importance of the plan. The acceptance of the plan also positively correlated with education and knowledge of food risk, meaning that higher education and knowledge is favourable for any changes in school food environment.

Table I: Factors correlating to acceptance of food risk management plan

Variables	r
Education Level	0.121*
Income	0.224*
Knowledge of Food Risk	0.159*
Parents' Trust in Food Seller	-0.149*
Perception of Food Risk	0.298*
Perception of Health Sanitation Risk	0.438*
Perception of Nutritional Benefit	-0.325*
Perception of Accessibility Benefit	0.035
Avoidance to Children's Street Food Consumption	0.343*

Note: *Pearson Correlation Test, p<0.01

Parents' trust in food sellers along with their perception of street food nutritional benefits, however, might hinder parents' support for the implementation of change. Consumer trust and perception of benefit are develop from over satisfaction and repeat purchase. The creation of safe zones in the plan could help to limit children's street food consumption and eventually, parents' resistance to change.

CONCLUSION

The plan to assign a certain safe zone area allows school management to control the foods sold to children. Parents showed their acceptance of the proposed plan, and further support might be obtained by making parents understand clearly the risks of children's street food consumption.

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EXTENDED ABSTRACT

Factors Associated with Anaemia among Adolescents of Food Insecurity Households in Post-Disaster Suburban Areas

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SUMMARY

Anaemia is an adolescent health problem in Indonesia. The purpose of this study was to determine the factors associated with anaemia, including nutrient intake, eating habits, anthropometry, nutritional knowledge and the influence of friends and parents of adolescents living in food-insecure households in post-disaster suburban areas in Palu, Indonesia. A total of 108 adolescents from households facing food insecurity were chosen by consecutive sampling. Frequent consumption of eating sweet food, the lower nutrient adequacy ratio (NAR) of iron, and higher NAR of calcium were found to be significantly associated with anaemia ($p<0.05$). Proper eating behaviour is important to prevent anaemia.

Keywords: Adolescents, Anaemia, Food insecurity, Nutritional status, Post-disaster

INTRODUCTION

Anaemia is a public health problem in Indonesia, including among adolescents. The prevalence of anaemia in adolescents in 2018 increased by 14 percent from the previous year (1,2). Anaemia increases the risk of barriers to cognitive function, susceptibility to infectious diseases, death during childbirth, and the risk for mothers to have stunted babies. Anthropometry and nutrient intake are positively associated with low haemoglobin in adolescents from low socioeconomic conditions. Nutrient intake and mothers' education are associated with anaemia in urban and rural areas respectively. This study aimed to determine the factors associated with anaemia. These include nutrient intake, eating habits, anthropometry, nutritional knowledge, the influence of friends and parents, household expenses and family types in food-insecure households in post-disaster suburban areas.

MATERIALS AND METHODS

The population for this study was determined by consecutive sampling. It comprises a total of 108 adolescents from households facing food insecurity who lived in the suburbs of Palu city and attended school in areas affected by a major natural disaster in 2018. Anaemia was assessed using hemocue Hb 201+ and determined by a haemoglobin level of <12 g/dl and <13 g/dl in female and male, respectively (3). Data on nutritional knowledge, influence of adolescents' friends and parents, household expenses and family types were collected through interviews using a questionnaire. A qualitative food frequency questionnaire was used to probe the adolescents' eating habits. Nutrient intake was assessed by non-consecutive 24-hour dietary recalls to obtain the nutrient adequacy ratio (NAR) of 14 nutrients. The BMI-for-age value was derived through an assessment of anthropometric status (4). Bivariate analysis and a binomial logistic regression were performed using SAS.

RESULTS AND DISCUSSION

Around two-third of the subject in this study were female adolescents (69.5%). The prevalence of anaemia among the adolescents was 39.8%; specifically, 24.4% for the males and 46.7% for the females. There were significant differences in gender, school location and sweet food eating habits between the anaemic and non-anaemic groups ($p<0.05$). However, while the relationship between gender and anaemia as well as school

Table I: Variables associated with anemia among adolescents in of food Insecurity households of post-disaster suburban areas

No	Variable*	Anaemia status		OR (95%CI)	p-value
		Anaemic	Non-anaemic		
1	Sweet food eating habits (Mean (SD))	3.7 (1.0)	3.2 (1.1)	5.65 (1.40-22.8)	0.02**
2	NAR Iron (Mean (SD))	49.5 (23.9)	59.3 (27.7)	0.90 (0.81-0.99)	0.03**
3	NAR Calcium (Mean (SD))	40.4 (31.7)	35.8 (24.4)	1.06 (1.00-1.13)	<0.04**

*Only significant variables presented in the table
**p-value <0.05 for the regression test

location and anaemia were not significant following the regression test. Sweet food eating habit was found to have a significant association with anaemia status after considering other variables (Table I). Furthermore, Iron NAR and Ca NAR values also had significant associations with the anaemia status of adolescents living in food-insecure households after regression test ($p<0.05$). The predictive power of the model was 70% ($R2=0.70$).

A higher mean of median score of sweet food eating habits frequency was positively related to anaemia in adolescents (Table 1). Frequent consumption of sweet foods led to a fall in the consumption of other foods containing the iron, folic acid, vitamin B12 and vitamin C that contribute to haemoglobin formation in the body. In contrast, high calcium adequacy was significantly associated with adolescents' anaemia status. Calcium intake prevents the optimal functioning of ferroportin as an iron transporter that transports iron from the inside out of the cells. Calcium may also in these circumstances inhibit the iron absorption process within the body (5).
A significant association was also found between low Iron adequacy and anaemia. Iron deficiency anemia is one of the most common forms of anemia in developing countries such as Indonesia. Without adequate iron intake, the body cannot produce hemoglobin-forming red blood cells.

CONCLUSION

In conclusion, eating habits and nutritional intake are related to anaemia in adolescents who live in food-insecure households. An intervention programme is required with a focus on changing eating behaviours and a consideration of the food resources available for families facing food insecurity.

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EXTENDED ABSTRACT

Risk Factors of Sleep Duration among Shift Workers

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SUMMARY

Previous studies showed that shift workers had a higher risk of Non-Communicable Diseases (NCDs) related to the low duration of sleep. This study investigates the association of income reduction, breakfast habits, and exercise with sleep duration. The present study used a case-control design with 148 subjects. The result shows that the sleep duration of shift workers was associated with income reduction and exercise, but not with breakfast habits. This result indicates that the disruption of economic factors during the Covid-19 pandemic affect the sleep quality of shift workers.

Keywords: Eating habits, Exercise, Occupation, Shift worker, Sleep

INTRODUCTION

According to the epidemiologic evidence, elongated working hours are correlated with health risks, such as sleep disturbances, cardiovascular diseases, and occupational injuries (1). During the Covid-19 pandemic, workers worldwide had experience income reduction from their jobs. Thus, the problem could increase the risk of worsening insomnia episodes (2). Hence, this study examines whether income reduction, breakfast habits, and exercise were associated with the sleep duration of shift workers.

MATERIALS AND METHODS

This study used a case-control study with 74 subjects of each group, based on sleep duration (case-group: the shift worker had sleep duration <7h; control-group: the shift worker had sleep duration ≥7h) (3,4). Matching was conducted using the following characteristics: working in Karawang Regency and having the experience of shift work in the last week. The online self-reported questionnaire was used for assessment, including questions about income reduction (Yes; No) (2), daily breakfast habits (Yes; No) (5), and exercise in the week (Never; 1-2x/week; 3-5x/week; 6-7x/week) that rely on the subject's memory (5). The online questionnaire had been tested in a validation test before being given to the subjects. The informed consent was signed by the subjects after they read the explanation of the study. The Chi-square and Mann-Whitney test were used for statistical analysis of bivariate.

RESULTS AND DISCUSSION

The present study showed the factors that were associated with sleep duration in the shift worker. The sleep duration was significantly associated with income reduction and exercise (p-value<0.05), but it was similar in terms of breakfast habits (Table I).

This study reveals that sleep duration was impaired by income reduction and exercise. A recent study of 4384

Table I: Factors correlated sleep duration in case- and control-groups

Variable	Control-groups		Case-groups		*p*-value [OR(95%CI)]
	n	%	n	%	
Total subjects	74	100.0	74	100.0	
Income Reduction					
Yes (0)	35	47.3	53	71.6	0.004
No (1)	39	52.7	21	28.4	[0.356 (0.180-0.703)][a]
Daily Breakfast Habits					
Yes (1)	52	70.3	44	59.5	0.168
No (0)	22	29.7	30	40.5	[0.621 (0.314-1.226)][a]
Exercise					
Never	16	21.6	23	31.1	0.033[b]
1-2x/ week	38	51.4	42	56.8	
3-5x/ week	14	18.9	6	8.1	
6-7x/ week	6	8.1	3	4.1	

Reference: 1
[a] Based on Chi-Square test, significance at *p*-value <0.05
[b] Based on Mann-Whitney test, significance at *p*-value <0.05

respondents showed that income reduction >30% was associated with new-onset or worsening pre-existing insomnia episodes (2). The association of exercise and sleep duration in this study is in line with a case-crossover study which found that exercise potentially increased 37 minutes of sleep duration (3). However, sleep quality including sleep duration induces productivity and health of the workers. The previous study found that the productivity of those who sleep <6h per day decreased by 2.4%. Sleep duration affects concentration, fatigue, and memory (4).

CONCLUSION

Sleep duration is associated with income reduction and exercise. These habits could potentially decrease both the health status and productivity of the workers. The results of our study may also indicate the need for interventions for sleep health-related to working and non-working hours.

ACKNOWLEDGEMENT

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EXTENDED ABSTRACT

Factors Associated with Protein Concentration in Breastmilk of Women in Makassar, Indonesia

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SUMMARY

Proteins in breastmilk have beneficial effects on an infant's health and development. This study aimed to evaluate the correlation of protein concentration in breastmilk with maternal nutritional status and dietary intake. Respondents were measured with regard to their height and weight and interviewed to identify their dietary intake. Breastmilk sample was collected to analyse total protein. Means of protein concentration of mature breastmilk was 1.08 g/dl. About 78.6% of the women are in normal range of BMI. Protein concentrations of breastmilk had no significant correlation with maternal current BMI and maternal diet, but it showed a significant correlation with pre-pregnancy maternal BMI.

Keywords: Breastfeeding, Breastmilk, Daily intake, Maternal BMI, Protein concentration

INTRODUCTION

Nutritional composition of human milk may change and vary among breastfeeding mothers. Protein content and quality in human milk are essential for infants' growth and long-term development (1). Many factors may affect the nutritional content of human milk, including maternal factors such as nutritional status and dietary intake (2). During lactation, the nutritional needs of women increase to support the production of milk and fulfil their needs, and consequently, mothers must increase their dietary intake too. Inadequacy of maternal diet can adversely influence mothers' nutritional status (3). Information about the protein content of breast milk from mothers in Makassar and its correlation with maternal nutritional status as well as dietary intake is limited. This study investigated the correlation between maternal nutritional status of body mass index (BMI) and dietary intake with a protein concentration of breastmilk.

MATERIALS AND METHODS

This cross-sectional study involved women who provided samples of their breastmilk. Using purposive sampling technique, the total respondents were 42 exclusively breastfeeding mothers (exclusively breastfeeding 1-6 months baby). All of the respondents were visited in their homes to obtain informed consent. They were interviewed on characteristics, pre-pregnancy weight, and dietary intake using food recall 24-hour. The anthropometric measurements (current body weight and height) were calculated to identify the current body mass index (BMI). At the same time, 30 ml human milk sample was collected by the respondents themselves using an electric breast pump or manual expression. Breastmilk samples were analysed for their total protein using Kjedhal Method in the laboratory. Data were reported in means and standard deviations, frequencies, and percentages, while the correlation between protein concentration and BMI was tested using the Pearson 0correlation test.

RESULTS AND DISCUSSION

In this study, the mean concentration of mature milk protein was 1.08 g/dl (Table I). The mean was higher than mean's protein of breastmilk from previous studies in developing countries such as the Philippines, Bangladesh, and Guatemala (4). It is reported that maternal nutritional status, according to maternal BMI, did not affect milk production of mother (5). Maternal anthropometric measurements showed that the women had a mean height, weight, and BMI of 1.53±0.5 cm, 50.02±9.03 kg, and 21.26±3.05 kg/m^2, respectively. About 78.6% of the women are categorized as having normal BMI, while 14.3% are underweight, and only 7.15% are overweight. Maternal pre-pregnancy BMI showed that 52.4% had normal nutritional status, 42.9% were underweight, and the rest was overweight.

Correlation analysis using the Pearson correlation test showed that there was no correlation between protein concentration of breastmilk and maternal BMI during lactation. On the ither hand, breastmilk protein concentration showed a significant negative correlation with maternal pre-pregnancy BMI ($p<0.05$) (Table II). Given that human milk was already synthesized by lactogenesis I since early pregnancy, so breastmilk production and composition were affected by maternal adipose nutrient stores where pre-pregnancy nutritional status have role through it.

Analysis of energy and macronutrient intake of the women revealed that the intake was fewer than the requirements for energy and macronutrients. The percentages of participating women who had inadequate intake was 64.3% for energy, 59.5% for protein, 71.4% for fat, and 81% for carbohydrate. Protein concentration of breastmilk and maternal daily intake showed no significant correlation. This is consistent with earlier research which showed that the nutritional value of maternal daily intake appeared to be mostly independent from the nutritional content of milk (3). These findings also support the theory that variability in the maternal diet might be disguised by the composition of breastmilk.

Table I: Respondent characteristics

Maternal Characteristics	Mean±SD
Breastmilk Protein (g/dl)	1.08±0.335
Anthropometrics	
Height (m)	1.53±0.5
Current weight (kg)	50.02±9.03
Pre-pregnancy weight (kg)	46.19±8.6
BMI	
during lactation (kg/m^2)	21.26±3.05
pre-pregnancy (kg/m^2)	19.64±3.1
Dietary Intake	
Energy (kcal)	1910.8±477
Protein (g)	69.1±25.8
Fat (g)	63.8±36.7
Carbohydrate (g)	260.7±69.4

Table II: Correlation analysis of breastmilk protein

Maternal BMI and Dietary Intake	r value	p value
BMI		
during lactation (kg/m^2)	-0.229	0.145
pre-pregnancy (kg/m^2)	- 0.309	0.046*
Dietary Intake		
Energy (kcal)	0.089	0.575
Protein (g)	0.171	0.280
Fat (g)	-0.20	0.900
Carbohydrate (g)	0.118	0.455

*Pearson's correlation is significant at $p<0.05$ (2-tailed)

CONCLUSION

In conclusion, our study indicates that protein concentrations of breastmilk did not show a significant correlation with maternal BMI during lactation and maternal daily intake. In adverse, breastmilk protein concentration showed a significant negative correlation with maternal pre-pregnancy BMI ($p<0.05$).

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EXTENDED ABSTRACT

Child Nutrition Prior and During Early Pandemic and its Relation to Socio-Economic Status of Households in Bogor City

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SUMMARY

This study aimed to examine the socio-economic status (SES) of households and child nutrition prior to and during early pandemic. The SES measured the objective well-being of the households, and the subjective well-being measured the family's perception of wealth satisfaction. The child nutrition data before the pandemic was collected using a growth card and measured during pandemic using anthropometrics assessment (weight per age). Before the pandemic (January-March) in 2020, the percentage of underweight children increased. Then, it decreased consecutively in March and one month later. In addition, the study showed that mothers' education related to children's nutrition before and during early pandemic.

Keywords: Child nutrition, Covid-19, Family well-being, Socio-economic, U-5 children

INTRODUCTION

The Covid-19 pandemic has affected many countries across the world, including Indonesia. During the pandemic, the economy and business in Indonesia struggled to survive. From September 2019 to March 2020, the poverty rate in Indonesia has risen 9.78 percent, concentrated on Java Island (1). Therefore, many citizens became jobless and strived to earn income. These issues inevitably affect family life and children's well-being. One of the factors that could affect children's well-being is their nutritional status. Henceforth, this study intended to determine the relationship between the SES of households and child nutrition status prior to and during Covid-19 in Bogor City, West Java.

MATERIALS AND METHODS

This cross-sectional study was conducted in Kampung Pulo Geulis. The location was purposively chosen as the village is located in Central Bogor District, one of the densest and most crowded districts in Bogor City (2). One hundred twenty families with U-5 children were included in this study and the questionnaire was given to the mothers. The SES data collected included family income per capita, mother's education, family size, employment status, and income stability. Children's nutritional status (WAZ) data prior to the pandemic were collected from a growth card (January-March 2020) and an anthropometric assessment during early pandemic (April 2020). The family well-being data were assessed by objective and subjective family well-being (3). All collected data were analysed using SPSS 16. Index scoring was applied to determine family well-being, while anthropometrics data were analysed using weight for age z-score index. Children's Z-scores cut-off points were measured based on WHO classification (4).

RESULTS AND DISCUSSION

The prevalence of underweight children prior to the Covid-19 situation (January-March 2020) increased from January (14.8%) to February (15.7%), then decreased to 14.3% in March, and decreased to 14.2% during the pandemic (April 2020). The family income average was IDR 2,628,500 ($172.93), while the average family income per capita was IDR 594,344 ($39.10), which is above the poverty line of Bogor City. However, 50 families (41.6%) lived below the poverty line. The employment status remained the same (72.5%); 33 of the family's job statuses shifted (27.5%), whereas 12.5% lost their job during the pandemic. Meanwhile, objective family well-being tended to be low but subjective well-being tended to be high. In the correlation test, the SES of the family had no relation to children's nutrition both prior to and during early pandemic except for the mother's education (r=0.227). However, the mother's education correlated positively with income per capita, which also correlated with income stability and the mother's education. Research in Bangladesh during the

Table I: Correlation test of SES, family well-being, children's nutritional status

Variables	1	2	3	4	5	6	7	8
Family Size (1)	1							
Income per capita (2)	-0.069							
Income Stability (3)	0.103	0.287**						
Employment Status (4)	-0.124	0.051	0.242**					
Mother's Education (5)	-0.095	0.352**	0.003	-0.072				
Objective Family Well-Being (6)	0.060	0.426**	0.278**	0.342**	0.140			
Subjective Family Well-Being (7)	0.056	0.276**	0.056	-0.008	0.073	0.396**		
Child Nutrition Pre-Covid-19 (8)	-0.018	0.131	0.008	-0.076	0.231*	0.034	-0.061	
Child Nutrition Early Pandemic (9)	-0.007	0.080	-0.069	-0.109	0.227*	0.013	-0.038	0.780**

*significant at the 0.05 level; **significant at the 0.01 level

pandemic also found that a higher mother's education reduces the likelihood of the children being stunted and underweight (5). This implies the importance of the mother's role and education in maintaining child nutrition.

CONCLUSION

This study revealed that only mother's education among other SES variables that significantly correlated to child nutrition both prior and during early pandemic. The finding emphasizes the relation of a mother's education to enhance children's nutritional status. However, research cannot be generalized to the national level as it needs greater samples.

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EXTENDED ABSTRACT

Acceptance of High-Protein Catfish Nuggets among Children under Five Years Old in the Coastal Area of Semarang

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SUMMARY

Catfish nuggets developed for under five children were assessed in terms of the acceptability and effects on children's health and nutritional status in the coastal areas of Semarang. Five variations of nuggets were laboratory-scale developed and the original catfish nuggets were preferred according to acceptability test done by expert panellists. As many as 30 children aged 36-40 months age were given 100 g of sample for four months. The result shows that the catfish nuggets were preferred as a snack. The average nuggets consumption was 83.5 grams per day and it contributed 23.8% of protein. The catfish nuggets given may improve children's health and nutritional status.

Keywords: Acceptability, Catfish nuggets, High protein, Improve health and nutritional status

INTRODUCTION

The impact of the corona virus has worsened the nutritional status of children. The causative factor is chronic protein deficiency. Children's food and nutrient needs are not met, and the children food is not tasty. Parents only give simple food, while they are expected to provide high protein to support children's growth. This is aggravated by the low understanding of mothers about the benefits of consuming fish for the growth and development of the brain (2–4). Consumption of catfish nuggets is thought to increase children's health so that the children do not experience malnutrition. Malnutrition will endanger the growth rate and may result in stunting. In fact, kids absolutely love bulk nuggets. Therefore, catfish nuggets may have a great opportunity to meet their protein needs (1.2–4). This study aimed to analyse the acceptability of catfish nuggets and observe the effect on under five children's health and nutritional status.

MATERIALS AND METHODS

Five variations of nuggets were laboratory-scale developed on April-November 2021, which included original catfish nuggets, broccoli, carrots, red-beans and mushrooms (1). Level of acceptability (texture, taste, colour and aroma attributes) of the nuggets developed were assessed by expert panelists (culinary lecturers). Nuggets protein contents were analysed at the UNNES Biology Laboratory. The preferred nugget products were then given to 30 under five children in Berahan Wetan Village, 100 grams/day for four months. The subject selection was based on the local KMS Posyandu data, i.e children aged 36 to 42 months old in good health. The health of the children was observed personally by medical personnel and their nutritional status was measured using the HAZ, before and after the nuggets intervention. Subject compliance in consuming nuggets was recorded with a control card. Distribution of the nuggets and replacement of new control cards as well as interviews with mothers were done every Saturday.

RESULTS AND DISCUSSION

Original catfish nuggets obtained the highest score of acceptability of 4.6, compared to other variants (4.5 for mushroom, 4.3 for red-beans, 4.2 for carrots, and 4.0 for broccoli). The taste and texture attributes of the original nuggets were acceptable to expert panelists and the public (1.5). The savory taste of the original nuggets creates a different taste sensation than the usual nuggets. The texture of the catfish is soft and gives a distinctive taste. As many as 75% of expert panelists liked the original catfish nuggets. The protein content is relatively high, which is 28.5% in the original catfish nuggets so that it can be used as an alternative source of protein.
The nugget consumption compliance level is relatively good. The health of children under five before the research was 17.6%; they had flu. The children's health worsened due to the COVID-19 pandemic and improved

after receiving 100 grams of catfish nuggets per day for four months (Figure 1). The average consumption of nuggets was 83.5 grams per day and it contributed 23.8% of protein. The nuggets that were not eaten by the respondents were often eaten by their relatives. The average height of children under five is 85.7 cm, and the weight is 12.1 kg. The distribution of height according to age (HAZ) is presented in Table I.

Giving catfish nuggets help to improve the children's appetite to fish-based food, so that children will consume more fish-based foods. Acceptance of catfish nuggets is very good as an additional food for children under five. Children's health increases when the body's protein needs are met (3,4). The consumption of catfish nuggets can meet protein needs to improve children's nutritional status.

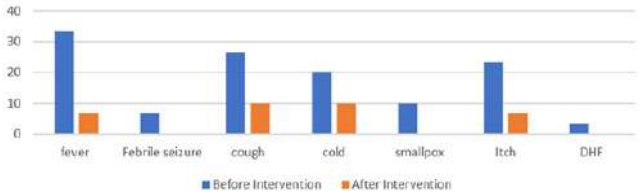

Fig.1: Child's health one month before and after the research

Table I: Nutritional status of children under five before and after nuggets intervention

HAZ	n	%
Before Catfish Intervention		
<-3 SD	1	3.3
-3 SD <-2 SD	14	46.7
-2 SD - +2SD	15	50.0
>+2SD	0	0
After Catfish Intervention		
<-3 SD	1	3.3
-3 SD <-2 SD	8	26.7
-2 SD - +2SD	20	66.7
>+2SD	1	3.3
Total	30	100.0

CONCLUSION

The original catfish nuggets obtained the highest score of acceptability of 4.6 compared to other catfish nuggets. Original catfish nuggets can be accepted by the under-five children. The average consumption of nuggets was 83.5 grams and it contributed 23.8% of protein. Catfish nuggets may improve the nutritional status of under-five children.

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EXTENDED ABSTRACT

Canalization, the Synthesized Model on Improving Determinants of Stunting in 1000 Days of Early Life in West Bandung Region, Indonesia

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SUMMARY

Some socio-economic and infrastructure disparities between villages contributed to poor program performance and variation in stunting rate. The purpose of this study is to identify the determinants of stunting at the micro-level and develop a synthetized model for improving program performance. This survey was conducted at 20 priority villages and covered 640 households. The poor specific and sensitive program performance contributed to the high stunting level. The synthesized model is proposed as a strategy for developing the integrated program and synergizing target groups in a specific and sensitive nutrition intervention program.

Keywords: Determinant factors, Stunting, Synthesized model, Toddler, West Bandung

INTRODUCTION

Stunting is a chronic undernutrition problem among children that affects the occurrence of growth and development disorders both short-term and long-term (1). The prevalence of stunting in the West Bandung Region is higher (29.6%) compared to the national and provincial levels (24.4% and 24.5%) (2). This is caused by socioeconomic and infrastructure disparity, and also the variability of the program effectiveness, which influences the poor performance of determinant factors. Low access of risk groups in using services was mainly caused by a lack of connection between sensitive and specific programs and poor sustainability between coverage performance and quality performance. This study aimed to identify factors that cause low performance of determinants of stunting at the village level and strengthen the existing convergent, holistic, and integrated model, as well as improve quality of services by proposing a synthesized model.

MATERIALS AND METHODS

This research comprised two stages: a field survey in the first stage and synthesizing the development model in the second stage. A field survey was carried out purposively randomized at 20 priority villages, 640 toddlers, and his/her households. Accessibility and utility to the sensitive and specific program were asked to the toddlers' mothers using a service questionnaire. The gap analysis was conducted using analytical statistics, comparing the performance of determinant factors and toddler nutritional status as a dependent variable. Identification of system weaknesses was obtained based on the availability, accessibility, and utility performance of each program. The synthesis of the developing model used the cognitive process decision-making of problem-solving frameworks, consisting of (a) intelligence step: identifying the defect system using gap analysis, (b) designing step: proposing four alternatives model (canalization, capacity building, community participation, and quality services), (c) selecting steps (deciding canalization model, based on highest score of selected criteria) (3).

RESULTS AND DISCUSSION

The average prevalence of stunting among toddlers in 20 priority villages was 17.8% (6.3%-31.3%). Meanwhile, the prevalence of neonatal low birth weight and shorter birth length was 9.7% and 14.3% respectively. Based on the Indonesian Nutritional Status Survey in 2021, the stunting prevalence rate among children under five years of West Bandung Region was 29.6% (2). Using multivariate statistical analysis, there were six significant ($p<0.05$) determinants of stunting in the toddler which

are: (a) older age group (POR=2.895), (b) male toddler (POR=1.712), (c) shorter birth length (POR=2.489), (d) suffered from wasting (POR=2.794), (e) incompleted basic immunization (POR=1.999), and (f) poor housing ventilation (POR=1.811) (Figure 1).

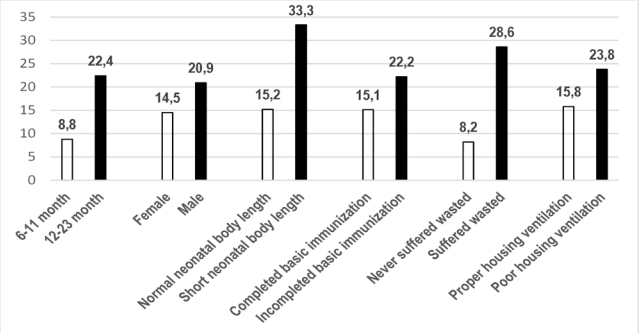

Fig.1: Stunting prevalence in different factors categories

There was a high variation of the stunting prevalence rate in 20 priority villages, illustrating disparities in socioeconomic, and infrastructure conditions. However, the higher prevalence of stunting was not all in the remote rural villages, but also in some villages in the suburbs. Another finding was that the sensitive nutrition intervention programs were underutilized by the risk group due to the weak implementation of the convergent strategy in the field. Two main problems regarding low program performance were low coverage and poor service quality (Figure 2). Low program coverage is influenced by the difference in selecting target groups among programs (some programs did not directed to risk group). Poor service quality is presented by less sustainability and low outcome of services (e.g. incompleted basic immunization, small increase of body weight during growth monitoring, low adherence to consuming 90 iron tablets). It is necessary to apply a bridging strategy for connecting specific and sensitive programs by implementing the synthesizing model (Figure 3). The synthesized model is working by adding new channels to connect existing channels to the risk group or hall program (4).

CONCLUSION

There were six determinants of toddler stunting: older age, male toddlers, ever-suffered wasting, incomplete basic immunization, and poor housing ventilation.

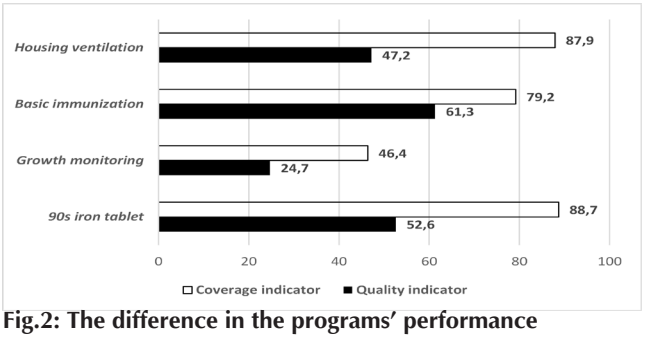

Fig.2: The difference in the programs' performance

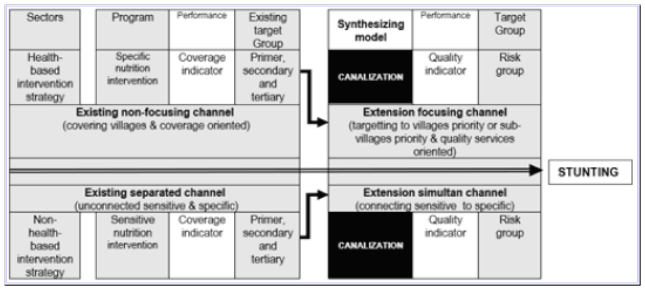

Fig.3: Canalization synthesizing model to connect & synergizing program

Strengthening convergent strategy to eliminate the stunting problem should be supported by developing the canalization synthesizing model for improving the integration of the sensitive and specific program.

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EXTENDED ABSTRACT

Food Pattern, Dietary Diversity Score, and Money Expenditure Priorities among Mothers Living in the Stunting Locus of Muara Enim Regency

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SUMMARY

Stunting remains a public health concern in Indonesia. This study aimed to analyse food pattern, individual dietary diversity score (IDDS), and money expenditure priorities among mothers living in the stunting locus of Muara Enim Regency. This cross-sectional study involved 35 mothers who lived in stunting locus villages. The study found low-frequency consumption of fruits (0.6 times/day) and vegetables (0.3 times/day) among the mothers. Only 11.4% of the mothers were categorized as having good IDDS. Foods and education were the most prior need for the money expenditure. Moreover, installment payment priority was significantly correlated with IDDS ($p<0.05$).

Keywords: Food pattern, IDDS, Locus, Money expenditure, Stunting

INTRODUCTION

Stunting has been one of global nutrition challenges, including in Indonesia. The recent report in 2021 showed that 24.4% of Indonesian under-five children suffered from stunting (1). Inadequate food intake is one of the significant determinants. Previous study reveals that poor dietary quality is associated with the length-for-age z-score of children in low and middle-income countries (2). Moreover, the diet quality of mothers and children are found to be positively correlated (3). Maternal diet quality may predict household food security and stunting incidence, where household food insecurity might be caused by money misspending. In addition, household expenditure, food consumption pattern and stunting are reported to have a significant correlation (4). Muara Enim Regency has become one of the stunting loci in Indonesia since 2019. Hence, the present study aimed to analyse food pattern, dietary diversity, and money expenditure priorities among mothers living in the stunting locus of Muara Enim Regency.

MATERIALS AND METHODS

This study was based on a Focus Group Discussion (FGD) conducted by the Food Security Office of Muara Enim discussing the determinants of stunting in that regency. A cross-sectional design was used for this study involving 35 mothers who lived in the stunting locus; all of the mothers participated in the FGD. Using the formula of Lemeshow at the level of significance of 5%, the total number of mothers was adequate to observe dietary quality among this group. Food pattern and individual dietary diversity score (IDDS) were obtained using food frequency questionnaire and 24-h food recall, respectively. The mothers were then asked to order their money expenditure priorities for several needs, including foods, education, electricity, clothes, fuel, internet, installment payment, home furniture, and recreation (1= most prior, 9= least prior). Spearman rank test was performed to evaluate the correlation between IDDS and money expenditure priorities at p-value<0.05.

RESULTS AND DISCUSSION

Our study demonstrated a relatively adequate frequency of mealtime among the mothers (2.9 times/day). The frequency of carbohydrate and protein sources consumption were 2.7 and 2.3 times/day, respectively. Rice was the main source of carbohydrate, while fish was the main source of protein. However, this study found a very low frequency of vegetables (0.3 times/day)

and fruits (0.6 times/day) consumption (Table I). Lower fruits and vegetables consumption has been linked to poorer diet quality and nutritional status.

This study revealed that only 11.4% of the mothers had a good dietary diversity score (Table II). IDDS describes the total number of different food groups consumed by individuals without considering the minimum intake. Low IDDS has been linked to inadequate nutrients intake and suboptimal nutritional status. Mothers' IDSS may describe dietary diversity among family members, including under-five children. Therefore, mothers' diet quality may predict children's nutritional status. Furthermore, food and education were the most prior needs for money expenditure. We only found a significant correlation between installment payment and IDDS ($p<0.05$, $r=0.370$) (Table III). Lesser importance of installment payment was correlated with higher IDDS. Since non-food consumption is dominated by installment payment on motorcycles in South Sumatera, this payment could determine money available in households for other basic needs, including foods and health service (5). People may prioritize the installment payment on motorcycles for their monthly expenditure than other needs since motorcycles are essential for transportation and livelihood in South Sumatera including Muara Enim Regency.

Table I: Frequency of foods consumption

Foods	Frequency (times/day)
Meal times	2.9±0.5
Carbohydrate sources	2.7±1.1
Rice	2.2±0.9
Wheat flour products	0.4±0.2
Tubers	0.1±0.5
Protein sources	2.3±1.7
Fish	1.3±0.9
Chicken	0.4±0.8
Eggs	0.3±0.5
Tofu/ tempeh	0.1±0.2
Vegetables	0.3±0.2
Fruits	0.6±0.3

Table II: Mother's IDDS

Category	n (%)
Poor (score 0-4)	31 (88.6)
Good (score >4)	4 (11.4)
Total	35 (100.0)

CONCLUSION

Poor dietary diversity was found among mothers living in the stunting locus of Muara Enim Regency. Even though foods are still the most pressing need, installment payment was significantly correlated with IDDS. This implies that economic status enhancement is essential to improve food consumption and nutritional status.

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Table III: Money expenditure priorities and its association with IDDS

Needs	Average expenditure priority order*	Correlation with IDDS**	
		p-value	r
Foods	1.7±1.4	0.615	-0.088
Education	3.5±2.4	0.203	-0.224
Electricity	4.0±3.1	0.456	0.130
Clothes	4.4±1.8	0.452	-0.135
Fuel	4.7±1.6	0.885	-0.025
Internet	5.7±2.1	0.230	0.208
Installment payment	5.8±3.1	0.034	0.370
Home furniture	6.3±1.9	0.754	0.059
Recreation	6.8±1.8	0.360	-0.167

*Money expenditure used 9-scale score (1 = most prior; 9 = least prior)
**Spearman Correlation Test, $p<0.05$)

EXTENDED ABSTRACT

Relationships of Demographic, Healthy Living Behaviour, and Maternal Nutrition Knowledge with Stunting among School-Aged Children in Cihampelas District, West Bandung Regency

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SUMMARY

Stunting is a condition of height-for-age z score (HAZ) <-2 SD and is still a major nutritional problem in Indonesia. This cross-sectional study aimed to determine the relationships of demographic, healthy living behaviour, and maternal nutrition knowledge with stunting among school-aged children in Cihampelas, West Bandung. The study involved 241 school-aged children and their mothers in Pataruman and Tanjungwangi villages. The results showed a significant relationship between the father's education level and maternal nutrition knowledge; parental education level and healthy living behaviour. Meanwhile, no significant relationship between parental education, mother's nutrition knowledge, healthy living behaviour and HAZ category.

Keywords: Healthy living behaviour, Maternal nutrition knowledge, Parental education, School-aged children, Stunting

INTRODUCTION

Indonesian Basic Health Research (2018) showed that 16.9% of school-aged children (6-12 years) were classified as stunted and 6.7% were severely stunted (1). This data is categorized by WHO as high prevalence of stunting (2). WHO describes stunting as a failure to drive linear growth caused by suboptimal health condition. The high prevalence of stunting in children in developing countries is related to poor socio-economic conditions, increased risk and exposure from an early age that causes disease, and improper parenting/ feeding patterns (2-3). Parental education is one of the determinants of stunting. Higher maternal education is associated with decreased stunting prevalence due to improvements in children health and care (3). Pataruman and Tanjungwangi villages were the focus of stunting control in Cihampelas District (4). This study aimed to investigate the relationships of demographic, healthy living behaviour, and maternal nutrition knowledge with stunting among school-aged children in Cihampelas, West Bandung.

MATERIALS AND METHODS

This cross-sectional study involved 241 school-aged children (52.3% male and 47.7% female) aged 6 to 14 years old and their mothers in Pataruman and Tanjungwangi villages. Data collected were: the demographic factors (age, gender, parent's education and occupation), the healthy living behaviour (delivery in favour of health workers, nutritional status check-up, washing hands with soap and clean water, using clean water, using a healthy latrine, combating larvae, doing physical activity, and smoke-free), maternal nutrition knowledge (nutritional needs of pregnant and lactating women, exclusive breastfeeding, weaning/ complementary food, source of nutrients, and stunting) and measurement of children's height and weight using microtoise and digital weighing scale. Validated questionnaire were adopted from previous research (5). Data collection was conducted in March 2021. Data were analyzed using SPSS 26.0 software (IBM) for identifying the normality of data, descriptive statistic, and Chi-Square test.

RESULTS AND DISCUSSION

Table I shows more than half of the children were aged 6-10 years old and male. Most of the fathers' last education level was elementary school (42.3%), similar to that of the mothers (52.7%). The fathers' occupation varies, namely farmer/gardening (2.1%), trader (5.8%), entrepreneur (9.5%), private employee (24.5%), and others (54.8%). Other occupations referred to working in construction, odd jobs, etc. Most mothers were

Table I: Demographic description and child nutritional status

Variables		n	Percent (%)
Children's Age (year)	6 - 10	134	55.6
	11 - 14	107	44.4
Sex	Boys	126	52.3
	Girls	115	47.7
Father's Last Education	Not Attending School	14	5.8
	Primary School	102	42.3
	Junior High School	66	27.4
	High School	58	24.1
	Diploma	1	0.4
Mother's Last Education	Not Attending School	3	1.2
	Primary School	127	52.7
	Junior High School	82	34.0
	High School	28	11.6
	Diploma	1	0.4
BAZ Category	Underweight	22	9.1
	Normal	204	84.6
	Overweight	14	5.8
	Obese	1	0.4
HAZ Category	Normal	185	76.8
	Stunted	48	19.9
	Severely stunted	8	3.3
Total		241	100.0

housewives (74.3%). Others work as farmers (0.8%), traders (9.1%), private employees (5.0%), entrepreneurs (4.1%), and others (6.2%). Other jobs are working part time , etc.

Based on body mass index-for-age z score (BAZ), this study found more underweight (9.1%) than overweight-obese (6.2%) children, while based on height-for-age z score (HAZ), there were 23.2% stunted children. Based on cut-off values for stunting, the prevalence of stunting children in Pataruman and Tanjungwangi villages is classified as 'high prevalence' (2). This condition may be caused by socioeconomic factor, inadequate and improper diet, inadequate care and health services, etc (3).

Table II shows that there was no relationship between parental education and the nutritional status of children in HAZ category ($p \geq 0.05$). There was no significant relationship between the mothers' nutritional knowledge; healthy living behaviour and the children's nutritional status in HAZ category. On the other hand, fathers' education had a significant relationship with maternal nutrition knowledge, and parental education had a significant relationship with healthy living behavior ($p < 0.05$) (Table III).These findings is different from those of previous studies indicating that higher parental education levels are associated with improved child nutritional status (3).

CONCLUSION

Our data indicate the relationship between the fathers' education level and maternal nutrition knowledge; the parents' education level and healthy living behaviour. This study suggests that improving parents' education may promote mothers' nutrition knowledge and healthy living behaviour.

Table II: Chi-square test of parental education, maternal nutrition knowledge, healthy living behavior and HAZ category

Variables		HAZ Category		Total	P
		Stunted n (%)	Normal n (%)		
Father's Formal Education	Primary School and Lower	32 (13.3)	84 (34.8)	116 (48.1)	0.165
	Junior High School and Higher	24 (9.9)	101 (41.9)	125 (51.9)	
	Total	56 (23.2)	185 (76.8)	241 (100)	
Mother's Formal Education	Primary School and Lower	37 (15.4)	93 (38.6)	130 (53.9)	0.054
	Junior High School and Higher	19 (7.9)	92 (33.2)	111 (46.1)	
	Total	48 (23.3)	185 (71.8)	241 (100)	
Maternal Nutrition Knowledge	Poor	22 (9.1)	96 (39.8)	118 (49.0)	0.133
	Good	34 (14.1)	89 (36.9)	123 (51.0)	
	Total	56 (23.2)	185 (76.8)	241 (100)	
Healthy Living Behaviour	Poor	22 (9.1)	69 (28.6)	91 (37.8)	0.911
	Good	34 (14.1)	116 (48.1)	150 (62.2)	
	Total	56 (19.9)	185 (76.8)	241 (100)	

Table III: Chi-square test of parental education with maternal nutrition knowledge and healthy living behavior category

Variables	Maternal Nutrition Knowledge			Healthy Living Behaviour			Total
	Poor n (%)	Good n (%)	p	Poor n (%)	Good n (%)	p	
Father's Formal Education							
Primary School and Lower	66 (27.4)	50 (20.7)	0.025*	49 (20.3)	67 (27.8)	0.022*	116 (48.1)
Junior High School & Higher	52 (21.6)	73 (30.3)		42 (17.4)	83 (34.4)		125 (51.9)
Total	118 (49.0)	123 (51.0)		91 (37.8)	150 (62.2)		241 (100)
Mother's Formal Education							
Primary School and Lower	73 (30.3)	57 (23.6)	0.211	58 (24.1)	72 (29.9)	0.025*	130 (53.9)
Junior High School & Higher	45 (18.7)	66 (27.4)		33 (13.7)	78 (32.4)		111 (46.1)
Total	118 (49.0)	123 (51.0)		91 (37.8)	150 (62.4)		241 (100)

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EXTENDED ABSTRACT

Nutritional Fulfillment of Children under Three in Stunting Area of Kepung Public Health Center, Besowo, Kediri

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SUMMARY

Besowo Village is one of the focus locations to resolve stunting in Indonesia. To understand the nutrition fulfillment of under three children in the location, a case control study design was applied. The socio-economic characteristic of Besowo village society tends to be homogeneous. The incidence of stunting in the area is influenced by birth length and history of early initiation of breastfeeding (EIB). Stunted children with EIB did not continue exclusive breastfeeding. Parents' characteristic, history of micronutrient adequacy from supplements during pregnancy, nutrients adequacy of children, nutrition knowledge of mothers between two groups did not show significant differences.

Keywords: Birth length, EIB, Nutrients fulfillment, Stunting

INTRODUCTION

Stunting is one of nutritional problems caused by chronic nutrient deficiency. The term refers to children's height below the growth standards as a biomarker of growth failure (1). Stunting causes many negative impacts, from individual consequences, leading to macro-level disadvantages. Resolving the problem of stunting has become the Indonesian government's priority due to its high prevalence. The government classified regions with high stunting rate up to the village level and identified them as focus location of stunting alleviation. One of the focus locations in 2022 is Besowo Village, Kediri Regency, East Java. The village is located in a mountainous area, separated from city and district government, and has limited access to the market, educational services, and hospital. Currently, no study has been conducted in the area on the nutrient fulfillment of stunted and non-stunted children while nutrient fulfillment is one of the direct factors leading to stunting.

MATERIALS AND METHODS

This case control study involved 38 subjects aged 19 –36 months. Subjects were selected through total sampling from 9 areas in Besowo village and allocated into two groups based on nutrition status (case: stunted children with Height for Age (HAZ)<-2 SD, control: children with HAZ>-2 SD). Subjects were matched by age and sex. This research used primary and secondary data. Secondary data included birth length, birth weight, and recent anthropometric measurement in the Integrated Health Centers. Primary data included subjects', parents, and socio-economic characteristics, history of supplements consumption during pregnancy, EIB, exclusive breastfeeding, subjects' current nutrients adequacy levels (collected using recall 2x24 hours), and mothers' nutrition knowledge (collected using validated structured questioner). Data processing and analysis used Microsoft Excel and Chi Square Test by SPSS version 16.0 for Windows.

RESULTS AND DISCUSSION

The median of HAZ in both groups was classifed as low although the stunting group (-2.39 SD) was lower than the normal group (-1.31 SD). More than half of the subjects (57.9%) were boys. There were no significant differences of parents' and socio-economic characteristics in both groups. This research showed that low birth weight (LBW) ($p=0.071$) and short birth length ($p=0.016$) were higher in the stunting group compared to non-stunting group. This is in line with other research indicating that normal birth length decreases the stunting risk (2). Significant differences in history of micronutrient fulfillment during pregnancy were not found because of inadequacy in both groups ($p>0.05$). Micronutrient fulfillment during pregnancy needs more attention because of its effect on birth length (3). EIB postponement causes colostrum consumption loss. There were more stunting groups which received EIB than the non-stunting group ($p=0.027$). This is not in line with previous research which showed that infants who received EIB will have 11.1 times lower risk of experiencing stunting (4). This might occur because subjects in the stunting group who received EIB did not continue to be exclusively

Table I: Characteristic of stunting and normal children

Variable	Stunting (%)	Normal (%)	P-value
HAZ	-2.39 SD	-1.31 SD	0.359
Sex			
Boy	57.9	57.9	
Girl	42.1	42.1	
Birth weight			0.071
LBW (<2500 g)	15.8	0	
Normal (≥2500 g)	84.2	100	
Birth length			0.016*
Short (<48 cm)	26.3	0	
Normal (≥48 cm)	73.7	100	
Pregnancy's micronutrient inadequacy fulfillment			
Iron	31.6	47.4	0.319
Zinc	100	100	
Vit B12	73.7	84.2	0.426
Folate	31.6	26.3	0.721
Iodium salt	21.1	10.5	0.374
EIB			0.027*
No	10.5	42.1	
Yes	89.5	57.9	
Exclusive breastfeeding			0.501
Yes	68.4	57.9	
No	31.6	42.1	
Nutrients adequacy level			
Energy	21.1	36.8	0.373
Protein	68.4	78.9	0.461
Iron	47.4	31.6	0.319
Zinc	57.9	47.4	0.516
Vitamin A	94.7	84.2	0.290
Mother's nutritional knowledge			
Mother's nutritional cognitive level			0.071
Poor	92.1	100.0	
Moderate	7.9	0.0	
Good	0.0	0.0	
Mother's nutritional affective level			0.419
Poor	36.8	31.6	
Moderate	57.9	52.6	
Good	5.3	15.8	
Mother's nutritional behavioral level			0.428
Poor	5.3	5.3	
Moderate	42.1	42.1	
Good	52.6	52.6	

*significant (<0.05)
Chi Square Test

breastfed (68.4%). Subject's energy adequacy level tends to be inadequate in both groups (p=0.373). Adequate protein consumption was found higher in the normal group than the stunting group (p=0.461). There were no significant differences in micronutrient adequacy level between two groups. More than 90% mothers' nutrition knowledge at cognitive level tends to be low in both groups. Nutrition knowledge of subjects' mothers need improvement to support better attitude and behavior related to nutrition especially exclusive breastfeeding behavior and nutrients adequacy level because subjects in the stunting group who receive EIB mostly did not exclusively breastfed. Inadequacy level of nutrient consumption is the primary cause of stunting (5). Therefore, subjects' nutrient adequacy level needs to be improved.

CONCLUSION

Stunting under three-years aged children in Besowo village has significant correlation with birth length and EIB. Supplements availability for pregnant women needs more attention from the district government and health services providers. It is important to improve mothers' nutrition knowledge to decrease the prevalence of stunting.

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EXTENDED ABSTRACT

Diet Quality, Nutritional Intake, and Double Burden of Malnutrition of School-Going Adolescent Girls in Bogor, West Java, Indonesia

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SUMMARY

Double burden of malnutrition (DBM), the coexistence of under- and overnutrition, is a problem for adolescent girls. A total of 239 school-going adolescent girls from Bogor participated in this cross-sectional study that aimed to examine nutritional intake and diet quality in relation to different types of malnutrition. Anaemia, overweight, stunting, and DBM prevalence were 21.3%, 7.5%, 13.4%, and 10.5%, respectively. The subjects' dietary consumption was inadequate, particularly in micronutrients among DBM subjects. Stunted adolescents ate more fat, while overweight and DBM subjects had poorer calcium intake. Overweight subjects favour vitamin A-rich plant foods over eggs and dairy products.

Keywords: Adolescent girls, Anaemia, Dietary diversity, Double burden of malnutrition, Stunting

INTRODUCTION

Adolescent girls struggle with double burden of malnutrition (DBM), the coexistence of under- and overnutrition, both globally and in Indonesia (1). These nutritional issues, including anaemia, stunting, and obesity in adolescent females, are connected to poor diet. However, more research is still required on the nutrition quality and quantity of this population. This study aimed to identify the nutritional intake and diet quality of adolescent girls in relation with different types of malnutrition.

MATERIALS AND METHODS

In 2017, information was gathered from 239 adolescent girls from four vocational and three junior high schools in Ciampea Sub-district, Bogor. Adequacy levels of nine macro-micronutrients and dietary diversity score (DDS) were calculated from information on food intake and quality collected through a single 24-hour recall (2). Weight and height measurements were conducted and analysed by WHOAnthroPlus to determine overweight and stunting. Capillary haemoglobin concentration of 12.0 g/dL as measured by HemoCue Hb 301 was used to establish anaemia status. IBM SPSS 21 was used to analyse the data using descriptive statistics and Kruskal-Wallis Tests. Five subject categories of data were given (no problem, anaemic, stunted, overweight, and DBM). DBM is a combination of at least two malnutrition categories in a single person, such as stunting-overweight or stunting-anaemia. When a subject has no nutritional issues, they are classified as having no problem.

RESULTS AND DISCUSSION

According to the findings, prevalence of anaemia, overweight, stunting, and DBM were 21.3%, 7.5%, 13.4%, and 10.5%, respectively. Median age in each group was 15 years, with mothers graduating from elementary school. There were significantly more anaemic subjects who received daily allowance of more than IDR 20,000 or USD 1.3 ($p=0.034$). Fathers' education tends to be higher among overweight and DBM subjects (senior high school vs. elementary school).

Overall, subjects in each group consumed five of the eight food groups, showing medium level of dietary diversity (Table I). Subjects with no nutritional problem tend to consume more variety of food (6 vs. 5 food groups). The nutritional intake of subjects was still severely lacking, especially for micronutrients, which were mostly below 50% adequacy level. Among individuals who had DBM, most nutrients were still low. Stunted adolescents consumed considerably more fat ($p=0.020$), indicating the consumption of foods high in calories and fat but deficient in protein, vitamins, and minerals. Subjects with DBM and overweight had significantly poor calcium intake ($p=0.004$). Low calcium intake raises calciotropic hormones, which trigger lipogenesis and can result in obesity (3). Overall, most overweight subjects (61.1%) tend to consume more vitamin A-rich plant foods but

Table I: Dietary diversity score and nutrient adequacy of subjects with different nutritional status, med (IQR)

Variables	No Problem (n=113)	Anaemic (n=51)	Stunted (n=32)	Overweight (n=18)	DBM (n=25)	p
Dietary diversity score	6 (2.5)	5 (2.0)	5 (2.3)	5 (2.0)	5 (2.0)	0.265
Nutrient Adequacy (%)						
Energy	68.9 (45.1)	75.3 (58.6)	81.0 (34.0)	61.5 (38.8)	62.8 (40.3)	0.115
Protein	64.3 (47.2)	81.6 (66.4)	69.8 (49.1)	52.9 (27.7)	52.4 (63.3)	0.076
Carbohydrate	60.5 (47.0)	59.8 (41.0)	72.2 (27.9)	55.8 (41.7)	52.2 (21.6)	0.185
Fat	68.8 (59.2)	77.8 (83.9)	99.6 (49.8)	66.1 (53.1)	52.5 (50.7)	0.020*
Fibre	17.9 (16.7)	18.2 (22.9)	23.4 (15.3)	19.7 (15.2)	16.2 (13.0)	0.389
Zinc	33.5 (32.4)	34.6 (28.1)	40.5 (50.6)	26.5 (30.6)	28.1 (42.3)	0.437
Iron	23.6 (22.3)	22.6 (22.2)	28.3 (28.3)	18.2 (24.5)	16.8 (18.5)	0.091
Vitamin C	10.1 (28.5)	15.2 (24.9)	22.4 (27.7)	12.2 (10.2)	10.6 (19.6)	0.159
Calcium	18.8 (27.3)	18.1 (29.3)	18.5 (41.8)	9.0 (20.2)	10.2 (10.7)	0.004*

*Independent-Samples Kruskal-Wallis Test, p<0.05.

Table II: Dietary diversity of subjects with different nutritional status, n (%)

Food Groups	No Problem (n=113)	Anaemic (n=51)	Stunted (n=32)	Overweight (n=18)	DBM (n=25)	p
Grains, roots, tubers	112 (99.1)	51 (100.0)	32 (100.0)	18 (100.0)	25 (100.0)	0.892
Vitamin A-rich plant foods	40 (35.4)	23 (45.1)	13 (40.6)	11 (61.1)	11 (44.0)	0.297
Other fruits or vegetables	68 (60.2)	30 (58.8)	20 (62.5)	10 (55.6)	12 (48.0)	0.820
Meat, poultry, fish, seafood	96 (85.0)	41 (80.4)	23 (71.9)	14 (77.8)	20 (80.0)	0.552
Eggs	67 (59.3)	29 (56.9)	15 (46.9)	7 (38.9)	14 (56.0)	0.456
Pulses/legumes/nuts	57 (50.4)	24 (47.1)	16 (50.0)	8 (44.4)	13 (52.0)	0.982
Milk and milk products	48 (42.5)	16 (31.4)	14 (43.8)	2 (11.1)	9 (36.0)	0.095
Foods cooked in oil/fat	111 (98.2)	48 (94.1)	31 (96.9)	17 (94.4)	24 (96.0)	0.702

less eggs (38.9%) and milk and milk products (11.1%) (Table II). Adolescents who want to lose weight may employ dietary restrictions to limit their consumption of Western-style foods (4.5).

CONCLUSION

Adolescent malnutrition continues to be a problem, as does DBM. Dietary intake among subjects was insufficient, particularly for micronutrients and among DBM subjects. Stunted adolescents ate more fat, while overweight and DBM subjects consumed less calcium. School-based nutrition education is encouraged for adolescent girls to increase diet quality and quantity.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Training on Balanced Nutrition for Raudhatul Athfal Teachers in Semarang City

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SUMMARY

This study aimed to increase teachers' knowledge of stunting prevention of Raudhatul Athfal (RA) students in Semarang City using quasi-experimental design. The teachers were selected from nine RAs. The module consisted of balanced nutrition to prevent stunting, iron deficiency anaemia, obesity, and dengue haemorrhagic fever. Teachers' knowledge was examined through a questionnaire before and after the module was implemented for four sessions; each session comprised 50 minute-presentation and discussion. The average values of teachers' knowledge were 83.39 (pre-test) and 98.46 (post-test) (t=4.099, p<0.01**). Training on balance nutrition can increase the knowledge of RA teachers.

Keywords: Raudhatul athfal, Semarang city, Stunting, Teachers, Training on balanced nutrition

INTRODUCTION

Training is a method to increase the competence of teachers or the community in preventing stunting (1). The prevalence of stunting in children under five in Semarang City have 21.3 percent which means it is still above 14.0 percent which is expected to be achieved in 2024 (2), as part of Raudhatul Athfal students was 4-5 years old. The training on balanced nutrition approach for Raudhatul Atfhal teachers is a formal learning strategy at the early childhood education (called PAUD) level to introduce nutritional problems in children and prevent nutritional problems, especially stunting in children (3). Teachers have never received training on balanced nutrition supported the learning process in the classroom to be practiced to prevent stunting in RA students. The aim of this study was to increase teachers' knowledge of balanced nutrition to prevent stunting in students of Raudhatul Athfal in Semarang City.

MATERIALS AND METHODS

The study used a quasi-experimental design, where the RA teachers were trained on balanced nutrition material for four hours in a day. The module consisted of balanced nutrition to prevent stunting, iron deficiency anaemia, obesity, and dengue haemorrhagic fever. Methods for delivering training materials were presentation and discussion. The 13 RA teachers were selected proportionally from nine RAs in Semarang City to become the subject of the study. A set of 10 questionnaire comprised seven multiple-choice questions of balanced nutrition, stunting, iron deficiency anaemia, obesity and three essay questions of dengue haemorrhagic fever. The teachers answered the set of questionnaire before and after the training. Each item of questionns weighed 10 score, so the maximum teachers' knowledge is 100. The score was categorized as fair (60.0-69.0), good (70.0-79.9), and very good (80.0-100.0). The differences between teachers' knowledge before and after training were tested using Wilcoxon.

RESULTS AND DISCUSSION

The RA teachers are all female with an average age of 40.8 years (±10.8 years) and a working period of 15.4 years (±10.2 years). Most of the teacher education is Bachelor (S1) (96.2%). The average score of RA teacher knowledge before intervention was 83.39 (±12.77; ranged from 63.0 to 98.0), while after the intervention was 98.46 (±3.76; ranged from 90.0 to 100.0). Figure 1 showed the distribution of RA teacher according to their knowledge classification before and after intervention. In the end of training all the teachers have very good score. According to reference (4), the assistant, the supervisor, and the group of parents can support their career development, chiefly through the establishment of mentoring-like relationships and collaboration with the new teacher.

Figure 2 showed the difference in teacher knowledge per item. Before training, the lowest score of teacher was on

Fig 1: Distribution of teachers according to knowledge before and after intervention

Fig 2: The average score of subject knowledge for each of item question

the topic how to prevent dengue fever and the highest score of teacher was on the topic balanced nutrition, obesity, and caused of dengue fever. After training, it was showed that on the the average score of subject knowledge for each of item question, overall the score increased significantly ($Z=2.67$, $p<0.05$).

Mothers lack of knowledge about child nutrition and limited resources lead to poor diets among children in developing countries, increasing theirs risk of chronic undernutrition. The results highlighting the importance of adding an effective educational component to existing transfer programs (5).

CONCLUSION

Training on balanced nutrition for Raudhatul Athfal teachers in Semarang City can increase Raudhatul Athfal teachers' knowledge of balanced nutrition in Semarang City.

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EXTENDED ABSTRACT

The Association of Birth Weight History and Other Factors with Children's Health Status in Padang City

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SUMMARY

Low birth weight has been a problem in developing countries, including Indonesia. This study aimed to determine the association between mothers' and children's factors with the health status of children under two using a cross-sectional study in Padang City. A total of 189 children under two participated. Data was collected by a standardized questionnaire. The study found that low birth weight, visits to the health facility, and maternal age at risk were factors associated with children's health status. We suggest health education should be given to mother routinely among mothers to increase children's health status.

Keywords: Birth weight, Children under two, Health facility, Health status, Maternal age

INTRODUCTION

Children morbidity has always been an important public health problem worldwide specifically in low-economic countries. Thishas consequences to higher prevalence of children mortality (1). One of the causes of morbidity among children is diarrheal infectious disease which is the second cause of mortality among children younger than five. Many factors contribute to children's health status, such as Low Birth Weight (LBW). Based on world's data, approximately 15% - 20% of birth problems are LBW (2). Medical records of Dr. M Jamil Padang hospital showed that LBW cases were 99 babies (26.0%). As previous studies on children's morbidity showed, factors such as children's and mothers' characteristics, Chronic Energy Deficiency (CED), breastfeeding pattern and region are important risk factors associated with children morbidity (3-5). The study aimed to determine the association of birth weight history and maternal factors with children's health status in Padang City.

MATERIALS AND METHODS

This cross sectional study involved children under two in Padang City. A total of 189 children under two participated and primary data was collected using a standardized questionnaire. The data consisted of children's health status, LBW, visits to the health facility (VHF), maternal age at risk and others characteristics of mothers and children. Univariate, bivariate and multivariate analysis were done using computerized program. Multivariate multiple logistics regression test was used to examine factors related to children's health status and it was shown from p value<0.05 and Prevalence Risk (PR) > 1. Ethical clearance for this study was obtained from the Research Ethics Commission of the Faculty of Public Health, Andalas University. We processed the permission of the study which was taken from Padang City health office and the respondents' agreement was obtained through signing the informed consent after receiving an explanation about the aim of the study.

RESULTS AND DISCUSSION

There were 16.9% children with low health status who suffered from infectious disease. Children percentage with low health status was higher on mothers' age at risk, CED, underweight, low education, maternal working, LBW, malegender and low VHF. We identified LBW (p=0.002; PR=3.798; CI=1.647-8.759), VHF (p=0.001; PR=7.610; CI=2.295-25.237) and mothers' age (p=0.0001; PR=8.389; CI=2.676-26.303) had association with children's health. Early marriage of mothers at an early age might have an impact on capability on caring children and risk of delivering LBW babies.

CONCLUSION

This study identified mothers' age, visits to the health facility, and LBW as important factors that are related to children's health status, mainly children under two.

Table I: The association between maternal and child's characteristics with children's health

Variables	Children's Health				p
	Low		Normal		
	n	%	n	%	
Maternal's factors					
Age					
At risk	8	57.1	6	42.9	0.0001
No risk	24	13.7	151	86.3	
CED					
Yes	6	25.0	18	75.0%	0.403
No	26	15.8	139	84.2	
BMI					
Underweight	5	20.0	20	80.0	0.774
Normal	27	16.5	137	83.5	
Education					
Low	8	19.5	33	80.5	0.793
High	24	16.2	124	83.8	
Working					
Yes	4	28.6	10	71.4	0.262
No	28	16.0	147	84.0	
Child's factors					
LBW					
Yes	16	34.0	31	66.0	0.001
No	16	11.3	126	88.7	
Gender					
Boy	18	18.8	78	81.3	0.629
Girl	14	15.1	79	84.9	
VHF					
Low	8	57.1	6	42.9	0.0001
Normal	24	13.7	151	86.3	

Table II: The determinant factors of children's health

Variables	PR	95% CI		p
		Lower	Upper	
Full Model				
Maternal's factors				
Age	7.443	2.138	25.190	0.002
CED	1.184	0.328	4.278	0.796
BMI	1.130	0.282	4.535	0.863
Education	1.039	0.385	2.805	0.940
Working	0.676	0.170	2.680	0.577
Child's factors				
LBW	3.859	1.497	8.943	0.004
Gender	0.724	0.315	1.667	0,448
VHF	7.443	2.138	25.190	0.002
Last model				
Maternal's age	8.389	2.676	26.303	0.001
LBW	3.798	1.647	8.759	0.002
VHF	8.389	2.676	26.303	0.001

Community based-education for reducing morbidity and undernutrition prevalence among children is needed besides increasing mothers' motivation to visit health facilities routinely with children.

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EXTENDED ABSTRACT

Comparison of the Effectiveness of E-Booklets And Animation Videos on Knowledge and Attitude of Anemia in Adolescent Girls in Senior High School in Bogor, Indonesia

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SUMMARY

Nutrition education should be delivered using media. E-booklets and animation videos can increase knowledge and attitude, but these two media have not been compared in previous research. This study analyzed the effectiveness of e-booklets and animation videos on knowledge and attitude associated with anemia in adolescent girls. This quasi-experimental research used a non-equivalent control group design with e-booklets, animation videos, and a control group. The 11 days intervention was delivered online via Whatsapp messenger. There is no difference in effectiveness between e-booklets (knowledge 82, attitude 91) and animation videos (knowledge 84, attitude 91) because each media has its advantages.

Keywords: Adolescent girls, Anemia, Animation videos, E-booklets, Nutrition education

INTRODUCTION

There are many media that can be used for delivering nutrition education such as visual media, audio, and audiovisual media. Previous findings show that booklets and videos can increase knowledge and attitude (1). The media used for nutrition education in this study were e-booklets and animation videos. Adolescents are prone to anemia due to lack of knowledge and attitude associated with anemia. Therefore, to improve it, nutrition education should be delivered using the media. This study aimed to analyze the effectiveness of e-booklets and animation videos on knowledge and attitude associated with anemia in adolescent girls.

MATERIALS AND METHODS

This quasi-experimental research involved 71 respondents from Kosgoro Senior High School in Bogor with a non-equivalent control group design. Students who can operate smartphones and use Whatsapp were included in this study. The 11 day-intervention was delivered online via Whatsapp messenger, and the students were given e-booklets and animation videos two times over a 3-day interval of intervention (2). The pre-test was given one day before the intervention, and the post-test was delivered one week after. The contents inludes definition, causes, symptoms, impact, and prevention from anemia. The questionnaires were tested for validity using corrected item-total correlation, and the reliability using Cronbach's Alpha score that was 0.60. All data were tested for normality using the Shapiro-Wilk test. If the data were normal, paired-t test, ANOVA test, and post hoc ANOVA test were used. If the data were not normal, the Wilcoxon test, Kruskal-Wallis test, and Mann-Whitney test were used.

RESULTS AND DISCUSSION

Cronbach's Alpha scores in knowledge were 0.830 and attitude 0.755. The respondents were divided into three groups: e-booklets, animation videos, and control groups. The results show that there are differences in knowledge and attitude associated with anemia before and after being given nutrition education using e-booklets and animation videos in the adolescent girls ($p<0.05$); meanwhile, the control group showed that there was no difference ($p>0.05$). E-booklets media is an electronic learning media made from a combination of print media, and considered more practical to access by presenting structured and interesting information. Animation videos have advantages, such as material in the form of images and animated as visuals and can be heard (3). Increased knowledge will relate to attitude that will affect anemia status. There was no difference between e-booklets and animation videos on knowledge and attitude ($p>0.05$). There was no difference in pre-test scores between e-booklets and animation videos with control ($p>0.05$). There was a difference in post-test scores between e-booklets and animation videos

with control (p<0.05). Statistically, there is no difference in effectiveness between e-booklets and animation videos because each media has its advantages. But when viewed from the three groups, e-booklets groups show the highest NGain score is 59 knowledge and 14 attitude. Media e-booklets are booklets that are presented in digital form so that readers can easily access them through gadgets by showing structured and exciting information (4). The data on differences in knowledge and attitude associated to anemia before and after are presented in Table I.

Table I: Differences in knowledge and attitude associated to anemia before and after

Variable	Group		
	E-booklets	Animation Videos	Control
Knowledge			
Pre-test	56.5±13.3	65.8±19.1	63.2±20.4
Post-test	82.9±11.8 [a]	84.3±9.8 [b]	64.2±17.4 [a,b]
NGain	59.2	53.8	-11.4
Attitude			
Pre-test	77.857±7.5	81.0±7	79.0±9.43
Post-test	91.1±4.5 [c]	91.2±4.9 [d]	78.2±11.2 [c,d]
NGain	14.4	11.8	-0.8

[a]Posttest knowledge of e-booklets differently significant with control (Mann Whitney test sig. at p-value 0.05)
[b]Posttest knowledge of animation videos differently significant with control (Mann Whitney test sig. at p-value 0.05)
[c]Posttest attitude of e-booklets differently significant with control (Post hoc anova test sig. at p-value 0.05)
[d]Posttest attitude of animation videos differently significant with control (Post hoc anova test sig. at p-value 0.05)

CONCLUSION

Nutrition education with e-booklets and animation videos increase the knowledge and attitude of adolescent girls associated with anemia, but statistically there was no difference in effectiveness. E-booklets show the highest NGain score between group that indicated the highest effectiveness. E-booklets and animation videos are essential to increase knowledge and attitude.

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EXTENDED ABSTRACT

Urinary Pyridinium Crosslinks as a Sensitive Biomarker of Linear Growth in Adolescents

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SUMMARY

The research aimed to assess urine Pyd as an indicator that can be used to detect stunting incidents. The research design was a cross-sectional study. The subjects consisted of 64 selected teenagers (12-15 yo) from SMPN 1 Kampar in Riau Province. Subjects were measured on January 2022. The indicators of nutrition status were urine Pyd and HAZ as gold standards. Curve of receiver operating characteristic was used to assess the ability of diagnostic test. The ability of urine Pyd in diagnosing stunting was good (AUC area of 70.0%). The urine Pyd qualified as a predictor for the incidence of stunting.

Keywords: Height, Linear growth indicators, Pyridinium crosslinks, Sensitivity, Stunting adolescents,

INTRODUCTION

Stunting is a major nutritional issue worldwide (1). One of the efforts to reduce the prevalence of stunting is to provide a reliable stunting detector. Treatment is more effective at an early stage if stunting can be detected at a preclinical stage. The early detection is part of stunting prevention, that is detecting the possibility of experiencing stunting in children without symptoms. The current stunting indicator is height for age z-score (HAZ). The results of measuring height are often dubious obtained by using measuring gauges and standardization of instruments. The urine Pyd is expected to be an indicator of stunting with bone growth disorders associated with bone resorption (2). The Pyd is dissolved by osteoclastic cells and excreted in the urine (3). The objective of this study is to evaluate the validity of urine Pyd against the HAZ gold standard that can be used to measure linear growth related to early detection of stunting.

MATERIALS AND METHODS

This cross-sectional study involved 64 selected teenagers (12-15 yo) from SMPN 1 Kampar in Riau Province. Subjects were measured on January 2022. The indicators of nutrition status were the urine Pyd and HAZ as gold standard. Height gauges (microtoise) used STATURE METER. The urine was collected between 7:00 and 10:00 am by using sterile pot; it was then stored in freezer at -20^{o}C (until further analysis). Pyd measurements were performed by using MicroVue™ PYD EIA kit and a Spectrophotometer. The analysis of urine samples was carried out at Prodia Jakarta. The curve of receiver operating characteristic (ROC) was used to assess the ability of the diagnostic test and to determine the cut of point test results from urine Pyd to detect stunting. The ability of a test is declared appropriate if the area under the curve (AUC) is 0.7 (4).

RESULTS AND DISCUSSION

The prevalence of stunting subjects was 34.4% (Table I). This result revealed that the value was higher than the prevalence of stunted adolescents aged 13-15 years in Riau Province, namely 25.5% (1). The urine Pyd is not only to measure linear growth in the age group of adolescents aged 12-15 years but also applies to the age group of neonates (0-3 days) and the group of children aged 4-6 years (2). In the future, urine Pyd is expected to be used for pregnant women.

The ability of urine Pyd in diagnosing stunting was good with an AUC area of 0.700 (70.0%) at measurement. The sensitivity of the urine Pyd test to state positive for the ones experiencing stunting was 72.4%. The higher the sensitivity of a test, the more positive test results are obtained in the ones who are stunted or the fewer the number of false negatives (5). The specificity of the urine Pyd test for negative shows that for the ones who did

Table I: Indicators of linear growth

Variable	n	Value*
HAZ		
Stunting	22	-2.4±0.3
Normal	42	-0.5±0.6
Height (cm)		
Stunting	22	145.4±3.5
Normal	42	158.8±5.6
Pyd (nmol/mmol creatinine)		
Stunting	22	173.7±75.0
Normal	42	133.0±69.1

NOTE*: Mean ± SD

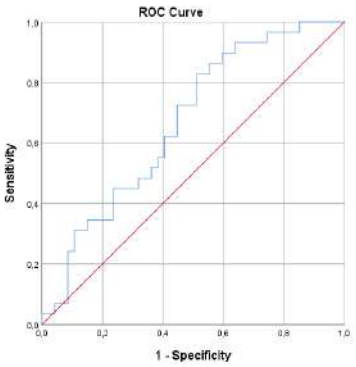

Fig 1: Curve of receiver operating characteristic (ROC)
—— Urine Pyd ROC area: 0.7
—— Reference

not experience stunting was 53.2%; specificity of the urine Pyd test described the number of those who had a negative test result in the ones who were not stunted (number of false positives). The urine Pyd accuracy is the proportion of the correct test's results among all respondents examined, namely 60.5%. The predictive value of negative test that is the proportion of those who were not sick among negative test results was 75.8%. The best cut point of urine Pyd for diagnosing stunting was 133.5 nmol/mmol creatinine.

CONCLUSION

The urinary Pyd is considered an acceptable measurement for assessing stunting. The Pyd qualified as a predictor instrument for stunting. The Pyd has a higher sensitivity value than the specificity value. The urinary Pyd needs to be investigated further in the future regarding its reliability in groups of pregnant women and their babies.

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EXTENDED ABSTRACT

The Impact of a Community-Led Health and Nutrition Training for Women of Oil Palm Smallholder Farmers in Riau, Sumatera, Indonesia

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SUMMARY

Health and nutrition training (HNT) is a potential solution to increase the livelihoods of oil palm smallholder families. An average of 3,949 participants from three districts (Pelalawan, Rokan Hulu, and Rokan Hilir) in Riau Province, Indonesia was given HNT by trained women-leaders in three monthly sessions. A post-test control group design was applied to evaluate the HNT among 335 women who received HNT and 100 control subjects. The results showed that women in the intervention group practiced more home gardening, fish farming, had better food security scores, food consumption scores and were more empowered compared to the control group.

Keywords: Food consumption, Food security, Home gardening, Nutrition training, Women

INTRODUCTION

The palm oil industry is one of the largest contributors to the economic growth of Indonesia. Forty percent of the palm oil industry come from small-holder farmers (1). Although several studies have shown the economic impact of oil palm plantation on household income, food expenditure remains high and diet quality is less explored in existing studies (2). This suggests the need to improve the health and nutrition knowledge and practices of oil palm small holder families. The study aims to evaluate the impact of three-monthly sessions of HNT delivered by trained women leaders on home gardening, fish farming, food security, food consumption and women's empowerment.

MATERIALS AND METHODS

In 2020, a community-led health and nutrition training involving 335 women was evaluated and compared to 100 women who did not receive HNT, using a post-test control group design, in three districts (Pelalawan, Rokan Hulu, and Rokan Hilir) of Riau Province, Indonesia. The training included topics on balanced nutrition for the family, home gardening, and fish farming in a bucket which was delivered by trained women leaders. Outcomes were measured 3 months after the last training session. Home gardening and fish farming were documented through a structured questionnaire. The Food Insecurity Experience Scale (FIES) was used to assess the food security status of households (3). Food consumption was measured using the Food Consumption Score (FCS) (4). Meanwhile, women's empowerment was assessed using the Abbreviated-Women's Empowerment in Agriculture Index (A-WEAI) (5). Statistical analysis was performed using IBM SPSS 21 using descriptive statistics, T-Tests for numeric variables, and Chi-Square Tests for categorical variables.

RESULTS AND DISCUSSION

The study revealed that three months after HNT, home and community gardening were significantly higher among the treatment group compared to the control group in Pelalawan and Rokan Hulu District. Community gardening was practiced less compared to home gardening due to different management of the program, where in Rokan Hulu, women leaders were more engaged with the participants and initiated positive activities beyond the scope of the program. This was also apparent for fish farming practices which was only found to be significant in Rokan Hulu among the treatment group ($p=0.003$). Higher participation of HNT in Rokan Hulu also led to higher FCS ($p<0.001$). As an indicator of diet quantity and quality, a greater FCS is linked to a higher calorie intake and better dietary diversity (4).

In terms of food insecurity, although the overall trend of better food security status was found among the treatment

Table I: Outcome variables between treatment and control group in selected three subdistricts

Outcome Variables	Pelalawan			Rokan Hulu			Rokan Hilir		
	Treatment (n=90)	Control (n=30)	p	Treatment (n=145)	Control (n=40)	p	Treatment (n=100)	Control (n=30)	p
Home gardening (%)	78.9	56.7	0.030*	96.6	40.0	<0.001*	42.0	40.0	1.000
Community gardening	18.9	0.0	0.006*	73.1	2.5	<0.001*	0.0	0.0	NA
Fish farming (%)	11.1	6.7	1.000	31.7	7.5	0.003*	1.0	3.3	0.539
FCS (mean ± SD)	76.7±16.4	74.0±14.0	0.404	78.9±16.1	65.7±14.9	<0.001***	80.6±12.5	76.9±20.9	0.368
FIES (%)			0.845			<0.001**			0.001**
Food secure	68.9	70.0		80.0	47.5		84.0	53.3	
Mild Food Insecure	30.0	30.0		17.2	42.5		14.0	26.7	
Moderate food insecure	1.1	0.0		2.8	7.5		2.0	16.7	
Severe food insecure	0.0	0.0		0.0	2.5		0.0	3.3	
A-WEAI (%)									
Production	74.4	36.7	<0.001*	98.6	57.5	<0.001*	97.0	56.7	<0.001*
Asset	91.1	40.0	<0.001*	85.5	42.5	<0.001*	85.0	66.7	0.035*
Income	83.3	73.3	0.284	97.2	60.0	<0.001*	98.0	56.7	<0.001*
Leadership	93.3	56.7	<0.001*	99.3	60.0	<0.001*	96.0	83.3	0.030*
Time	56.7	70.0	0.282	81.4	70.0	0.129	50.0	6.7	<0.001*
Overall	50.0	23.3	0.011*	89.7	22.5	<0.001*	76.0	36.7	<0.001*

*) Fischer exact test, p<0.05
**) Chi square test, p<0.05
***) T-test, p<0.05

group compared to the control in the three districts, the findings were particularly significant in Rokan Hulu and Rokan Hilir (p<0.001). The study showed that moderate and severe food insecurity was still found among the control group (7.2% and 2.5% in Rokan Hulu; 16.7% and 3.3% in Rokan Hilir, respectively). Meanwhile, in the treatment group, moderate food insecurity was only found in less than 3% of the respondents and none were found to be severely food insecure.

The percentage of adequate A-WEAI score also showed positive results among the treatment group compared to the control group for almost all of the components, except for income in Pelalawan District, and time in Pelalawan and Rokan Hulu, demonstrating the positive impact of HNT towards women's empowerment.

CONCLUSION

HNT delivered by women-leaders showed positive impacts towards household gardening, farming practices, household food security, food consumption and women empowerment. Although the results were not equal in all the three districts, the results are promising and can potentially benefit the wider community.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Nutritional Knowledge, Food Consumption, and Nutritional Status of Primary School Children at Teluk Batang Village, North Kayong District, West Kalimantan Province

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SUMMARY

The aim of this cross-sectional study was to examine the correlation between nutritional knowledge and the quality of food consumption with the nutritional status of elementary school students in Teluk Batang Village, North Kayong District. The level of nutritional knowledge of the subject is classified as moderate. The results of the correlation test showed that the subjects' nutritional knowledge, their mother's nutritional knowledge, and the quality of food consumption were not significantly corelated with nutritional status (P>0.05). However, the level of protein adequacy had a significant negative relationship with the nutritional status of the subjects (P<0.05).

Keywords: Food consumption, Nutritional knowledge, Nutritional status, Primary school children

INTRODUCTION

Food diversity has been recognized as a factor that determines the quality of a person's food consumption. Quality of food consumed is influenced by many factors including nutritional knowledge. Good nutritional knowledge serves as a strong foundation shaping good nutritional attitudes and behaviour (1). Malnutrition in children will have an impact on decreasing intelligence, learning ability, creativity, and productivity due to disruption of the children's brain development (2). The prevalence of undernutrition (5.87% for underweight and 11.8% for very thin) and overnutrition (9.52% for overweight and 8.7% for obesity) in elementary school students in North Kayong District is high (Ministry of Health 2017). In addition, Teluk Batang Village is a coastal area. So, access to animal food from the sea is relatively high. This will affect the quality of food consumption and the nutritional status of children. Therefore, this study focuses on examining the relationship between nutritional knowledge and the quality of food consumption with the nutritional status of elementary school students.

MATERIALS AND METHODS

The study design was cross-sectional and conducted among 64 students in grade 5 and 6 at SDN 01 Teluk Batang and MIS Babul Mu'minin Teluk Batang. The data collected includes the characteristics of the subject, nutrition knowledge of subject, and food consumption. Nutritional knowledge was measured using a questionnaire developed consisting of 10 messages from the Balanced Nutrition Guidelines (3). The level of nutritional knowledge was categorized as less (<60%), moderate (60-80%), and good (>80%). The quality of food consumption is based on the Dietary Diversity Score (DDS) was categorized as good (DDS scores≥6), moderate (DDS score is 4-5), and less (DDS score≤3) (FAO 2010). Nutritional status of children aged 5-18 years based on BMI for age indicators categorized according to the (4). Analysis of the data that has been processed is the Spearman and Chi square relationship test.

RESULTS AND DISCUSSION

The nutritional knowledge level of the subject is in the moderate category (66.7%) (Table I). The average energy intake of subjects (46.7%) was sufficient but the intake of protein, fat, and carbohydrates was considered insufficient. The quality of the subject's food consumption is classified as lacking. The data on the types of food groups consumed by the subjects showed that the staple foods of starch, meat & fish, and eggs were consumed by most of the subjects. Meanwhile, fruit and vegetable food groups are sources of vitamin A, as well as milk and dairy products are the food groups that are the least consumed. This study found that one of three children in the study area are overweight and obese. A low DDS indicates a low quality of food consumption. This is related to the incidence of overweight and

Table I: Distribution of children nutritional knowledge, food consumption, and nutritional status

Variable	Total		Male		Female	
	n	%	n	%	n	%
Nutritional knowledge						
Less (<60%)	2	3.3	0	0	2	6.4
Moderate (60-80%)	40	66.7	18	62.1	22	71.0
Good (>80%)	18	30.0	11	37.9	7	22.6
Average±SD	76.4±9.7		78±9.0		74.4±10.1	
Energy Adequacy Level						
Underfed	28	46.7	11	37.9	17	54.8
Adequately fed	24	40.0	13	44.8	11	35.5
Overfed	8	13.3	5	17.2	3	9.7
Average±SD	87.5±27.3		94.5±27.9		81.0±25.4	
Protein Adequacy Level						
Underfed	44	73.3	20	70.0	24	77.4
Adequately fed	10	16.7	5	17.2	5	16.1
Overfed	6	10.0	4	13.8	2	6.5
Average±SD	77.0±24.9		80.3±27.4		73.8±22.3	
Fat Adequacy Level						
Underfed	43	71.7	18	62.1	25	80.6
Adequately fed	9	15.0	6	20.7	3	9.7
Overfed	8	13.3	5	17.2	3	9.7
Average±SD	74.5±33.2		82.6±36.5		66.9±28.3	
Carbohydrate Adequacy Level						
Underfed	28	46.7	12	41.4	16	51.6
Adequately fed	19	31.7	10	34.5	9	29.0
Overfed	13	21.6	7	24.1	6	19.4
Average±SD	91.3±29.6		98.1±28.4		84.9±29.6	
Dietary Diversity Score (DDS)						
Low (≤3 food groups)	25	41.7	13	44.8	12	38.7
Moderate (4-5 food groups)	35	58.3	16	55.2	19	61.3
Good (≥6 food groups)	0	0	0	0	0	0
Average±SD	3.4±0.7		3.4±0.8		3.4±0.6	
BMI for Age						
Thinness	6	10.0	5	17.2	1	3
Normal	33	55.0	13	44.8	20	65
Overweight	7	11.7	3	10.3	4	13
Obesity	14	23.3	8	27.6	6	19
Average of z-score±SD	0.32±2.31		0.30±2.56		0.32±2.09	

Source: primary survey data analysis

Table II: Correlation between nutritional knowledge and food consumption with nutritional status

Independent variables	Nutritional status	
	R	p-value
Nutrition Knowledge		
Subject's nutrition knowledge	0.086	0.512
Food Consumption		
Quality of Food Consumption	0.209	0.109
Quantity of Food Consumption		
Energy	-0.162	0.216
Protein	-0.272	0.036*
Fat	-0.210	0.108
Carbohydrate	-0.105	0.426

*Statistically significant with spearman correlation test

obesity in children so that it is necessary to increase the consumption of diverse foods to achieve good quality food consumption.

There is no significantly correlation between the subjects' nutritional knowledge and quality of food consumption with the nutritional status (P>0.05) (Table II). However. there was a significant correlation (P<0.05) between the protein adequacy level and the nutritional status. The negative relationship between the level of protein adequacy and nutritional status is suspected because subjects with poor nutritional status have a desire to improve their nutritional status to increase their intake. On the other hand. subjects with overweight and obesity tend to reduce their intake because they want to lose weight and improve their nutritional status. This causes the percentage of protein adequacy level in subjects with thinness status is higher than subjects with overweight and obesity. Diets lacking in protein can impact food consumption. increasing body weight and affecting fat mass; however. how the primary mechanism works is still poorly understood (5).

CONCLUSION

Nutrition education for students and elementary school teachers to increase the consumption of diverse foods according to the recommended balanced nutrition guidelines is necessary. especially regarding the consumption of fruits and vegetables. the consumption of a variety of staple foods. and the consumption of foods high in protein.

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EXTENDED ABSTRACT

Changes in Knowledge, Attitudes, and Fruit Consumption Practices of Participants in "Let's Drink Fruit" Program

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SUMMARY

Low fruit consumption in Indonesia Increases the non-communicable disease risks. The objective of this study was to analyze the impact of the "Let's Drink Fruit" program in increasing mothers' knowledge, attitudes, and practices (KAP) in consuming and preparing fruits for their families. A pre-post intervention design using an online questionnaire was conducted in May-July 2022 and involved 100 mothers who were members of an online community. Overall, this program significantly contributed ($p<0.05$) to improving the participants' knowledge and practices in consuming and preparing fruits for their family.

Keywords: Attitude, Fruit consumption, Knowledge, Online, Practice

INTRODUCTION

Recommendations for daily fruit consumption for a healthy life have been given by various national and world health institutions/organizations. However, national data in Indonesia shows that around 90% of people still consume fruit and vegetables less than the recommendation (1). Some factors that cause this problem are low understanding of nutrition guidelines, fresh fruit access, technical preparation, and preferences. The government has made various approaches to promote the healthy living movement (GERMAS), which includes collaborating with industry, academia, and community organizations. One of the activities is the "Let's Drink Fruit" program, the online nutritional education for millennial mothers to increase fruit consumption in the family. Therefore, this study aims to examine changes in mothers' knowledge, attitudes, and practices (KAP) in preparing and consuming fruits for their families. Previous studies showed that innovative nutritional education could be the right strategy to overcome various nutritional problems (2, 3).

MATERIALS AND METHODS

This study applied a pre-post intervention design with the "Let's Drink Fruits" program as the online nutrition education intervention. The program participants were members of the online community who were randomly selected and willing to participate in the entire program series. This study was conducted in May-July 2022 with ethical approval number 698/IT3.KEPMSM-IPB/SK/2022. The educational materials consisting of 10 topics related to fruit consumption were presented in booklets and infographics form, and afterward delivered through a Whatsapp group (WAG). Furthermore, during the intervention period (21 days), the participants received a detailed materials explanation in the form of WAG interactions with the resource person. The effectiveness of the program was measured by an online questionnaire which included questions about the mother and her family characteristics as well as KAP related to fruit consumption in any form. The analysis was carried out by comparing the result of KAP with the non-parametric Wilcoxon signed rank test.

RESULTS AND DISCUSSION

Based on their socio-economic characteristics, generally, the participants were housewives with an average age of 29 years old, have a middle and high education level, and live around Jakarta. Moreover, the participants came from well-income families, as seen from their monthly spending above the DKI Jakarta minimum regional wage in 2022. In the aspect of knowledge, this study showed a significant increase in the knowledge scores of the participants from 67.7±15.1 to 71.8±16.0 (Fig.1). In addition, the number of participants who increased in knowledge score was more than those with decreased knowledge (54 vs. 30 people). In the aspect of attitude, although there was no significant increase in the score (from 93.0±6.7 to 94.3±8.3), the number of subjects

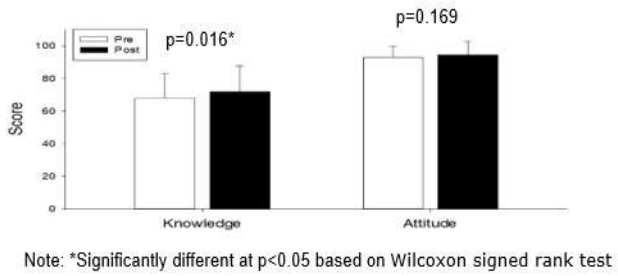

Fig 1: Changes in knowledge and attitude scores of participants (n=100)

who increase their attitude to positive was still more than those who turned to negative (48 vs 33 people).

Changes in attitude that lead to practice can occur by starting with a stimulus from the environment. Social cognitive theory by Bandura (4) explains that the presence of information from the outside (in the form of nutrition education) is able to change a person's attitudes and practices that starts with a change in their knowledge.

After the program, there was a significant increase ($p<0.05$) in maternal practice in terms of providing frequency (4.4±2.3 to 5.8±4.0 times/week), shopping frequency (2.7±1.6 to 3.1±1.4 times/week), serving of fruit juice for families (3.0±2.0 to 4.5±2.7 times/week), and the portion of fruit consumed, both by mothers (2.0±0.9 to 2.5±0.7 serving/day) and their children (1.8±0.7 to 2.2±0.9 serving/day) (Fig. 2).

CONCLUSION

Online education through "Let's Drink Fruit" program can improve mothers' knowledge and practice of fruit consumption for their children and families. Each household has various characteristics, so the strategy to improve fruit consumption can be adjusted according to the budget, family's fruit preferences, and creativity in choosing and serving fruit.

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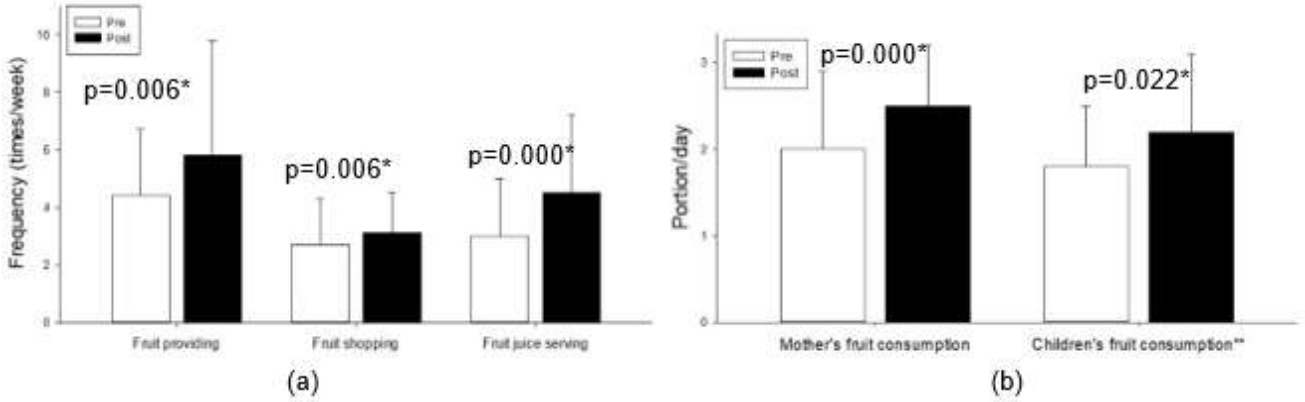

Fig 2: Changes in preparing (a) and consuming (b) fruit practices of participants (n = 100)

EXTENDED ABSTRACT

Eating Habits and Sleep Quality of University Students during the COVID-19 Pandemic in West Java

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SUMMARY

Activity restrictions during the COVID-19 pandemic have caused changes in the way of life. The purpose of this cross-sectional study was to examine the eating habits and sleep quality of university students in West Java during the pandemic. A total of 152 subjects aged 17-25 years old completed an online survey. The results showed that changes were found in eating habit of vegetables, fruits, and fast-food groups. As many as 93.4% subjects had poor sleep quality. Students' eating habits and sleep quality have changed during the pandemic, and may affect their long-term health if continuously applied.

Keywords: COVID-19, Eating habits, Sleep quality, West java university students

INTRODUCTION

The COVID-19 pandemic has significantly changed university students' eating patterns and food-purchasing behavior (1). Most university students have eaten and snacked more frequently than usual during the COVID-19 pandemic (2). A study on students reported that the majority of students consumed more dark green vegetables and fruits (3). Poor sleep quality is also reported to have increased during the pandemic for both women and men (4). Activity restrictions during the COVID-19 pandemic have caused changes in the behavior of university students. This study was conducted in West Java because the province has the most universities in Indonesia. The aim of the study is to examine the eating habits and sleep quality of university students in West Java during the COVID-19 pandemic.

MATERIALS AND METHODS

A cross-sectional study was conducted from January to April 2022 using online surveys with the Google Form application. The subjects completed the google form questionnaire by themselves. A total of 152 subjects aged 17-25 years old were involved using the purposive sampling method with the following inclusion criteria; students studying and living in West Java. A food frequency questionnaire was administered by subjects including retrospectively (before the pandemic) and prospectively (during the pandemic). The subjects' sleep quality during the last month was evaluated using the Pittsburgh Sleep Quality Index (PSQI). The PSQI questionnaire was validated by involving the 30 university students and the result of Cronbach's alpha was 0.74. This study used descriptive statistical analysis and an independent sample t-test with a p-value ($0<0.05$) for statically significance. This research has been approved by Health Research Ethics Committee UPNVJ (64/IV/2022/KEPK).

RESULTS AND DISCUSSION

Table I shows the change in the overall subjects' eating habits (37.5% increased and 24.3% decreased). The highest increase was found in vegetable and fast food, while the lowest decrease was in protein source food, which was also reported as the highest food in the not changed category. The condition of students studying from home during the pandemic led to lifestyle changes in food consumption. Students like fast and easy food to eat during the COVID-19 pandemic (3). In comparison to before the COVID-19 pandemic, there was a significant difference in the eating frequency of the vegetable group (Table II). Before the COVID-19 pandemic, most university students had inadequate diets. However, university students believed that a balanced diet may prevent the COVID-19 pandemic during that time. The consumption of water, vegetables, fruits, meat, chicken, fish, and milk consumption has increased among university students (1). The previous study also showed that university students consumed more green vegetables and fresh fruit (3). The students were aware of the benefits of vitamins and minerals in vegetables and fruits for the immune system during the COVID-19 pandemic (2,3).

Most of the subjects (93.4%) were classified in the category of poor sleep quality with an average length of

Table I: Changes in eating habits of subjects during the COVID-19 pandemic

Eating Habits	Increased		Decreased		Not changed	
	N	%	n	%	n	%
Overall	57	37.5	37	24.3	58	38.2
Staple food	57	37.5	38	25.0	57	37.5
Protein source	60	39.5	32	21.0	60	39.5
Vegetables	67	44.0	38	25.0	47	31.0
Fruits	60	39.5	38	25.0	54	35.5
Snack	57	37.5	37	24.3	58	38.2
Fast food	69	45.4	40	26.3	43	28.3

Table II: Frequency of food consumption before and during COVID-19 pandemic

Food Group	Before COVID-19 (times per day)	During COVID-19 (times per day)	P-value
Staple food	2.75	2.69	0.384
Protein source	1.10	1.05	0.210
Vegetables	0.78	2.01	0.041*
Fruits	1.21	1.59	0.167
Snack	2.36	2.23	0.246
Fast food	1.83	2.52	0.067

*Significant (p-value<0.05)

sleep of 7.5±1.85 hours. The subjects reported problems with sleep quality such as frequent awakenings at night, disturbed sleep, and discomfort when waking up in the morning. Additionally, prior studies have revealed that most adult participants in Ecuador reported having poor sleep quality during the COVID-19 pandemic (2). Poor sleep quality accompanied by increased eating habits at night will cause the circadian system to be disrupted (4). The findings indicate that changes in eating habits and sleep quality that occur during a pandemic might be considered predisposing risk factors for health connected to the COVID-19 pandemic.

CONCLUSION

In conclusion, our results showed that during the COVID-19 pandemic, there were changes in eating habits and sleep quality. These findings suggest that students' eating habits and sleep quality may become risk factors for their health during the COVID-19 pandemic.

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EXTENDED ABSTRACT

Contribution of Economic and Food Consumption Factors toward Stunting Prevalence among Children aged 0-59 Months in Indonesia

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SUMMARY

Stunting prevalence in Indonesia is high and has negative consequences. This study aimed to analyze the contribution of economic variables and food consumption to stunting prevalence among children aged 0-59 months. The research used multivariate linear regression. Gini ratio, Gross Regional Domestic Product (GRDP), unemployment, food and non-food expenditures, Desirable Dietary Pattern (DDP) score, energy and protein adequacy rate were found to contribute towards stunting among children (R2=75.81%). Protein adequacy rate contributed 13.16% to increasing stunting. Meanwhile, DDP score contributed 20.03% to reducing stunting. Therefore, policies and programs must focus on modifying animal-sourced foods consumption for diversity.

Keywords: Economic variables, Food consumption, Indonesia, Multivariate linear regression, Stunting

INTRODUCTION

Stunting problems have been considered a serious health problem, with an increase in both its short-term (mortality and morbidity, poor cognitive skills) and long-term consequences (economic loss due to decreased productivity). Various factors can can become causal factors such as, including economic as contextual and food consumption as causal factors. Increasing GRDP can decrease stunting (AOR:0.89) by facilitating expenditure on higher-quality food (1). However, Indonesia has experienced uneven economic development. A rise in GRDP has not been followed by a fall in Gini ratio and unemployment rate, while poverty rate is high, especially in eastern Indonesia (2). These situations can disrupt nutritional intake. Over the long term, lack of quality consumption can result in children becoming malnourished and lead to growth and development failure. This study aimed to analyze the contribution of economic and food consumption factors to stunting prevalence among children aged 0-59 months based on the stunting conceptual framework by WHO in 2013.

MATERIALS AND METHODS

The research was a formative study that consisted of an ecological study with 34 provinces as the unit of analysis. Main data was secondary data from 2019 with nine independent variables. The Gini ratio, GRDP (Rp/capita/year), poverty (%), unemployment (%), food expenditure and non-food expenditure (Rp/capita/months) were from Statistics Indonesia (BPS). Food consumption such as energy and protein adequacy rates (%), and the DDP score were from the Food Security Agency of the Ministry of Agriculture of the Republic of Indonesia (BKP). As a dependent variable, stunting prevalence (%) among the children aged 0-59 months was from the Ministry of Health of the Republic of Indonesia. The analytical instrument used SAS with multivariate linear regression backward elimination and a significance of ≤0.05. The contribution of all associated variables is shown by R^2 model, while the contribution of each variable is obtained from the partial R^2 value.

RESULTS AND DISCUSSION

Stunting prevalence in Indonesia reached 27.30% in 2019 (Table I). Analysis results showed that poverty variable was eliminated and other eight independent variables caused stunting as best model of regression (Table II). Partially, each protein adequacy rate and DDP score made a significant and high contribution to stunting. Protein adequacy rate contributed 13.16% to increasing stunting. Stunted children had consumption of plant-sources protein higher than animal-sources and decreased micronutrient intake, such as amino acids (3). In Indonesia, consumption of plant-sources

Table I: Situation of stunting prevalence, economic, and food consumption in 34 provinces

Variables	Minimum	Maximum
Stunting prevalence (%)	14.3	43.7
GRDP (Rp/capita/year)	39 694	2 816 760
Poverty (%)	3.4	26.6
Unemployment (%)	1.6	8.1
Gini ratio	0.26	0.44
Food expenditure (%)	38.6	59.3
Non-food expenditure (%)	40.8	61.4
Energy adequacy rates (%)	84.0	113.5
Protein adequacy rates (%)	79.1	133.3
DDP score	65.9	94.4

Table II: Factors which contributed to stunting based on multivariate regression analysis

Variables	B	R^2 partial	p value
Intercept	95.38173	-	<0.01
Gini ratio	13.83306	0.0047	0.51
GRDP	0.00000209	0.0333	0.08
Unemployment rate	–0.24264	0.0026	0.61
Food expenditure	–0.00002045	0.0192	0.17
Non-food expenditure	–0.00001289	0.0204	0.16
Energy adequacy rate	–0.30901	0.0161	0.21
Protein adequacy rate	0.52874	0.1316	<0.01*
DDP score	–0.94119	0.2003	<0.01*

*Multivariate linear regression backward elimination, p≤0.05;
R^2 model: 75.81%

protein (70.98%) was higher than animal-sources (35.74%) and dominated by grains (47.08%) (2). This is caused by traditional dietary practices whereby rice is eaten as primary food, which is associated with food consumption diversity (4).

DDP score contributed 20.03% to decreasing stunting. Diversity of food consumption can prevent stunting by 8.9% (4) and ensure nutritional intake is maximized then growth can proceed optimally (5). Meanwhile, other food consumption and economic variables included in the model but not significant could have indirect associations. Further studies are needed to determine the direction of associations between those variables to stunting.

CONCLUSION

Economic variables and food consumption contributed 75.81% to stunting prevalence. Partially, protein adequacy rate contributed 13.16% to increasing stunting prevalence, which was caused by lower consumption of animal-sourced protein. DDP score contributed 20.03% to decreasing stunting prevalence. Therefore, policies and programs must focus on modifying animal-sourced foods consumption for diversity.

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EXTENDED ABSTRACT

Nutrition Attitude and COVID-19 Vaccine Intention of Indonesian

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SUMMARY

Consumption of a balanced nutritious diet can prevent infection. This study examines differences in nutrition attitude to prevent of covid-19 between the group intending to vaccinate and those who did not intend to vaccinate. This online study used a cross-sectional design, using online form. There were 1220 eligible subjects with different nutritional attitudes between the groups who had plans to be vaccinated and those who did not, except on points related to eating a variety of foods.

Keywords: Covid-19 vaccine, Diet, Nutrition attitude, Online research

INTRODUCTION

Changes in diet during the pandemic affect the risk of being infected with covid-19, especially in vulnerable populations (1). Attitude of nutrition affects eating pattern. A nutritionally balanced diet can meet adequate intake of nutrients that boost the immune system, which can prevent infection. Therefore, the government issued guidelines for balanced nutrition during the covid-19 pandemic (2). In the first year of pandemic, many people believed that the covid-19 vaccine was not effective enough that they did not want to get it (3). The purpose of this study was to analyze differences in attitude of nutrition as a prevention of covid-19 between groups who wish to be vaccinated and those who do not intend to vaccinate.

MATERIALS AND METHODS

The study is part of a study on factors that influence the intention to vaccinate against covid-19. This study was conducted as an online cross-sectional study from June-July 2021. The target population is adults in Indonesia aged 18-59 years who have not received the covid-19 vaccine; 1220 eligible subjects were involved using snowball sampling. The questionnaire used a google form distributed via social media WhatsApp. Questions regarding nutritional attitude were arranged based on balanced nutrition guidelines issued by the Ministry of Health (2). The ethical approval for this study was granted by the Mataram Health Polytechnic of the Ministry of Health Indonesia under approval number: LB.01.03/6/4693/2021.

RESULTS AND DISCUSSION

There were 1220 eligible subjects, 79% were women, and most of whom live in Java (78%). There were differences in nutritional attitude between the intending and non-intentional groups.

Table I shows that most of the subjects assumed that consumption of various foods was not the way to prevent covid-19. Hygiene and sanitation; sugar, salt, and fat;

Table I: Nutritional attitude between vaccine intention and not intention groups

Question	No intention			Intend to vaccinate			*p-value*
	Disagree	Neutral	Agree	Disagree	Neutral	Agree	
Vegetables and fruit must be washed thoroughly first	16 (7.6)	26 (12.3)	169 (80.1)	40 (4.0)	70 (6.9)	899 (89.1)	<0.001*
Side dishes should be cooked thoroughly	18 (8.5)	43 (20.4)	150 (71.1)	45 (4.5)	128 (12.7)	836 (82.9)	<0.001*
Limit the sugar, salt and fat intake is important	15 (7.1)	47 (22.3)	149 (70.6)	50 (5.0)	144 (14.3)	815 (80.8)	0.001*
Spices used as flavourings in food processing have antioxidant properties and can improve the taste of food	10 (4.7)	56 (26.5)	145 (68.7)	40 (4.0)	186 (18.4)	783 (77.6)	0.007*
Applying the Balanced Nutrition Guidelines can prevent covid-19	12 (5.7)	36 (17.1)	163 (77.3)	39 (3.9)	80 (7.9)	890 (88.2)	<0.001*
Eat a variety of foods to prevent Covid-19	41 (19.4)	79 (37.4)	91 (43.1)	223 (22.1)	337 (33.4)	449 (44.5)	0.919
Implement a Clean and Healthy Lifestyle (PHBS) to prevent Covid-19	12 (5.7)	25 (11.8)	174 (82.5)	42 (4.2)	61 (6.0)	906 (89.8)	0.003*
Doing physical activity routinely and monitoring body weight to remain normal to prevent Covid-19	17 (8.1)	39 (18.5)	155 (73.5)	49 (4.9)	139 (13.8)	821 (81.4)	0.008*

Notes: frequency presented as number of subject (percentage); Mann-Whitney; *p-value <0.05 was significant

application of balanced nutrition; and the application of physical activity and weight monitoring agreed by the subjects were believed to prevent covid-19 and was significantly related to their interest in vaccination. During the covid-19 pandemic, people's perceptions and behaviours changed, including smoking, physical activity, washing hands, wearing masks, sunbathing, and consuming processed foods (4). People who have health concerns have better nutrition attitudes (5).

CONCLUSION

There was a difference in attitude between the groups which intend to vaccinate and those which do not, except on points related to eating food variety. Education about the consumption of various foods is necessary.

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EXTENDED ABSTRACT

Snack Consumption and Physical Activity Associated with Overweight in Adolescents at Nururrahman Islamic Senior High School in Depok City, Indonesia

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SUMMARY

Unhealthy eating behaviour can be a factor that causes overweight in adolescents. In addition, low physical activity also significantly influences the incidence of overweight. This study determines the relationship between meal skipping, snack consumption, and physical activity with overweight among adolescents at Nururrahman Islamic Senior High School in Depok City, Indonesia. Data were collected using questionnaires and measuring instruments, such as digital scales and microtoise. There is a relationship between snack consumption and physical activity with overweight in adolescents, with p-value of (0.010) and (0.044) respectively. Snack consumption (high calories, fat and sugar) and physical activity are associated with overweight in adolescents.

Keywords: Adolescent, Meal skipping, Overweight, Physical activity, Snack

INTRODUCTION

The habit of meal skipping makes students eat snacks. Eating snacks that high sugar content makes fat deposits not used and accumulate to become abnormal and cause overweight (1). Technological advances have caused adolescents to have a sedentary lifestyle rather than physical activities, causing overweight in adolescents (2). Research on the relationship between meal skipping, snacks, and physical activity with overweight in adolescents in Indonesia is still rare. Therefore, this study determines the relationship between meal skipping, snacks, and physical activity with overweight in adolescents at Nururrahman Islamic Senior High School in Depok City, Indonesia.

MATERIALS AND METHODS

This is a cross-sectional study among students of Nururrahman Senior High School aged 15-17 years old, Sixty students were taken as samples using stratified random sampling. The inclusion criteria were active high school students on grade 10 and 11, aged 15-17 years, and willing to participate as subjects while the exclusion criteria included subjects who had digestive disorders, diagnosed with eating disorders, on a diet and taking certain drugs or supplements to lose or gain weight. Data were taken using a meal skipping questionnaire, Food Frequency Questionnaire (FFQ) to determine snack consumption, and Physical Activity Level (PAL) questionnaire to determine the level of physical activity. In addition, height and weight were measured using microtoise and digital scales. The weight status of adolescents was calculated using the z-score (BMI/Age). Data analysis includes univariate analysis and bivariate analysis using chi-square test.

RESULTS AND DISCUSSION

Table I shows that the majority of the subjects are 16 years old (45%). Subjects were mostly female (53.3%). Most of the subjects had meal skipping habits (58.3%), rarely consumed snacks (53.3%), and had low physical activity levels (71.7%). Table II shows that there is an association between snack consumption (p=0.010) and physical activity (p=0.044) with overweight in adolescents. The more frequent snack consumption and lower physical activity, the higher the incidence of overweight is. There is no relationship between meal skipping and overweight in adolescents (p=0.162). However, the data shows that overweight subjects have a habit of skipping meals more than non-overweight subjects (31.7%). Snacks are usually high in calories, fat, and sugar. So, consuming snacks too often can lead to overweight (3). Consumption of snacks can also cause adolescents to skip meals. So, their dietary

Table I : Characteristics of subjects

Variable	n=60	%
Age (Years)		
15	14	23.3
16	27	45
17	19	31.7
Gender		
Boy	28	46.7
Girl	32	53.3
Weight Status		
Overweight	28	46.7
Non-overweight	32	53.3
Meal Skipping		
Skipper	35	58.3
Non-Skipper	25	41.7
Snack Consumption		
Frequent	28	46.7
Rare	32	53.3
Physical Activity		
High	4	6.7
Moderate	13	21.7
Low	43	71.7

Table II : Relationship between meal skipping, snack consumption, and physical activity with overweight in adolescents

Variable	Weight Status				P-value
	Overweight		Non-overweight		
	n	%	n	%	
Meal Skipping					
Skipper	19	31.7	16	26.7	0.162
Non-Skipper	9	15	16	26.7	
Snack Consumption					
Frequent	18	30	10	16.7	0.010*
Rare	10	16.7	22	36.7	
Physical Activity					
High	0	0	4	6.7	0.044*
Moderate	4	6.7	9	15	
Low	24	40	19	31.7	
Total	28	46.7	32	53.4	

habits become irregular, putting them at risk of being overweight. In addition, low physical activity can also cause overweight because the excess energy contained in the body will be stored as fat, gradually leading to overweight. Therefore, if the adolescents' physical activity is low, accompanied with a high energy intake from a poor diet and consumption of unhealthy snacks, the risk of being overweight can increase (4).

CONCLUSION

Snack consumption (high calories, fat and sugar) and physical activity are associated with overweight in adolescents. This finding suggests that adolescents should pay attention to a healthy diet and lifestyle. These results highlight the importance of promoting a healthy lifestyle that includes good eating habits and adequate physical activities in adolescents.

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EXTENDED ABSTRACT

Children's Eating Habits in Agricultural and Coastal Areas of Sampang District, Indonesia

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SUMMARY

Children in agricultural and coastal areas are more vulnerable to malnutrition. This study analyses children's eating habits in agricultural and coastal areas. This cross-sectional study involved 384 children under five and their parents in Sampang District, East Java, Indonesia. Milk and fruit consumption was low in both areas, especially in the agricultural area. Children's eating habits differed between coastal and agricultural areas due to disparities in food availability. Increasing consumption of milk and fruits (both areas), and vegetables (coastal area) that are preferred by children and widely available will benefit children's health in both areas.

Keywords: Children, Dietary habit, Food frequency, Food habit, Rural

INTRODUCTION

Consumption of a variety of foods is essential to achieving a well-balanced diet and children's good health, growth, and development (1,2). Increasing children's food consumption (quantity and quality) needs to consider the food availability and preferences (3). A study in East Java showed that agricultural and coastal areas have a high prevalence of stunting children (4). Food availability in both areas can influence children's intake, preferences and nutritional status (3). Therefore, it is essential to understand children's dietary habits in both areas. This study analyses children's eating habits in agricultural and coastal areas.

MATERIALS AND METHODS

This cross-sectional study was conducted in Sampang District, East Java, Indonesia. The coastal area was represented by Pulau Mandangin Village, while the agricultural area was represented by Gunung Maddah Village. The sample of children under five was determined by a sample size formula to estimate the proportion in the population with absolute precision (5%). The inclusion criteria are children under five registered at the Integrated Health Post (*Posyandu*). Three hundred and eighty-four children under five and their parents were distributed proportionally between the two regions. Children's eating habits were collected using a Food Frequency Questionnaire in the previous month (never, daily, weekly, monthly). Children who consumed daily or weekly or monthly were categorized into consuming (Yes). The FFQ was adapted from a previous study on Madura Island (5). The Chi-square statistic was used to analyze the differences in eating habits in both areas.

RESULTS AND DISCUSSION

Pulau Mandangin is a densely populated area (11,979.4 per km^2). Meanwhile, Gunung Maddah had a low population density (1,046.3 per km^2). Coastal areas have more food vendors than agricultural areas. Most fathers in the coastal area worked as fishermen, whereas farmers and laborers predominated in agricultural areas. The father had 7.6 years of education and the mother had 7.4 years. Households in the agricultural area (IDR 585,948 ≈ US$ 39.49/cap/month) had a slightly higher income than those in the coastal area (IDR 401,929 ≈ US$ 27.09/cap/month).

Rice was consumed on a daily basis in both areas as a staple food. Children in the agricultural area consumed more corn rice (p=0.000), but fewer noodles (p=0.000), and bread (p=0.000) than those in the coastal area.
Table I reveals that children in both areas had a similar consumption of eggs, chicken, meatballs, and tempeh. Milk consumption was low in both areas, especially in the agricultural area. Children in the coastal area consumed more sausages and milk but fewer tofu than

Table I: Protein food sources consumption

Food	Agriculture (n=130)	Coastal (n=254)	Total (n=384)	p value
Eggs				
Yes	104 (80)	216 (85)	320 (83.3)	0.210
Never	26 (20)	38 (15)	64 (16.7)	
Chicken				
Yes	58 (44.6)	125 (49.2)	183 (47.7)	0.393
Never	72 (55.4)	129 (50.8)	201 (52.3)	
Meatballs				
Yes	106 (81.5)	194 (76.4)	300 (78.1)	0.247
Never	24 (18.5)	60 (23.6)	84 (21.9)	
Sausage				
Yes	58 (44.6)	192 (75.6)	250 (65.1)	0.000
Never	72 (55.4)	62 (24.4)	134 (34.9)	
Milk (non-breastmilk)				
Yes	31 (23.8)	119 (46.9)	150 (39.1)	0.000
Never	99 (76.2)	135 (53.1)	234 (60.9)	
Saltwater fish				
Yes	106 (81.5)	210 (82.7)	316 (82.3)	0.782
Never	24 (18.5)	44 (17.3)	68 (17.7)	
Tofu				
Yes	107 (82.3)	176 (69.3)	283 (73.7)	0.006
Never	23 (17.7)	78 (30.7)	101 (26.3)	
Tempeh				
Yes	102 (78.5)	194 (76.4)	296 (77.1)	0.646
Never	28 (21.5)	60 (23.6)	88 (22.9)	

Table II: Vitamin and mineral food sources consumption

Food	Agriculture (n=130)	Coastal (n=254)	Total (n=384)	p value
Carrot				
Yes	58 (44.6)	177 (69.7)	235 (61.2)	0.000
Never	72 (55.4)	77 (30.3)	149 (38.8)	
Spinach				
Yes	92 (70.8)	138 (54.3)	230 (59.9)	0.002
Never	38 (29.2)	116 (45.7)	154 (40.1)	
Moringa leaves				
Yes	101 (77.7)	99 (39)	200 (52.1)	0.000
Never	29 (22.3)	155 (61)	184 (47.9)	
Water spinach				
Yes	61 (46.9)	104 (40.9)	165 (43)	0.263
Never	69 (53.1)	150 (59.1)	219 (57)	
Orange				
Yes	42 (32.3)	133 (52.4)	175 (45.6)	0.000
Never	88 (67.7)	121 (47.6)	209 (54.4)	
Banana				
Yes	64 (49.2)	186 (73.2)	250 (65.1)	0.000
Never	66 (50.8)	68 (26.8)	134 (34.9)	
Papaya				
Yes	34 (26.2)	117 (46.1)	151 (39.3)	0.000
Never	96 (73.8)	137 (53.9)	233 (60.7)	
Apple				
Yes	20 (15.4)	90 (35.4)	110 (28.6)	0.000
Never	110 (84.6)	164 (64.6)	274 (71.4)	

those in the agricultural area. More than half of the children consumed carrots, spinach, moringa leaves, and banana. Children in the agricultural area ate more spinach and moringa leaves but fewer carrots and fruits than those in the coastal area (Table II).

This study found that children's eating patterns differed across coastal and agricultural areas due to differences in food availability. A large number of food vendors and street food sellers (within 50 meters) in the coastal area made children consume more noodles, bread, sausage, milk, and fruits than those in the agricultural area. Meanwhile, children in the agricultural area consume more corn rice, tofu, spinach, and moringa leaves than those in the coastal area. Rice and corn are widely cultivated by residents in agricultural areas and moringa trees flourish abundantly in their community.

CONCLUSION

Children's eating habits differed between coastal and agricultural areas due to disparities in food availability. Increasing consumption of milk (both areas), vegetables (coastal area), and fruits (agricultural area) that are preferred by children and widely available is needed to have a diverse food consumption.

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EXTENDED ABSTRACT

Hypertension in Pregnant Women: Relationship with Nutrients Intake, Physical Activity, and Pregnancy Characteristics

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SUMMARY

Hypertension, i.e. increased blood pressure is one of the causes of maternal death. Nutrients intake, physical activity, and pregnancy characteristics have a relationship with blood pressure. This cross-sectional study involved 110 pregnant women in the 3rd trimester in Bogor. The Spearman analysis showed that eicosapentaenoic acid/EPA intake had a correlation with diastolic blood pressure, while physical activity was not related. The pregnancy characteristics closely related to blood pressure were history of abortus, pre-pregnancy BMI, gravidity, mid upper arm circumference/MUAC, parity, and maternal age. This study highlights the importance of pregnancy characteristics to control hypertension.

Keywords: Hypertension, Nutrients intake, Physical activity, Pregnancy characteristics

INTRODUCTION

Physical and poor metabolic changes during pregnancy can cause pregnancy complications and become one of the causes of maternal death (1). WHO (2014), estimated that around 800 women die everyday due to pregnancy complications and childbirth. Hypertension is the most dominant cause of maternal mortality, which is 33% in Bogor City in 2018. A study indicates that nutrients intake, physical activity and pregnancy characteristics may also affect blood pressure (2). Pregnancy characteristics were history of abortus, gravidity, parity, maternal age, gestational age, pre-pregnancy BMI, and MUAC also reported by Poston et al. (2017) have a correlation with hypertension. This study analyzed the associations of nutrient intake, physical activity and pregnancy characteristics with hypertension in pregnant women.

MATERIALS AND METHODS

This study used cross-sectional study design and secondary data from the PUFA intake in pregnancy study by The SEAFAST CENTER IPB and BASF ASIA 2018. Data from 110 pregnant women in their 3rd trimester was collected from July-December 2018 in Bogor City (North Bogor and Tanah Sareal). Socioeconomic characteristics (mother's education and family income), food intake, physical activity, blood pressure, saturated fatty acid levels (SFA) and pregnancy characteristics (gravidity, parity, history of abortus, maternal age, gestational age, pre-pregnancy body mass index/BMI, and mid upper arm circumference/MUAC) were collected using interviews and taken from the medical records. Table I shows the cut-off used to classify level of adequacy intake.

Data analyses were done using Microsoft Excel 2013 and SPSS 21.0 version for windows (Spearman test). Calculation of nutrients intake was done using Nutrisurvey 2007 with database from Australian Food, Supplement and Nutrient Database (AUSNUT).

Table I: Cut-off of nutrients intake

Category	Cut-off	Category	Cut-off
Macronutrients		**Micronutrients**	
Severe deficit	<70%	Deficit	≥70%
Moderate deficit	70-79.9%	Normal	<70%
Mild deficit	80-89.9%		
Normal	90-110%		
Excess	>110%		

Source: WNPG (2012)

RESULTS AND DISCUSSION

Table II shows the average adequacy level and physical activity level of subjects. It shows that the most severe deficit nutrients were protein (macronutrients) and EPA (micronutrients). Meanwhile, the most excessive intake were observed in saturated fatty acid/SFA and linoleic acid/LA. The subjects have an average physical activity level (PAL) of 1.49, categorized as light physical activity. Statistical results showed that the higher the EPA intake,

Table II: Adequacy level of nutrients intake and physical activity level

Nutrients intake	Adequacy level of nutrients		Physical activity	
	Adequacy level (%)	Category	Category	n (%)
Energy	79.5±26.2	Moderate deficit	Light	97.3
Protein	49.9±19.1	Severe deficit	Moderate	2.7
Fat	102.4±43.0	Normal	Vigorous	0
Carbohydrate	62.6±22.9	Severe deficit	Average	1.49 ± 0.1
SFA	127.1±59.5	Excess		
Cholesterol	93.5±66.3	Normal		
Sodium	103.3±23.9	Normal		
Potassium	38.8±19.6	Deficit		
Calcium	35.7±25.6	Deficit		
Magnesium	83.0±38.3	Normal		
LA	149.2±97.5	Excess		
ALA	41.0±23.8	Deficit		
EPA	12.3±23.8	Deficit		
DHA	30.6±38.5	Deficit		

Source: Processed from SEAFAST CENTER IPB and BASF ASIA (2018)

Table III: Relationship of SFA in blood, physical activity and pregnancy characteristics with blood pressure

Variable	Systolic		Diastolic	
	r	*p*	*r*	*p*
SFA in blood	0.147	0.125	0.066	0.491
Physical activity	0.062	0.519	0.030	0.756
Gravidity	0.276	0.004*	0.131	0.173
Parity	0.197	0.040*	0.119	0.214
History of abortus	0.270	0.004*	0.046	0.635
Maternal age	0.271	0.004*	0.127	0.186
Gestational age	0.025	0.795	-0.037	0.703
MUAC	0.222	0.020*	0.198	0.038*
Pre-pregnancy BMI	0.204	0.033*	0.222	0.020*

*Spearman Correlation Test, p<0.05

the higher the diastolic blood pressure was. This result is not in line with the previous research which stated that intake of EPA can lower blood pressure. This adverse result may be explained as a result of the competition between arachidonic acid (AA/Omega-6) and EPA (Omega-3) in the formation of eicosanoids which can have different effects. Eicosanoids produced by AA and EPA have an inverse function. Eicosanoids from EPA have vasodilation, anti-aggression and anti-inflammatory function, which may lower blood pressure. Meanwhile, eicosanoids products from AA have vasoconstriction, platelet aggression and pro-inflammatory function may increase blood pressure (4).

Table III shows physical activity has no relationship with blood pressure. This result is in line with previous study, who found that the physical activity of pregnant women is in the light category (3). Blood pressure in pregnant women in Bogor was found related to pregnancy characteristics. The strongest relationship to both systolic and diastolic was shown by pre-pregnancy BMI and MUAC. Pre-pregnancy BMI and MUAC represent nutritional status before and during pregnancy.

CONCLUSION

Intake of EPA was significantly correlated with diastolic pressure, as EPA/omega-3 competes with AA/omega-6. History of abortus, gravidity, parity, maternal age were positively associated with systolic pressure, while MUAC and pre-pregnancy BMI were correlated with both. In linking food intake and blood pressure, more food elements must be included.

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EXTENDED ABSTRACT

Relationship of Body Fat Percentage with Hydration Status in Adolescents

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SUMMARY

Adolescents often experience dehydration due to physical activities that require energy and body fluids, and relative lack of fluid consumption. Dehydration is influenced by several factors, one of which is body fat percentage. Total body fluids±55-60% of body weight; this proportion is also related to the amount of body fat, gender, and age. The water content in muscle cells is higher than in fat cells. Therefore, the total body fluid in obese people is lower than that in people who are not obese.

Keywords: Adolescent, Hydration, Percent body fat

INTRODUCTION

Adolescents are vulnerable to a decrease in water content (1). Adolescents often experience dehydration due to physical activities that can drain energy and body fluids, causing a relative lack of fluid consumption (2). If there is an imbalance of fluids in the body, dehydration will occur (3). Dehydration has many adverse effects on health. Dehydration can lead to fatigue so that the body becomes weak and the individual loses focus. Dehydration can be caused by several factors, including knowledge, body fat percentage and drinking habits. Total body fluids±55-60% of body weight, the percentage is also related to the amount of body fat, gender, and age. The water content in muscle cells is higher than in fat cells. The total body fluid in obese people is lower than that in people who are not obese. In obese people, the ratio of water content to fat is 50%: 50% while in lean people, the ratio is 67%: 7%. In normal people, it is 60%: 16% (4).

MATERIALS AND METHODS

This cross sectional study involved involving 62 adolescents from a junior high school. The instruments used in this study are Bioelectrical Impedance Analysis (BIA) to measure the percent body fat, the FFQ form to determine the respondents' drinking habits and hydration status using the urine specific gravity method based on the urinometer method.

RESULTS AND DISCUSSION

Rank Spearman test results obtained p-value=0.879 (p-value>0.05). Statistically, there is no significant relationship between body fat percentage and hydration status. The weak relationship is indicated by the value of r=0.020 (Fig 1). This is because hydration status can be influenced by other factors such as body temperature and water output.

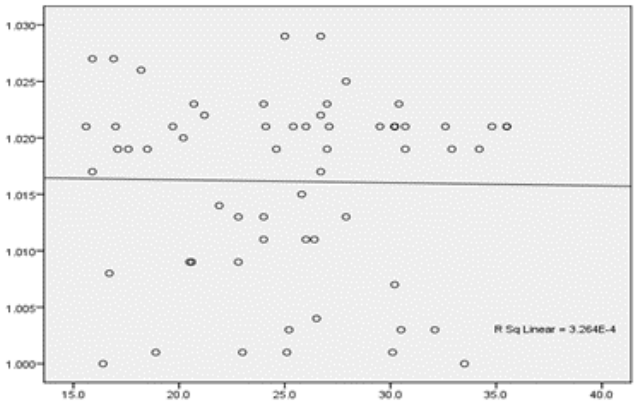

Fig 1: Correlation of body fat percentage and hydration status

In this study, the body fat percentage of 50% of adolescents was included in the fat category. This was due to the lack of physical activities carried out by the adolescents. Lack of physical activities can increase the risk of overweight and obesity, so that the percentage of body fat will increase. In obese people, the body experiences excess fat accumulation compared to non-obese people, because in obese people, the water content in fat cells is lower than the water content in muscle cells so that dehydration is more likely to occur in people whose fat percentage increases (5).

CONCLUSION

Based on the percentage of body fat, 50% of adolescents were included in the fat category and 77.4% of adolescents were dehydrated with an average of 1.0 g/dl + 0.00. Statistically, there is no significant relationship between body fat percentage and hydration status and the strength of the relationship is weak. This may be due to other factors that influence hydration status such as body temperature and water expenditure.

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EXTENDED ABSTRACT

Associations between College Students' Nutrition Knowledge, Eating Habits, and Physical Activity during COVID-19 Pandemic

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SUMMARY

Obesity is one of risk factors that aggravates when someone exposed to virus; in this case, coronavirus disease 2019 (Covid-19). The Covid-19 virus pandemic has resulted various changes, both in the socioeconomics of the country and individual habits. This study aims to examine the association between nutrition knowledge, physical activity, and college students' eating habits during Covid-19 pandemic. Data collected included nutrition knowledge, eating habits, and physical activity, which were obtained from an online survey using Google form. The analysis showed that there was no significant association between nutrition knowledge and nutrients adequacy levels along with eating habits and physical activity.

Keywords: College student, Covid-19 pandemic, Eating habits, Nutrition knowledge, Physical activity

INTRODUCTION

Obesity as a nutritional problem that continuously increases in Indonesia is one of the risk factors that aggravate the condition when someone exposed to the virus, one of which is coronavirus disease 2019 (Covid-19) (1). The pandemic of Covid-19 virus has affected both the socioeconomics of the country and individual habits or routines such as food habits and limited physical activities. Good eating habits are determined by individual nutritional knowledge. Several studies during the Covid-19 pandemic have shown an increase in individual consumption accompanied by low physical activities dominated by sitting duration. Research on college students generally shows an increase in energy intake and frequency of snacking; some consume more home-cooked dishes, vegetables, less fast food consumption, and most students lack physical activities (2,3). Therefore, this research aimed to analyze the association between college students' nutrition knowledge, eating habits, and physical activities during the Covid-19 pandemic.

MATERIALS AND METHODS

This cross-sectional study was conducted online using google form, starting from January to February 2021. The subjects were 83 college students aged 19-23 years who lived in Jabodetabek (Jakarta, Bogor, Depok, Tangerang, and Bekasi). The minimal subjects were calculated using Lemeshow formula and were purposively chosen based on the following inclusion criteria: healthy subjects, not having a special diet, and willing to participate and being interviewed. General characteristics and nutritional knowledge of the subjects were obtained using online self-administered questionnaire, while physical activity and eating habits were obtained by online interviews using the International Physical Activity Questionnaire Short Form (IPAQ-SF) and repeated (2x24-hour) recall and Food Frequency Questionnaire forms to see the fulfillment level of macro- and micronutrients (vitamins A, C, E, Fe, Zn). The data were processed statistically and inferentially using Microsoft Excel, Nutri Survey, and analyzed using the Statistical Program for Social Science for the normality test (Kolmogorov-Smirnov) and Spearman correlation test.

RESULTS AND DISCUSSION

The study showed that nearly a quarter of the subjects (24.1%) were overweight and obese, although most subjects (60.2%) had a normal BMI. The average BMI of the subjects was 22.4 kg/m^2. The parents' education levels of the subjects were high school; most of the subjects' fathers work as private employees and the mothers as housewives. The average income/capita/month of the subjects' family is Rp1,000,000, and 56.6% of the subjects were categorized as small family.

Nutrition knowledge of 83.1% of the subjects was in well category with an average score of 90.7. However, good nutrition knowledge does not guarantee a person will practice a healthy lifestyle. Physical activity is important to improve the immune system and reduce the risk of health conditions during pandemic (4). Almost half of the subjects had high categorized activity (Table I).

The subjects' strenuous activities include housework, internship, and a part-time job. Research in Canada during the pandemic showed an increase in physical activities (walking, cycling), exercise (running and workout), and housework (5). Additionally, 6.8 hours a day were spent sitting on average. According to balanced diet guidelines, the subjects' vegetables and fruits consumption is less than the recommended portion and had not varied. The average adequacy level meeting the requirement were protein and fat, but vitamins and minerals are still lacking, and only 2/3 (energy, vitamin A, vitamin C, zinc), 3/4 (iron), and 1/3 (carbohydrates and vitamin E) are met. Additionally, the Spearman correlation test showed that no correlation was found between nutrition knowledge and nutrients adequacy or between physical activity and eating habits ($p>0.05$) (Table II).

Table I: Distribution of subjects by IPAQ-SF category

IPAQ Category	Total	
	n	%
Low (<600 MET/week)	18	21.7
Moderate (600-1499 MET/week)	29	34.9
High (≥1500 MET/week)	36	43.3
Physical activity (MET/week)		
Average (± SD) Physical activity (MET/week)	1966.9 ± 1804.8	
Average (± SD) Sitting time (minutes/week)	2836.3 ± 1242.9	

MET = Metabolic equivalent task
SD = Standard Deviation

Table II: Association between nutrition knowledge, physical activity, and eating habits

Variables	Nutrition knowledge		Physical activity	
	ρ^b	p[a]	ρ^b	p[a]
Physical Activity	0.184	0.096		
Eating habits				
Energy Adequacy level	-0.078	0.481	-0.162	0.143
Protein Adequacy level	-0.079	0.476	-0.079	0.478
Fat Adequacy level	-0.034	0.762	0.004	0.974
Carbohydrate Adequacy level	-0.100	0.368	-0.268	0.074
Vitamin A Adequacy level	0.191	0.083	0.047	0.674
Vitamin C Adequacy level	0.104	0.352	0.000	1.000
Vitamin E Adequacy level	0.120	0.280	0.103	0.353
Iron Adequacy level	-0.072	0.515	-0.034	0.761
Zinc Adequacy level	0.048	0.668	0.024	0.831

[a]Spearman correlation-test, significant *p-value*<0.05, [b]Spearman's rank correlation coefficient (ρ)

CONCLUSION

Almost a quarter of the subjects were overweight and obese, as well as had low physical activity. Nutrition knowledge and nutrients adequacy, along with physical activity and eating habits, were not found to be correlated. This study suggests the need to study barriers among college students to applying balance diet guidelines.

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EXTENDED ABSTRACT

Effect of Islamic Alternate-Day Fasting (Daud Fasting) on Body Weight, Body Fat, and Skeletal Muscle in Male and Female Obese Young Adults in Dramaga, Bogor, Indonesia

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SUMMARY

This study aims to evaluate the effect of Daud Fasting (Islamic alternate-day fasting for 13-15 hours) on body weight, body fat, and skeletal muscle percentage. Twenty-nine obese young adults (19-29 years old) in Dramaga, Bogor, Indonesia, were randomized to fasting and control groups. Participants in the fasting group were asked to fast from dawn to sunset for four weeks. Anthropometric measurements (body weight, body fat, and skeletal muscle percentage) were performed. Body weight, BMI, and trunk fat percentage levels decreased significantly in fasting group without reduction of skeletal muscle, within four weeks. In conclusion, Daud fasting can be a solution to obesity.

Keywords: Body Fat Composition, Body Weight, Daud Fasting, Obesity, Young Adults

INTRODUCTION

Indonesia's Ministry of Health reported that 21.8% of adults in Indonesia are obese (1). A dietary approach to combat obesity includes fasting. Islamic alternate day fasting (Daud fasting) is fasting for 13-15 hours. Daud Fasting is quite popular among Indonesian Muslims as one of the sunnah. Meta-analysis shows that alternate-day fasting effectively reduces body weight, BMI, and fat mass in obese adults. This study aims to gain an insight into the effects of Daud Fasting on body fat, weight loss, and skeletal muscle in male and female obese young adults (19-29 years old) in Dramaga, Bogor, Indonesia.

MATERIALS AND METHODS

This experimental study was done in Dramaga, Bogor, Indonesia, and consisted of two stages: baseline and post-intervention (day 28th). Thirty-nine subjects (8 male and 31 female) were randomized into an intervention group (n-20) or control group (n=19) after applying inclusion criteria (19-29 years old age; having BMI ≥25 kg/m, mentally and physically healthy; and not used to Daud Fasting). Participants in the fasting group were prohibited from eating and drinking anything from dawn (Subuh) until sunset (~13 hours) on the first day. On the next day, subjects were free to eat and drink ad libitum. This was done alternatively between days until intervention ends. Exceptions were made for female subjects during their menstruation phase, in which they were free to drink zero-calorie drinks on fasting days. Data collected were as follows: anthropometric parameters, body fat, and skeletal muscle percentage done using a stature meter and bioelectrical impedance analyzer/BIA (Omron HBF-375 Karada Scan).

RESULTS AND DISCUSSION

The intervention group experienced significant weight loss after doing Daud Fasting for four weeks, while the control group did not, as shown in table I. The intervention group's mean bodyweight decreased by -1.3±1.3 kg (2.3%). This result is similar to Heilbronn et al. (4) where the subjects of the study experienced a 2.5% loss in bodyweight ($p<0.001$) from their baseline measurement after having done alternate day fasting for 28 days (about four weeks). Fasting for more than 12 hours will force the human body to find alternative fuel other than glucose, so that the body's energy metabolism will switch to other mechanisms of gaining energy, such as glycogenesis, gluconeogenesis, and lipolysis (5). This will cause energy storage to be depleted, inducing weight loss as a result.

Significant changes in weight loss in the intervention group were equal to reduced BMI, which was significant as well (-0.6±0.5 kg/m^2). This aligns with the study by Heilbronn et al. (4). The results of body fat percentage measurement indicate a declining trend (-0.1±0.7%) for the intervention group, but it is insignificant. This is in contrast with the study by Heilbronn et al. (4), which shows a significant decrease in the subjects' body fat

Table I: Variable differences between groups on baseline and 4th week

Parameter	Group	Baseline Mean ± SD	4th week Mean ± SD	Δ Mean ± SD	p-value
Weight (kg)[a]	Intervention	79±22.1	77.6±21.5	-1.3±1.3	0.001*
	Control	73±12.4	73.2±12.7	0.2±0.7	0.222
	p-value	0.19	0.25		
BMI (kg/m^2)[a]	Intervention	30.2±6	29.7±5.7	-0.5±0.5	0.001*
	Control	28.2±2.6	28.3±2.7	0.1+0.3	0.254
	p-value	0.13	0.21		
Body Fat (%)[b]	Intervention	32.7±5.9	32.6±6.2	-0.1±0.7	0.512
	Control	32.1±5.8	31.8±5.9	-0.3±0.9	0.201
	p-value	0.400	0.367		
Visceral Fat[a]	Intervention	11.9±7.5	11.4±7.1	-0.5±0.6	0.006*
	Control	9.4±3.4	9.4±3.4	0±0.4	0.690
	p-value	0.13	0.17		
Trunk Fat[a]	Intervention	25±7.1	24.7±7.1	-0.3±0.4	0.030*
(%)	Control	24.2±6.3	24.1±6.4	-0.2±0.6	0.365
	p-value	0.39	0.40		
Arms Fat[a]	Intervention	39.6±10.9	39.5±11.2	-0.1±0.8	0.733
(%)	Control	41.2±12.1	40.8±12.4	-0.5±1.3	0.209
	p-value	0.35	0.39		
Legs Fat[a]	Intervention	38.3±10	38.1±10.1	-0.2±0.8	0.381
(%)	Control	39.8±11.3	39.3±11.6	-0.5±1.2	0.189
	p-value	0.35	0.38		
Total Skeletal Muscle[a]	Intervention	26.5±3.9	26.5±4	0±0.3	0.932
(%)	Control	26.5±4.2	26.6±4.3	0.1±0.4	0.272
	p-value	0.49	0.46		
Trunk Skeletal Muscle[a]	Intervention	19.7±3.5	19.8±3.5	0.1±0.3	0.178
(%)	Control	20.2±3.4	20.4±3.6	0.2±0.4	0.163
	p-value	0.36	0.35		
Arms Skeletal Muscle[a]	Intervention	28.1±8.1	28.3±8.1	0.2±0.3	0.012
(%)	Control	28.4±7.3	28.5±7.4	0.1±0.5	0.592
	p-value	0.46	0.48		
Legs Skeletal Muscle[a]	Intervention	41.6±5.6	41.5±5.8	-0.1±0.4	0.237
(%)	Control	41.3±6	41.6±6	0.3±0.7	0.119
		0.44	0.48		

BMI: body mass index, Δ: changes between baseline and post-intervention.
[a] Were analyzed using Mann-Whitney U Test and Wilcoxon Signed Rank Test
[b] Body fat was analyzed using Independent Sample T-Test and Paired Sample T-Test
*Significant difference (p<0.05)

percentage (-4±1%; p<0.001) after having done 22 days of alternate-day fasting. In this study, trunk fat and visceral fat also decreased significantly, and skeletal muscle can be maintained. The limitation of the study includes uncontrolled nutrient intake, physical and activity exercise, which may affect the results.

CONCLUSION

Daud Fasting for four weeks may significantly decrease body weight, BMI, trunk fat percentage, and visceral fat. Daud fasting can be a solution to fight obesity.

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EXTENDED ABSTRACT

High Prevalence of Metabolic Syndrome among Middle-Aged People in the Rural Area of Cianjur, Indonesia

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SUMMARY

This cross-sectional study provides MetS prevalence of middle-aged rural Indonesians, which was performed on 224 subjects aged 45–59 years old in Cianjur, Indonesia from 2014 to 2015. Measurements include anthropometric, blood pressure and biochemical assessments. MetS prevalence, as defined by the International Diabetes Federation and National Cholesterol Education Program Adult Treatment Panel III criteria, was 30.8% (17.9% in men and 42.0% in women) and 23.7% (9.8% in men and 37.5% in women), respectively; difference due to IDF focuses on central obesity. High blood pressure is the most prevalent MetS component. Prevention and treatment of MetS should be implemented.

Keywords: Hypertension, Metabolic Syndrome, Middle-Aged, Rural Area

INTRODUCTION

Risk factors for non-communicable diseases may increase with the emergence of metabolic syndrome (MetS). The MetS components include long waist circumference (WC), high blood triglyceride (TG) concentration, low blood high-density lipoprotein (HDL) concentration, high blood pressure (BP), and high fasting blood glucose (FBG) concentration (1). Data on the prevalence of MetS in Indonesia are limited and scarce. Most studies on MetS were conducted in urban areas, while those in rural areas are still limited (2). The prevalence data is critical for determining the problem's magnitude and developing policy. The following study aimed to show basic data on MetS in rural areas. Understanding the prevalence of MetS in rural areas, particularly among middle-aged people, is important for developing effective prevention programs and strategies.

MATERIALS AND METHODS

This cross-sectional design study was conducted from 2014 to 2015 in Cianjur District, West Java, Indonesia. A simple random sampling among married couple aged 45–59 years old was used and 224 subjects were selected. The sampling frame was developed from Family Registration Form taken from Cisalak and Sukamantri Village Offices. Blood pressure was measured using an electronic BP monitor (OMRON HEM-7200). Body height and waist circumference were measured by stature meter and metering tape, respectively while body weight was measured using OMRON HBF-358-BW. Blood samples were collected after a fasting period of 10–12 hours in the morning from the peripheral veins of all participants. FBG was measured using a TRX 7010 Analyzer (Tokyo Boeki Japan Ltd.). TG and HDL were both using the Advia 1800 Analyzer (Siemens). All analyses of blood biochemistry were done at PRODIA (an ISO 17025:2017 accredited Lab by KAN), Bogor.

RESULTS AND DISCUSSION

MetS prevalence based on revised NCEP ATP III (National Cholesterol Education Program Adult Treatment Panel III) and IDF (International Diabetes Federation) criteria was shown in table I. The JIS (Joint Interim Statement) had the same criteria as the revised version of NCEP ATP III, so the results are presented in the same column.

The mean age of the subjects was 51.2±4.0 years old (53.4±3.6 years old for males and 49.0±3.2 years old for females), as shown in table II. The mean body height was 154.3±8.0 cm (160.1±6.0 cm for males and 148.6±5.0 cm for females) while the mean body weight was 55.2±10.3 kg (56.4±9.2 for males and 54.1±11.1 for females).

Hypertension was the most prevalent MetS component for both males and females (61.6% and 73.2%, respectively). High waist circumference and a total of overweight and obesity prevalence were significantly higher in females (67.8% and 40.2%, respectively)

Table I: Metabolic syndrome criteria

No	Risk Factor	Revised NCEP ATP III Criteria (3) JIS Criteria (1)	IDF Criteria (4)
		At least three risk factors	Central obesity plus two or more risk factors
1	Elevated waist circumference (WC) / central obesity)	≥90 cm males ≥80 cm females	
2	Elevated triglycerides (TG)	≥150 mg/dL	
3	Reduced HDL-C	≥40 mg/dL for males; ≥50 mg/dL for females	
4	Elevated Blood Pressure (BP)	Diastolic ≥85 mmHg Systolic ≥130 mg/dL	
5	Elevated Fasting Glucose Blood (FBG)	≥100 mg/dL	

Table II: Characteristics of subject by gender

Component	Men	Women	Total
Age (years)	53.4±3.6	49.0±3.2	51.2±4.0
Body height (cm)	160.1±6.0	148.6±5.0	154.3±8.0
Body weight (kg)	56.4±9.2	54.1±11.1	55.2±10.3
BMI (kg/m^2)	22.0±3.3	24.3±4.4	23.2±4.0
Waist circumference (cm)	79.7±9.8	84.8±12.9	82.3±11.7
BP systole (mmHg)	137±23	143±24	140±24
BP diastole (mmHg)	83±13	88±14	86±14
Fasting blood glucose (mg/dL)	99±48	100±42	99±45
HDL-c (mg/dL)	46±9	52±10	49±10
TG (mg/dL)	135±91	118±52	127±75
Obese (>27.0 kg/m^2)	9 (8.0)	27 (24.1)	36 (16.1)
High waist circumference [n (%)]	18 (16.0)	76 (67.8)	94 (42.0)
High blood pressure [n (%)]	69 (61.6)	82 (73.2)	151 (67.4)
High fasting blood glucose [n (%)]	22 (19.6)	21 (18.8)	39 (17.4)
Low cholesterol HDL [n (%)]	29 (25.9)	48 (42.9)	84 (37.5)
High triglyceride [n (%)]	28 (25.0)	24 (21.4)	52 (23.2)

Table III: Prevalence of metabolic syndrome [n (%)]

	NCEP ATPIII Criteria (3) JIS Criteria (1)		IDF Criteria (4)	
	MetS	Non MetS	Mets	Non MetS
Men	20 (17.9)	92 (82.1)	11 (9.8)	101 (90.2)
Women	47 (42.0)	65 (58.0)	42 (37.5)	70 (62.5)
Total	69 (30.8)	155 (69.2)	53 (23.7)	171 (76.3)

than in males (16% and 20.5%, respectively). High hypertension prevalence in this study was higher than in rural China (men 45.7% and women 38.5%) and Indonesia nationally (8.4%) (5). Hypertension increases the risk of many non-communicable diseases, mainly cardiovascular diseases and kidney disease.

MetS prevalence was 30.8% and 23.7% based on NCEP ATP III/JIS and IDF, respectively. The NCEP ATP III/JIS shows that males (17.9%) had a lower prevalence of MetS than females (42%), as shown in table III. Additionally, based on IDF criteria, which include central obesity as a mandatory component, the prevalence of Mets in females (37.5%) was significantly higher than that in males (9.8%). MetS prevalence defined by IDF criteria is lower than that by using NCEP ATP III and JIS criteria since IDF views central obesity as being essential in the development of MetS (4).

CONCLUSION

Daud Fasting for four weeks may significantly decrease body weight, BMI, trunk fat percentage, and visceral fat. Daud fasting can be a solution to fight obesity.

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EXTENDED ABSTRACT

Effects of Two-Year COVID-19 Pandemic on the Consumption of Beverages among Indonesia Women

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SUMMARY

The COVID-19 pandemic is suspected to change the consumption of beverages. This study aimed at analyzing the effects of the two-year COVID-19 pandemic on the consumption of beverages among Indonesian women. For this purpose, an online survey was designed and performed via social media in Java. As many as 1773 women participated in this study. The results showed that the two-year COVID-19 pandemic had an effect on increasing the consumption of bottled water, drinking water, isotonic drink, energy drink, milk, juice, coconut water, and herbal drink. Meanwhile, the consumption of tea, coffee, and soft drink decreased.

Keywords: Beverage consumption, COVID-19 pandemic, Indonesian women, Online survey

INTRODUCTION

The COVID-19 pandemic has the potential to increase the consumption of certain foods and beverages as well as supplements that were believed to be efficacious in strengthening the immune system. This is done by community members because they want to fulfill their nutritional needs as well as maintain and improve their health to face the pandemic. A small-scale study outside Java found that the COVID-19 pandemic caused changes in diet, beverages, supplements, and herbs consumption, especially in women (1). In addition, a systematic review by Castellana et al. (2) shows that the pandemic increased tea consumption. The data show that Java Island is the most densely populated island in Indonesia and has the highest COVID-19 positive number when compared to other islands in Indonesia (3). Therefore, this study aims to analyze the effects of two-year COVID-19 pandemic on the changes in beverage consumption among Indonesian women who lived in Java.

MATERIALS AND METHODS

A cross-sectional design with an online survey method was applied to 1773 women aged 25-54 years old in Java. Besides age, the subject were selected based on the following criteria: living in six provinces of Java, being able to use gadgets, being able to fill in the google form, and willing to participate in this study. This study was conducted from January to June 2022 and obtained ethical approval number 706/IT3.KEPMSM-IPB/SK/2022. The online survey link was disseminated through various social media networks (Kudata, Instagram, WhatsApp, Line, Facebook, and Twitter). The data collected include age, gender, educational level, occupation, income, health condition, the status of COVID-19 survivors, food expenditure, ways of food fulfillment, meal portions, eating and snacking frequency, as well as changes in consumption of beverages and nutritional supplements during the pandemic compared to before the COVID-19 pandemic. The statistical analysis used was the Mann-Whitney test.

RESULTS AND DISCUSSION

Most of the subjects were classified as healthy although around 30% of them were COVID-19 survivors. The results showed that the consumption of bottled drinking water and non-bottled drinking water both increased significantly ($p<0.01$) compared to before the COVID-19 pandemic. About half of the subjects did not consume soft drinks, isotonic drinks, and energy drinks, but most of the subjects who consumed these beverages stated that they experienced a decrease in consumption of soft drinks and a significant increase in consumption of isotonic and energy drinks ($p<0.01$). The consumption of milk and fruit juice increased during the COVID-19 pandemic.

Most of the subjects did not experience a change in their tea and coffee consumption, but their consumption

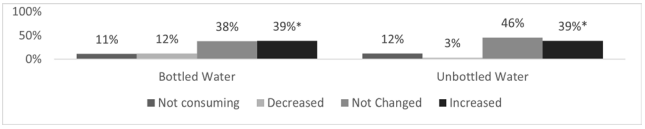

Fig.1: Changes in water consumption of subjects (n = 1773)
*Significantly change at p<0.01 based on Mann-Whitney U test

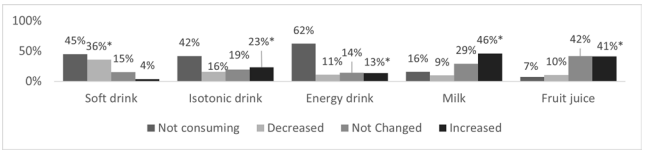

Fig.2: Changes in soft drink, isotonic drink, energy drink, milk and fruit juice consumption of subjects (n = 1773)
*Significantly change at p<0.01 based on Mann-Whitney U test

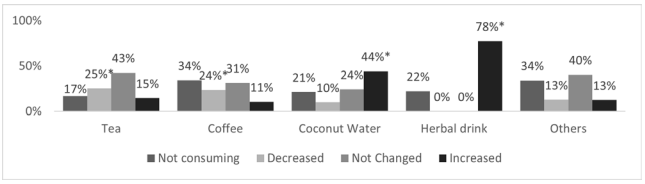

Fig.3: Changes in tea, coffee, coconut water, herbal drink, and other drinks consumption of subjects (n = 1773)
*Significantly change at p<0.01 based on Mann-Whitney U test

of tea and coffee has a significant decrease (p<0.01). The types of beverages that significantly increased in consumption during the pandemic were coconut water and herbal drinks. This finding was in line with other studies which show that the consumption of herbal drinks (based on ginger and turmeric) is part of an attempt to maintain health and increase immunity during the COVID-19 pandemic (4). Meanwhile, consumption of other beverages such as infused water, hot chocolate, soy milk, yogurt, ice cream, beer, wine, sake, soju, and whiskey did not change significantly (p>0.05).

CONCLUSION

The COVID-19 pandemic significantly increased the consumption of bottled and non-bottled drinking water, isotonic drinks, energy, milk, fruit juice, coconut water, and herbs, while tea, coffee, and soft drinks consumption decreased significantly. Further research which involves both sexes from outside Java as the subject is needed to give comprehensive results.

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EXTENDED ABSTRACT

Effect of Audio-Visual Educational Media on Adolescents' Knowledge of Anaemia at SMP 7 Jambi City, Indonesia

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SUMMARY

Anaemia is one of nutritional problems that often occurs in adolescent girls. Nutrition education as an intervention method has been proven to improve their knowledge to prevent anaemia. The study aimed to identify the effect of audio-visual educational media on knowledge of anaemia of adolescents girl at SMP 7 Jambi City in 2020. The research showed that there is an effect of audio-visual educational media on the adolescents' knowledge of anaemia at SMPN 7 Jambi City. Sustainable nutrition education is needed to improve students' knowledge; it is one of the efforts to prevent anaemia.

Keywords: Adolescent girls, Anaemia, Education, Media, Nutrition

INTRODUCTION

Anaemia is one of nutritional problems that often occurs in adolescents because they have menstruation and are in their growth period (1). One attempt to overcome the problem of Anaemia is to increase the knowledge of adolescent girls by providing nutrition education with a key component of success in the media. The media has a powerful function to attract the attention of participants so that cognitive, affective, and psychomotor changes can be accelerated (2). Based on an internet penetration survey, internet use increased by 40% during the pandemic among junior high school students (3).

MATERIALS AND METHODS

This quasi-experiment study used a one-group pre-test and post-test; it involved 23 female students from SMPN 7 Jambi who have anemia. The study was conducted from March to July 2020. The variables studied in this study were pretest and postest knowledge about Anaemia. This study used primary data obtained using questionnaires distributed through the WhatsApp group. Secondary data include student profiles and profiles of SMPN 7 Jambi City. The instruments used in this study were pre-post test questionnaires using google forms, audio-visual media, media feasibility validity test forms, WhatsApp, google drive, and youtube. Data analysis was performed univariately describing frequency and bivariate distributions using the Wilcoxon signed rank test.

RESULTS AND DISCUSSION

The results showed that after education was carried out, the respondents' knowledge increased by 56.5% (Fig 1). The question on how frequency of consumption of iron supplementation tablets during menstruation had the biggest impact on the percentage of right answers (65.2%). A total of 16 respondents had poor knowledge. The results of the posttest showed that the13 respondents had good knowledge. According to Notoadmodjo (2010), the increase in knowledge is influenced by the media and methods (4). The media used in this study was audio-visual media regarding Anaemia. There was a difference knowledge between pre and post intervention (p-value=0.00) and knowledge improvement of health education with audio-visual media. The respondents were more interested in watching and listening, resulting

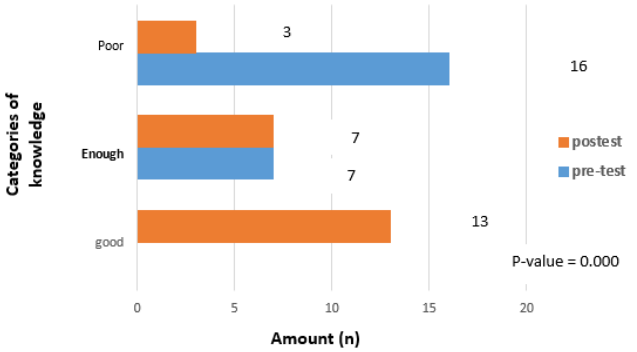

Fig.1: Categories of Knowledge of Respondents before and after education

in improved respondent behavior (5).

CONCLUSION

This research shows that audio-visual educational media can be used for nutrition education as interesting media for adolescent girls. Nutrition education is needed; therefore, it should be included in one of the school curriculum to improve students' knowledge. It is one of the efforts to prevent anaemia.

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EXTENDED ABSTRACT

Consumption of Iron-Rich Food in Children under Two Years in Urban and Rural Areas in Indonesia: An Analysis of Indonesian Demographic and Health Survey 2017

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SUMMARY

Iron-rich food consumption is an important determinant of anaemia status, and demographic characteristic may contribute to the fulfilment of iron intake. This study aimed to determine the consumption level of iron-rich and iron-fortified foods in children under two years in urban and rural areas. An analysis was done on the result of Indonesian Demographic and Health Survey 2017. Children in urban areas consume more iron-rich foods and iron-fortified food than those in rural. Socio-demographic and economic status are significant factors that determine iron-rich/fortified food consumption with relatively weak correlation strength. Therefore, we suggest that efforts in improving these factors should be encouraged.

Keywords: Children under two years, Iron-rich food consumption, Urban, Rural

INTRODUCTION

Indonesia is one of the countries facing the problem of iron deficiency anaemia (IDA) in children under two years. Based on data from Indonesia Basic Health Research (Riskesdas) in 2018, the prevalence of iron deficiency anaemia was high, i.e. 30.3% in urban and 25.8% in rural (1,2). The main cause of IDA is low consumption of iron foods. When a child is six months old, complementary foods should be given so the needs of energy and nutrients, particularly iron, are fulfilled (3). Demographic factors such as urban and rural are suggested to influence feeding practices and, consequently, iron intake. This study aimed to determine consumption level of iron-rich and iron-fortified foods in children under two years in urban and rural areas and to determine the contributing factors using data from Indonesian Demographic and Health Survey (IDHS) 2017.

MATERIALS AND METHODS

The IDHS received ethical approval from the ICF International Review Board Findings Form with project number 132989.000. This study included data of children aged under two years (6-23 months). Children with incomplete data on social and economic characteristics and food consumption were excluded. Data from 2.393 children from rural areas and 2.390 from urban areas were analysed. Iron-rich foods in this study consisted of flesh foods such as meat, organs, and seafood and commercial food fortified with iron. Children who consumed iron-rich, iron-fortified, or both food the day before the interview were categorized as 'consuming iron-rich/fortified food as recommended'. Differences in iron-rich/fortified food consumption were analysed using Mann-Whitney test. Associations of demographic and socio-economy characteristics with iron-rich and iron-fortified food intake were analysed using Chi-square or Spearman tests.

RESULTS AND DISCUSSION

Proportion of children whose consumption of foods rich in iron and/or iron-fortified meets the recommendation is higher in urban areas (75.8%) than those in rural areas (65.3%) ($p<0.001$). The number of children who tend to consume iron-rich foods such as flesh foods in urban areas was higher than that in rural areas (40.8% vs 23.9%). Likewise, there were more children living

in urban areas who consume iron-fortified food than in rural area (26.6% vs 18%).

Table I shows that determinants of iron-rich/fortified food consumption in both rural and urban areas were quite similar. Wealth index, parents' education level, media exposure, child's age, and breastfeeding status are significant determinants in both areas. Mother working status is a significant determinant of iron-rich/ fortified food consumption of children in urban area but not in rural area.

Table I: Factors associated with the consumption of iron-rich food in children under two years

Variable	Rural		Urban	
	r	**p-value**	**r**	**p-value**
Wealth index[b]	0.203	<0.001*	0.176	<0.001*
Father's working status[a]	-	0.839	-	1.000
Mothers working status[a]	-	0.165	-	0.009*
The educational level of father[b]	0.137	<0.001*	0.095	<0.001*
The educational level of mother[b]	0.113	<0.001*	0.103	<0.001*
Media exposure[b]	0.138	<0.001*	0.046	0.025*
Child age[b]	0.169	<0.001*	0.093	<0.001*
Gender[a]	-	0.489	-	0.489
Breastfeeding status[a]	-	<0.001*	-	<0.001*

[a]Chi-square test, [b]Spearman correlation test, *significant if p-value <0.05

Based on the results, this study confirmed the findings of previous studies which showed that household social and economic demographic factors are important determinants of iron-rich food consumption in children under two years with relatively weak correlation strength (4,5).

CONCLUSION

Household social and economic demographic factors are important determinants of iron-rich/fortified food consumption in children in urban and rural areas with relatively weak correlation strength. We urge the Indonesian government to support efforts in improving household socio-demographic and economic factors in both areas.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

The Risk Factors of Hypertension among Female Batik Workers in Yogyakarta Indonesia

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SUMMARY

Hypertension is more common in poor countries than in developed countries. The purpose of this study was to analyze the determinant of hypertension among Female Batik Wokers (FBW). From July to November 2019, a cross-sectional study was conducted in Kulonprogo, Yogyakarta. Structured questionnaires were used to collect sociodemographic information, while anthropometric variables and blood pressure were evaluated. Logistic regression models were used to examine the hypertension risk factor. FBW who had a secondary education level were 0.236 times more likely to be hypertensive than those who had no or primary level of education (p=0.005). FBW who had waist circumference (WC) >80 cm were 3.799 times more likely to be hypertensive than participants who had WC ≤80 cm (p=0.004).

Keywords: Female batik workers, Hypertension, Risk factors, Sociodemographic

INTRODUCTION

The 2018 Basic Health Research in Indonesia indicated that in people who are aged 18 years and above, there is an increase in the hypertension prevalence. It was recorded that the prevalence of hypertension among people aged 18 years and above in 2018 was 34.1%. Based on gender, the prevalence of hypertension in women was 36.9%, higher than the prevalence of hypertension in men (31.3%) (1). Hypertension is one of non-communicable diseases (NCDs) that has become a global concern because it has dangerous clinical manifestations, such as cardiovascular disease, stroke, kidney failure, and other clinical manifestations (2). Hypertension is one of occupational diseases that often occurs in the workplace. Low physical activity at workplace is associated with hypertension (3). The batik industry is one of the workplaces with low physical activity, especially for female workers. The purpose of the study was to analyze the risk factors for hypertension in female batik workers.

MATERIALS AND METHODS

This cross-sectional study was carried out in Kulonprogo, Yogyakarta, from July to November 2019; the total sample included 100 female batik workers. Informed consent was obtained from every participant. Structured questionnaires were used to collect sociodemographic information (level of education). Body weight was measured with an electronic scale. Waist and hip circumference were measured with the measuring tape. Systolic and diastolic blood pressure (SBP and DBP) values were measured with an electronic device (Omron HEM-7124 Automatic Blood Pressure).

The classification of hypertension is based on JNC-8: hypertension if the systolic blood pressure is ≥140 mmHg, and diastolic blood pressure is ≥90 mmHg; WC as a central obesity indicator was defined according to the WHO criteria: WC ≥94 cm for men and ≥80 cm for women. Logistic regression was used to analyze the odds ratio of the socio-economic and anthropometric variables that affected hypertension. SPSS version 24.0 statistical software was utilized for all analyses. This study was approved by the Ethical Committee of Medical and Health Research Ethics Committee (MHREC) Gadjah Mada University in Yogyakarta (Number KE/FK/0737/EC/2019).

RESULTS AND DISCUSSION

Hypertension is a multifactorial disease that occurs due to the interaction of various factors. Based on logistic regression analysis, our findings showed that age and educational level were not found to have a significant associated risk on hypertension. Whereas level of education and WC were significant predictors of hypertension among female batik workers. Participants who had a secondary education level were 0.236 times more likely to be hypertensive than participants who had no or primary level of education (Table I). Female batik workers who were less educated were more likely to be hypertensive. Education (junior high school or more) was statistically inversely associated with hypertension or a protective factor for hypertension in the multivariate analysis (OR=0.236; 95% CI: 0.087-0.644). This result is consistent with the previous study which showed that school education level was inversely associated with both systolic and diastolic blood pressures. Several studies also showed that the low education level was associated with hypertension (4). People with a higher education level can easily understand health-related information, especially hypertension and a healthy lifestyle. Increasing awareness of good health and fitness as well as blood pressure and cardiovascular maintenance are inseparable from improving educational attainment. Education plays a vital role in exposure to lifestyle-related diseases.

Table I showed that WC>80 cm was statistically associated with hypertension (OR=3.799; 95% CI: 1.54-9.369). Participants who had WC>80 cm were 3.799 times more likely to be hypertensive than participants who had WC≤80 cm. This finding is consistent with a previous study which indicated that waist circumference had a stronger correlation with hypertension than BMI. WC or Central obesity is associated with hypertension through several mechanisms. The increased fat around the abdominal causes a decrease in adiponectin. The atherosclerosis process can quickly occur. Other mechanisms of increased sympathetic activity (i.e., malfunctioning of baroreceptor sensitivity and an increase in free fatty acids, angiotensin II, insulin, and leptin) can increase vascular resistance that may lead to hypertension (5).

Table I: The risk factors of hypertension

Participant characteristic	OR (95% CI)	Sig
Education:		
No or primary education (ref)	1	
Secondary or tertiary level of education	0.236 (0.087-0.644)	0.005
Waist circumference:		
≤80 cm(ref)		
>80 cm	3.799 (1.54-9.369)	0.004

R square 0.273

CONCLUSION

It can be concluded that waist circumference is a risk factor for hypertension in female batik workers in Kulonprogo, Yogyakarta, while the protective factor is the level of education.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Development of Malaysian Students' Healthy Meal Plan for Public University Students in Peninsular Malaysia

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SUMMARY

A meal plan demonstrates how a nutritious diet can be achieved with limited resources. It improves diet quality and prevents obesity. However, meal planning has not been well-studied in Malaysia. Thus, this study aims to develop a Malaysian Student Healthy Meal Plan (MySHMP) for public university students in Peninsular Malaysia. The development of this MySHMP involved three phases. Phase I assessed the prevalence of food insecurity, followed by the development of MySHMP that was done in Phase II. In Phase III, MySHMP's serving size was compared against the Malaysian Dietary Guidelines (MDG) and evaluated based on the actual price survey.

Keywords: Healthy meal, Malaysia, Meal cost, Meal planning, University students

INTRODUCTION

Meal planning is useful in the prevention of obesity. It was linked to eating healthier and having a lower risk of being overweight (1). However, healthy eating is challenging in university. Financially struggling people often choose less healthy and cheaper foods. Currently, 43.5% to 70.0% of Malaysian university students are food insecure (2), mostly measured based on the Adult Food Security Survey Module (AFSSM). Given the high prevalence, more studies are needed to assist students struggling with access to food in university settings. However, it is unclear how much a healthy diet costs at Malaysian public universities. There is currently only one meal plan designed for low-income public university students in Malaysia (3). This meal plan was based only on one public university. Thus, a random sampling to represent the population is needed to determine the cost of a healthy meal plan for students at public universities in Peninsular Malaysia.

MATERIALS AND METHODS

This cross-sectional study involved 427 students from four different public universities responded to a self-administered questionnaire. Demographic and socioeconomic backgrounds, meal expenditure, physical activity level, 24-hour dietary recall, and food frequency questionnaire (FFQ) were queried in the questionnaire. The respondents were chosen in Phase I through multistage random sampling. Frequency, Mann-Whitney U-test, Kruskal-Wallis H-test, and one-sample t-test were used to analyse the variables. Meanwhile, in Phase II, the development of MySHMP was developed based on the finding in Phase I, such as food listing based on the FFQ and 24-hour dietary recall and on the meal expenditure and physical activity of the respondents. Finally, in Phase III, the serving size of MySHMP was compared to the Malaysian Dietary Guideline (MDG) (4), and evaluated based on the actual price survey. The price survey was done from February until April 2018.

RESULTS AND DISCUSSION

Table I presents the background characteristics of the respondents. About 60.9% were food insecure. The respondents spent about 66.70 ± 24.46 USD monthly on food. Based on the 24-hour dietary recall and FFQ, 65 types of foods were listed for MySHMP's menu.

Six reference groups for MySHMP were categorized based on gender and physical activity level. The reference groups were referred to as male and female with low physical activity levels (M_LPAL and F_LPAL), male and female with moderate activity levels (M_MPAL and F_MPAL), male and female with high

physical activity levels (M_HPAL and F_HPAL). A standard price was obtained from the average ceiling price provided by each of the universities. A seven-day menu was developed for the MySHMP based on each reference group's calorie recommendation. MySHMP meets the number serving size for all six food groups as recommended by the MDG. The average cost of MySHMP ranged from 3.72±0.36 USD to the highest at 4.69±0.50 USD daily (Table II).

The actual price of the MySHMP for University A and B was slightly higher than the standard price. The highest percentage increase for the actual price for the MySHMP is about 8.6% (0.40 USD). This is due to the localities of the universities. University A and B are in the urban area, meanwhile University C and D are in the rural area. Fresh foods like vegetables and fish can be among the costliest in cities due to marketing and transportation costs, with some perishable during transportation (5). There is no significant mean difference between the MySHMP' standard price and the actual price survey from each university. Hence, the standard price can be used as a guideline to estimate the healthy meal price for future policies or studies that improve healthy eating among public university students in Peninsular Malaysia.

CONCLUSION

MySHMP reveals that healthy food is attainable at public universities. However, eating healthily costs twice as much as what students can afford. As a result, students who are struggling financially will find it difficult to strike a balance between eating a healthy meal and meeting the needs of their studies.

ACKNOWLEDGEMENTS

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Table I: Background characteristics of respondents.

Characteristics	Male	%	Female	%	Total	%	Mean ± SD
Ethnic							
Malay	136	80.0	221	86.0	357	83.6	
Chinese	16	9.4	16	6.2	32	7.5	
Indian	13	7.7	12	4.7	25	5.9	
Bumiputra	5	2.9	8	3.1	13	3.0	
Age (years)							
19-21	87	51.2	145	56.4	232	54.3	21.56±1.35
22-25	83	48.8	112	43.6	195	45.7	
Residence							
On Campus	159	93.5	253	98.4	412	96.5	
Out Campus	11	6.5	4	1.6	15	3.5	
Household Income*							
B40 (<969.32 USD)	133	78.2	223	86.8	356	83.4	765.73±217.74
M40 (969.32-2138.51 USD)	27	15.9	25	9.7	52	12.2	
T20 (≥ 2138.73 USD)	10	5.9	9	3.5	19	4.4	
Amount of Scholarship	n=140		n=219		N=359		
< 444.64 USD	89	63.6	145	66.2	234	67.1	444.64±405.40
≥ 444.64 USD	51	36.4	74	33.8	125	35.9	

* Household Income and Basic Amenities, 2016; 1 USD = 4.50 MYR

Table II: Standard and actual prices MySHMP.

Menu set	Standard Price (USD ± SD)	University A (USD ± SD)	University B (USD ± SD)	University C (USD ± SD)	University D (USD ± SD)
Male					
M_LPAL	4.10± 0.36	4.37±0.39	4.35±0.38	4.12±0.36	4.22±0.36
M_MPAL	4.34± 0.40	4.71±0.40	4.69±0.39	4.44±0.38	4.55±0.37
M_HPAL	4.69±0.50	5.09±0.49	5.07±0.48	4.83±0.46	4.94±0.45
Female					
F_LPAL	3.72± 0.36	4.00±0.37	3.89±0.36	3.74±0.40	3.84±0.36
F_MPAL	3.92± 0.34	4.21±0.35	4.19±0.33	3.96±0.35	4.06±0.32
F_HPAL	4.09±0.37	4.38±0.40	4.36±0.39	4.12±0.37	4.23±0.37

LPAL: Low Physical Activity Level; MPAL: Moderate Physical Activity Level; HPAL: High Physical Activity Level; 1 USD = 4.50 MYR; SD: Standard Deviation

EXTENDED ABSTRACT

Evaluation of Nutritive Value of Commercially Packaged Snacks Available in Thai Supermarkets

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SUMMARY

Nutrition labels play an important role in giving information about key nutrients of packaged snacks. This study assessed the nutrient contents from nutrition labels and categorized commercially packaged snacks by health star rating (HSR) system. Results show that nuts and seeds group has the highest total energy (kcal) and meat based group has the lowest total energy. In the HSR system, among all 7 groups of snacks, 21.1% of nuts and seeds products have 5 stars but 78.7% of meat-based snacks have only 0.5 stars. Therefore, nuts and seeds group can be consumed in moderate amount during snack time.

Keywords: Commercial snacks, Health star rating (HSR), Non-communicable disease (NCD), Nutrient profile, Nutrition labels

INTRODUCTION

Many developing nations are going through a double burden of disease. Moreover, non-communicable diseases (NCD) are mainly caused by poor diet and excessive energy intake is one of the risk factors(1). In order to improve overall nutritional quality of diet, some nutrient profiles (NP), back of pack nutrition (BOP) labels and front of pack (FOP) nutrition labels are used as tools to categorize foods and drinks as healthy and unhealthy based on nutrient contents. Moreover, snacking prevalence has increased significantly over the last 3-4 decades especially in developed countries like United States and the most popular snacks have been salty snacks and candies(2). However, there is a limited report of nutrient quality of snack foods in Thailand. Therefore, this study aims to evaluate the nutrient quality of commercially available snacks according to the criteria of Health Star Rating system (HSR) which is one of FOP labels frequently seen on food packages.

MATERIALS AND METHODS

This study is a cross sectional analysis of nutrient quality of snacks. In March 2022, data collection took place in Tops, Big C and Lotus's supermarkets which are major retail supermarket chains in Thailand. Seven categories of snacks were included in this study and the FAO/WHO Food Standards CODEX Alimentarius food category number 15 was used for inclusion criteria (3). Snacks which fall under the criteria together with cookies, crackers and biscuits were included and all sides of those snack package photos were taken by mobile phones. A total of 850 products were collected and total energy and nutrient contents were converted into 100g in order to calculate HSR system, which ranges from 0.5 to 5 stars. The higher the number of stars, the healthier the product is. Kruskal Wallis and Mann Whitney U tests using SPSS software version 18 were run to analyze data.

RESULTS AND DISCUSSION

Table I shows median, interquartile range, minimum and maximum of total energy, saturated fat, total sugar, sodium, protein and fiber contents based on 100g. Among seven categories of snacks, nuts and seeds have the highest range of total energy in kcal which is 567±100 while meat-based snacks have the lowest kcal content which is 333±120. However, bakery products have the highest saturated fat content and total sugar among all groups and it is the second highest proportion of 0.5 star according to HSR while meat-based snacks having the highest sodium content. On the other hand, seaweeds contain the highest content of protein and fiber which are good nutrients. Moreover, Kruskal Wallis test shows significant median differences across groups which of P value is <0.05.

In the HSR system, 0.5 star describes the least healthy and 5 stars means the healthiest. In Figure 1, meat-based

Table I: Total energy, saturated fat, total sugar, sodium, protein and fiber contents displayed on the nutrition panels of packaged snacks available in Thai supermarkets, March 2022.

Key Nutrients	Potato-based (n=107)	Corn- based (n=47)	Meat-Based (n=47)	Nuts and seeds (n=179)	Seaweeds (n=28)	Rice-based and extruded snacks (n=132)	Bakery products (n=310)
Total energy (Kcal/100g)							
Median(IQR)	533(27)	500(36)	333(120)	567(100)	544(272)	500(54)	500(53)
Minimum	348	393	292	167	0	350	333
Maximum	1760	609	633	1733	714	1050	600
Saturated Fat (g/100g)							
Median(IQR)	13(2)	12(4)	0(10)	7(4)	8(19)	10(7)	15(7)
Minimum	0	2	0	0	0	0	0
Maximum	39	18	23	23	29	25	120
Total Sugar (g/100g)							
Median(IQR)	3(4)	4(17)	20(22)	7(13)	0(16)	9(14)	29(16)
Minimum	0	0	0	0	0	0	0
Maximum	15	59	46	69	56	82	67
Sodium (mg/100g)							
Median(IQR)	560(247)	600(233)	1700(854)	267(425)	1150(975)	574(419)	276(268)
Minimum	0	161	433	0	0	0	0
Maximum	2016	1400	2880	960	2375	2133	1400
Protein (g/100g)							
Median(IQR)	7(3)	5(3)	24(16)	20(7)	18(11)	6(7)	7(2)
Minimum	2	3	11	3	0	0	0
Maximum	17	10	67	60	50	30	18
Fiber (g/100g)							
Median(IQR)	3(1)	3(4)	0(13)	7(7)	15(10)	5(7)	3(1)
Minimum	0	0	0	0	0	0	0
Maximum	12	10	6	37	25	20	12

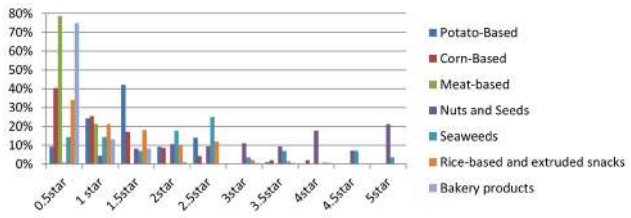

Fig.1: Percentage of Health Star Rating system of different snack groups

snacks have the highest percentage in 0.5 star which means that 78.7% of meat-based snacks are the least healthy. Also, 74.8% of the bakery products group which contains cookies, crackers and biscuits follows the meat-based group in the 0.5 star category because of high content of saturated fat and sugar. Even though the total energy content of nuts and seeds is the highest among all snacks, this group also has the highest percentage of 5 stars (healthiest) products which is 21.1% and another snack group having 5 stars is seaweed showing 3.6%. Excess sodium intake is a risk factor for high blood pressure and has been linked with NCDs and causes premature death globally- and is mostly common in Asian populations (4, 5). In order to improve diet quality as well as prevent NCDs, meat-based snacks should be avoided for snack time because they contain the highest amount of sodium and 78.7% are having 0.5 stars (least healthy category).

CONCLUSION

In conclusion, moderate amount and less frequency of snack consumption should be recommended since the snacks with high HSR are energy-dense; and snacks high in protein are also high in sodium. Therefore, moderate amount of nuts group and seaweed can be consumed more frequently than bakery products and meat-based snacks.

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EXTENDED ABSTRACT

Complementary Feeding Practices of Mothers in Three Geographical Areas in Virac, Catanduanes, the Philippines

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SUMMARY

This study determined the complementary feeding practices of mothers in three geographical areas in Virac, Catanduanes. Descriptive survey method was used. Result showed that complementary foods were given after the first six months of life and commercial cereal was the first complementary food given. These two practices were mostly observed in the lowland, followed by those in the coastal and the upland areas. This indicates that the timing of giving complementary foods is compliant with recommendations and commercial cereal is preferred most in the lowland probably due to its proximity to the market.

Keywords: Complementary feeding practices, Complementary food, Geographical areas, Mothers, Timing of giving complementary foods

INTRODUCTION

A child's optimum growth and full potential can be achieved through proper nutrition. The period from birth to two years of age is a "critical window" for the promotion of optimal growth, health and behavioral development. Longitudinal studies have consistently shown that this is the peak age for growth faltering, deficiencies of certain micronutrients, and common childhood illnesses such as diarrhea (2).

It is believed that malnutrition appears when infants are not properly fed and at the same time illness is present in the child. For this reason, it is essential to ensure that caregivers are provided with appropriate guidance regarding optimal feeding of infants and young children. This study aimed to determine the complementary feeding practices of mothers in three geographical areas of the municipality of Virac, Catanduanes.

MATERIALS AND METHODS

The study was conducted in the municipality of Virac, the capital of the province of Catanduanes located in the Bicol region of the Philippines. An interview was used in the study. Questions were formulated based on published literatures of the WHO/PAHO (2003) on infant and young child feeding and similar studies (2). Questions which were formulated in the English language were translated and asked in the Bicol dialect. Cluster sampling was the study design used. According to information from the Municipal Agriculture Office, the sixty-three barangays in the municipality were stratified according to geographical areas namely, coastal, upland, and lowland. From each area, three barangays were selected and from each cluster through simple random sampling. Descriptive statistics was used in processing the data. Oral informed consent was sought from the mothers. Data collection was done with the help of young dietitians residing in the locality who were hired and trained for that purpose.

RESULTS AND DISCUSSION

Result showed that the mothers gave the first complementary food after the first six months of life. Specifically, the lowland area has the biggest number of mothers (76.7%) who practiced this, followed by the coastal area (73.3%), and lastly by the upland area (33.3%). This result showed that the mothers complied with the recommendation that complementary foods should be given after the six months of life wherein breastmilk alone can no longer supply the energy and nutrient needs of the growing infant. Commercial cereal was the first complementary food given by the mothers rather than the home-cooked cereal ("lugaw"). This was practiced mostly in the lowland area (76.7%) followed by the coastal area (60.9%) and the upland area (47.6%). It indicates that the mothers mostly prefer buying commercial food for complementary feeding,

Table I: Complementary feeding practices of mothers in three geographical areas

Complementary feeding practices	Coastal		Upland		Lowland		Total	
	n=42	%	n=46	%	n=73	%	n=161	%
Age in months of introduction of CF								
Before 6 mos. of age	12	26.1	14	33.3	17	23.3	43	26.7
After 6 mos of age	34	73.9	28	66.7	56	76.7	118	73.3
First complementary food given								
Home-cooked cereal ("lugaw")	18	39.1	22	52.5	17	23.3	57	35.4
Commercial cereal	28	60.9	20	47.6	56	76.7	104	64.6

probably due to its ease in preparation. It may also be due to the fact that the lowland and coastal areas which practice this the most are more accessible to the market and groceries than the upland area.

CONCLUSION

The mothers in the three geographical areas are mostly compliant with recommendations of giving the first complementary foods after the first six months of life. They also prefer giving commercially bought cereal rather than preparing a home-cooked complementary food probably due to their proximity to the market and its ease in preparation.

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EXTENDED ABSTRACT

Development of Low-Fat Pamphlets Based on the Transtheoretical Model for Ischemic Stroke Patients

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SUMMARY

Ischemic stroke is the leading cause of death and disability in many countries. This study aimed to develop and use the focus group interview and content validity test to evaluate the appropriateness of the content of five educational brochures. The five pamphlets are designed for Asian especially Chinese ischemic stroke patients. The content is based on the transtheoretical model (TTM) to meet the information needs of the stroke population and achieve health improvement. The result indicates that these pamphlets had good content validity to educate stroke patients about reducing fat consumption.

Keywords: Content validity, Ischemic stroke, Low-fat, Transtheoretical model

INTRODUCTION

Stroke is a life-threatening medical condition and the leading cause of serious long-term disabilities. Globally, stroke is the second-leading cause of death (1) and up to 25% of stroke survivors will get recurrent ischemic within one year. The recurrence stroke (RS) will bring higher morbidity and mortality rates than primary stroke (2). A limited health literacy could increase health care costs by up to 5%. Using written materials can provide scientific information improving the timeliness of health education memory. In the meanwhile, the benefit of the pamphlet also includes low price, timely dissemination, and consistent message (3). Dietary saturated fat and trans-fat intake increase RS risk factors (4). Strong evidence of the use of the transtheoretical model (TTM) reduced total fat, saturated fat, and cholesterol intake in short and long-term follow-up (5). However, developing pamphlets based on TTM as a nutrition education tool has never been reported.

MATERIALS AND METHODS

This study was developmental research that aimed to design, develop and evaluate the content of nutrition education tools for ischemic stroke patients. There were three parts of the study as follows.
Part 1: Developing nutritional educational pamphlets according to clinical practice guidelines for ischemic stroke with integration stages of change based on TTM
Part 2: Conducting a focus group in which five nutrition experts examined nutrition content appropriately for ischemic stroke patients according to the stage of the change via online. The Focus group transcript text served as the basis for further analysis using the framework analysis
Part 3: Determining content validity of the developed pamphlets by 10 experts. Item-level content validity index (I-CVI), scale-content validity index (S-CVI), and Kappa statistics were computed.

RESULTS AND DISCUSSION

Regarding the pamphlet development, its content setting conformed to the theoretical structure of TTM and provided low-fat knowledge suitable for the precontemplation stage, contemplation stage, preparation stage, action stage, and maintenance stage populations. Regarding the design of the pamphlets, the experts suggested choosing a suitable color for the text, and content in order of importance. Regarding the content of pamphlets, the experts suggested deleting the redundant text; providing dietary advice based on real-life; giving easy-to-operate knowledge methods; listing more examples to help understand; some titles and sentences should be more suitable for the topic of the phase atmosphere; negative comments and words should be modified or replaced with other words. Regarding the motivation of the pamphlets, the experts suggested using some positive and negative motivation to encourage people to change behavior. The final version of 5 pamphlets were modified according to the

Table I: Content Validity Index, Modified Kappa for five Pamphlets

Pamphlet	I-CVI of each items	K* of each items	S-CVI /Ave	S-CVI/ UA	Evaluation
Precontemplation-Stage	all>0.8	all>0.74	0.98	0.78	excellent
Contemplation Stage	all>0.8	all>0.74	0.97	0.67	excellent
Preparetion Stage	all>0.8	all>0.74	0.98	0.78	excellent
Action Stage	all>0.8	all>0.74	0.97	0.67	excellent
Mainteance Stage	all>0.8	all>0.74	1.00	1.00	excellent

I-CVI = Item Content Validity Index.
K*= (I-CVI - PC) / (1- PC); PC= [N! /A! (N -A)!] * 0.5^N, N= number of experts in a panel and A= number of panelists who agree on good relevance.
S-CVI/UA = Scale Content Validity Index/Universal Agreement.
SCVI/Ave =The mean of I-CVI for all items on the scale

above suggestions. Overall, the five pamphlets passed the validity test, as shown in the Table I, the I-CVI score, S-CVI score, and K value all performed excellently. The S-CVI/Ave were 0.98, 0.97, 0.98,0.97, and 1.00. The S-CVI/UA were 0.78, 0.67,0.78, 0.67, 1.00 for the precontemplation, contemplation, preparation, action, and maintenance pamphlets, respectively. The maintenance stage pamphlet showed the best performance and obtained full scores on all the criteria.

CONCLUSION

This study innovatively designed a low-fat nutrition education tool with rich content and a beautiful appearance based on the TTM model. The contents in the pamphlet passed the validity test. However, this study did not collect target patients' opinions. The practical social value of the pamphlets might be enhanced.

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EXTENDED ABSTRACT

Knowledge, Attitude, and Practice of Early Childhood Feeding among Parents in Malaysia

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SUMMARY

Numerous published studies suggest that the percentage of mothers who breastfeed and use complementary feeding is low. This cross-sectional study aims to assess the level of knowledge, attitude, and practice of early childhood feeding among 143 Malaysian mothers (i.e., involving those living in Kelantan, Terengganu, Kedah, Pulau Pinang, Selangor, Perak, Negeri Sembilan, and Johor Bharu) using the Infant and Young Child Feeding (IYCF) questionnaire conducted through an online survey. The result indicated that the majority of mothers in this study had good knowledge (76.2%), a positive attitude (93.7%), and good practices (88.1%) of early childhood feeding.

Keywords: Attitude, Early childhood feeding, Knowledge, Malaysia, Practice

INTRODUCTION

The multiple benefits of breastfeeding and complementary feeding to infants have been widely studied and are well-recognized. However, there is still a lack of knowledge and poor practices among mothers regarding breastfeeding. According to the Malaysia National Health and Morbidity Survey (1), breastfeeding practices are still low among mothers. This is supported by the fact that only six out of ten mothers practiced early initiation of breastfeeding within one hour after birth. Furthermore, only 19.3% of women breastfed their babies for at least four months and 14.5% for at least six months (1). So, this study will provide insights into what mothers in Malaysia know, how they feel, and what they do when it comes to feeding young children.

MATERIALS AND METHODS

This cross-sectional study used the Infant and Young Child Feeding (IYCF) questionnaire survey of knowledge, attitude and practice (KAP) on early childhood feeding among parents with children aged under two years old in Malaysia. The study was conducted among parents with children aged under two years in Malaysia through convenience sampling. The eligible criterion for the sample selection was that the respondents must be mothers with children aged under two years in Malaysia. Ethical approval for this research was received from the Human Ethic Board of Committees of Universiti Malaysia Terengganu with reference number: UMT/JKEPM/2021/70. The respondents signed a written informed consent prior to data collection. The minimum sample size for this study was 143 mothers with children aged under two years based on the Cochran formula, given the prevalence of children eating difficulty is 36.3% (2).

RESULTS AND DISCUSSION

According to Table I, the majority of respondents had good knowledge, attitudes, and practice of early childhood feeding. The majority of the respondents had a good level of knowledge (76.2%) with a median of 77.42 (IQR 12.9); mothers who completed this questionnaire had a good attitude (93.7%) with a median of 84.86 (IQR 9.19); and the majority of the mothers (88.1%) had good practice in early childhood feeding with a median of 84.62 (IQR 12.5).

The Spearman correlation test in Table II shows that there was a statistically significant moderate relationship between knowledge and attitude in early childhood feeding (p=0.000, r=0.394), where respondents with higher knowledge had a higher attitude score. This study also found a statistically significant relationship between early childhood feeding knowledge and practice (p=0.006, r=0.228). There is also a statistically significant relationship between attitude and early childhood feeding practices (p=0.000, r=0.374).

According to UNICEF (3), 20.7% of Malaysian children

Table I: Mothers' level of knowledge, attitude and practice on childhood feeding (n=143)

Level	Frequency	Percent (%)	Median (IQR)
Knowledge[a]			
Good	109	76.2	77.42 (12.9)
Average	29	20.3	
Poor	5	3.5	
Attitude[b]			
Good	134	93.7	84.86 (9.19)
Average	5	3.5	
Poor	4	2.8	
Practice[c]			
Good	126	88.1	84.62 (12.5)
Average	9	6.3	
Poor	8	5.6	

a: Score for knowledge Min=0%, Max=100%
b: Score for attitude Min=20%, Max=100%
c: Score for practice Min=25%, Max=100%

Table II: Relationship between knowledge, attitude and practice (n=143)

Variables	Correlation relation (r)	p-value
Knowledge, Attitude	0.394	0.000*
Knowledge, Practice	0.228	0.006*
Attitude, Practice	0.374	0.000*

*Spearman correlation is significant at p<0.05

under five are stunted, 11.5% are wasted, and 12.7% are obese. It is difficult to explain this outcome, but one possibility is that mothers' knowledge, attitudes, and practices of early childhood feeding may not be the primary risk factors for child malnutrition. It is surprising that mothers' knowledge, attitude, and practice of early childhood feeding were all found to be at a good level, given that we expected them to have only a medium level of knowledge or practice. So, in the future, research should be done to find out the main causes of the rise in undernutrition, stunting, underweight, and obesity in children under five in Malaysia.

CONCLUSION

Despite mothers' good knowledge, attitude, and practice regarding childhood feeding, undernutrition among children under five continues to rise year after year. More research needs to be done to find out the main causes.

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EXTENDED ABSTRACT

Banana Peel and Catfish-based Brownies as an Alternative Snack for Preventing Stunting

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SUMMARY

Banana peel and catfish head flour can be used as additional ingredients to improve nutritional value. This study developed three formulas of brownies with the ratio of catfish head flour and banana peel. For formula 1 the ratio of catfish flour and banana peel is 20:30, ratio Formula 2 was 30:2 and ratio for Formula 3 was 40:10. Based on nutrients analysis, formula 3 (banana peel: catfish flour = 25 :75 w/w) had the highest amount of calcium (391.29 mg/100g), iron (7.28 mg/100g) and protein (8.59 %). The results of hedonic test of all of the three formulas were acceptable and did not differ markedly from the average hedonic value which is F1: 4.7 (like), F2: 4.6 (like), F3: 4.9 (like).

Keywords: Alternative snack, Banana peel, Catfish flour, Iron, Stunting

INTRODUCTION

Stunting is defined as low height for certain age as a result of chronic or recurrent undernutrition, usually associated with poverty, poor maternal health and nutrition, frequent illness or inappropriate feeding and care in early life (2). Riskesdas 2018 data shows that the stunting rate in Indonesia is 37.2%, far from the RPJMN target of 28%. The government is making efforts to overcome stunting through a strategic program to accelerate the handling of stunting. Nutrition intervention program carried out specifically and sensitively. The adequacy of food intake and nutrition is included in the specific intervention. The primary intervention target consists of pregnant women, breastfeeding mothers, children aged 0-23 months, young women, and children aged 24-59 months. The provision of nutritional interventions is mostly carried out in the form of supplementation, fortification, and supplementary feeding. The brownie products were selected because they can be accepted by the panelist. The brownies are a common cake in the Indonesian community.

MATERIALS AND METHODS

Three brownies formula were developed with the following ratios of catfish head flour and banana peel: F1 (2:3), F2 (3:2), and F3 (4:1). The analysis used in this study included chemical analyses such as water content, calcium, and iron (4). The iron and calcium analyses used atomic absorption spectrophotometry (AAS) and for water content used gravimetric method. In this study, organoleptic testing of the formulas was also carried out. The research design used was experimental with a complete randomized design.

RESULTS AND DISCUSSION

Table I shows the chemical tests which include tests of water content, calcium and iron of the brownies. Formula 3 has a higher protein and iron content due to the greater addition of catfish head flour is, which is 40%. In general, the moisture content of baked brownies ranges from 2.60-7.56% (3). In this study the brownies produced contained relatively high water content, which might increase the risk of damage. The results of hedonic test and appropriateness of intensity (AIT) values are shown in Table II and Fig 1.

The determination of the AIT value is based on the panelist's assessment of the intensity of sweetness, texture, aroma, and color. The scale is from 1 until 6.

Table I: Brownies chemical analyze

Chemical characteristic	F1	F2	F3
Water content	17%	20 g/100 g	17 g/100 g
Calcium	183.35 mg/100 g	367.81 mg/100g	391.29 mg/100g
Iron	4.39 mg/100g	6.47 mg/100g	7.28 mg/100g
Protein	6.76%	7.78%	8.59%

Table II: Hedonic test result

Formula	Hedonic score	Interpretation
F1	4.7	like
F2	4.6	like
F3	4.9	like

Criteria note: Hedonic test came from the judgement of panelist by tasted the product such as sweeteness, texture,aroma and color

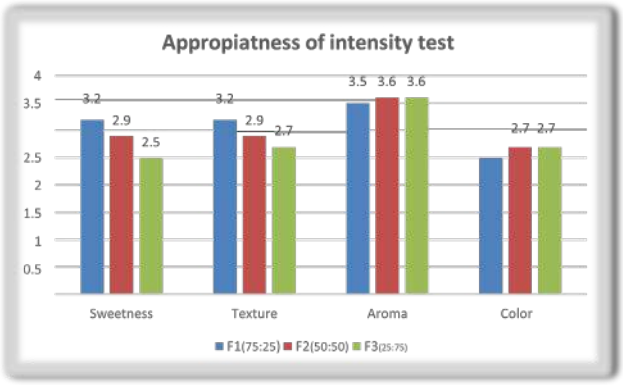

Fig.1: AIT test result

From the result of the intensity test, formula 1 has a sweeter taste compared to all the other three formulas and formula 3 has a preferred aroma. The aroma formed comes from the reaction of maillard which forms not only a brownish color but also a characteristic caramel aroma, in formula 1 the resulting taste is sweeter due to the contribution of sweetness from carbohydrates in banana peels, because in formula 1 banana peels are added more.

CONCLUSION

Banana peel and catfish head flour had the potential to be added to brownies as a source of calcium and iron. The best formula was formula 3 in chemical and organoleptic analyses. In formula 3, more catfish flour was added.

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EXTENDED ABSTRACT

High Fiber Snack Bar Made From Purple Sweet Potato (Ipomea batatas) and Black Soy-Bean (Glycine soja Sieb)

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SUMMARY

A high-fiber snack could be an alternative solution to enhance the fiber intake of the community. This study aimed to formulate and evaluate the nutrient profile of a high-fiber snack-bar made from local purple sweet potato and black-soybean from Indonesia. Four prototypes (tuber-extrusion:black-soybean; 80:20, 70:30, 60:40, and 50:50) were developed and evaluated with regard to the sensory profile, fiber content, proximate composition and antioxidant profile. The results revealed that the selected formula with 70% of extruded tuber enabled to contribute up to 27% of daily need of fiber. In conclusion, the selected formula could be claimed as a high-fiber bar.

Keywords: Black-soybean, Extrusion, Fiber, Local crops, Purple sweet potato

INTRODUCTION

The prevalence of obesity as an initial bridge to various non-communicable diseases has been continuously increasing all over the world (1). High dense-energy but low fiber and bioactive compounds on daily diet become a primary cause of obesity and its risks (2). Sufficient fiber intake could prolong the satiety perception. This might hinder the over-energy intake and maintain normal body weight (3,4). Another mechanism is that fiber helps to improve the gut microbiome profile (3). High fiber food could be an alternative solution to enhance the fiber intake of the community. In addition, a significant content of anthocyanin and antioxidant capacity in the diets would also help to reduce the risk of various degenerative diseases (2,3). This study aimed to formulate a high fiber snack bar made from purple sweet potato (*Ipomea batatas*) and black soy-bean (*Glycine soja* Sieb) locally from Indonesia.

MATERIALS AND METHODS

A completely randomized design with the ratio of tuber-extrusion and black-soybean as the main variable was applied, i.e. 80:20, 70:30, 60:40, and 50:50 as formula-one (F1), -two (F2), -three (F3), and –four (F4), respectively. The acceptance rate of those formulas was evaluated by 40 semi-trained panelists (familiar with sensory evaluation but not yet following the trained panelist selection) (5). A Quantitative Descriptive Analysis (QDA) was also conducted by 8 selected panelists (passing the basic visual, taste, aroma and intensity test) to evaluate the sensory profile of the formulas. The proximate analysis (oven-gravimetric, dry-ashing, kjeldahl, soxhlet and by-difference) had been applied to determine the content of water, ash, protein, fat and carbohydrate, respectively. Meanwhile, the edible fiber content was also analysed using enzymatic-gravimetric method. Water activity (water activity meter) and antioxidant capacity (DPPH method as methanol water fraction 1:1) of the selected formula had also been analysed.

RESULTS AND DISCUSSION

The results revealed that a ratio of extruded tuber and roasted black-soybean 70:30 was chosen as the optimal formula based on sensory and nutritional profile (Table I). The overall acceptance rate of the selected formula is 6.6 from 9 hedonic scales. This snack was able to provide 13.05g fiber per 100g snack so that it could be claimed as having a high fiber content (meeting the basic requirement for claim). Proximate analysis presented that the selected formula contained water, ash, protein, fat and carbohydrate, i.e. 10.14±0.08, 2.52±0.01, 7.20±0.20, 8.89±0.07, and 71.24±0.20 %wb, respectively. Moreover, this snack had water activity and antioxidant capacity (IC_{50}), i.e. 0.44 and 1161.69±8.08 ppm, respectively. This very low water activity indicates that the product might have a long shelf-life. This snack bar contributed 21.9 to 27.0% of daily need of fiber depending on the subject category (Table II).

Table I: Hedonic rate and edible fiber content of the formulas

Formula	F1	F2	F3	F4
Hedonic rate[1]				
Colour	7.05±1.15[a]	7.18±0.96[a]	6.90±1.19[a]	6.68±1.21[a]
Aroma	5.95±1.24[a]	6.18±1.24[a]	6.50±1.18[a]	6.40±1.30[a]
Texture*	6.05±1.43[b]	5.98±1.42[b]	4.95±1.47[a]	4.90±1.32[a]
Taste*	6.73±1.06[b]	6.55±1.47[b]	6.05±1.38[ab]	5.60±1.48[a]
Mouthfeel*	6.18±1.53[b]	6.08±1.38[b]	4.95±1.45[a]	4.78±1.48[a]
Aftertaste	6.15±1.29[a]	6.40±1.55[a]	5.80±1.54[a]	5.73±1.30[a]
Overall*	6.78±1.03[b]	6.60±1.17[b]	5.78±1.44[a]	5.83±1.28[a]
Edible fiber (%wb)	13.14 ± 0.35[a]	13.50±0.22[ab]	14.48±0.48[b]	16.60±0.16[c]

Note: [1]Hedonic rating range from 1 to 9; wb: wet basis; different superscript letters are significantly different (P-value<0.05), analysed using one-way-ANOVA and Tukey post hoc test.

Table II: Percent nutrient contribution from one serving size of the selected formula (60g) for various age categories

Nutrient	Unit	Nutrient content per serving size (60g)	% nutrient contribution					
			Men			Women		
			19-29	30-49	50-64	19-29	30-49	50-64
			years old					
Energy	kcal	236	8.9	9.3	11.0	10.5	11.0	13.1
Protein	g	4.3	6.6	6.6	6.6	7.2	7.2	7.2
Fat	g	5.3	7.1	7.6	8.8	8.2	8.8	10.6
Carbohydrate	g	42.7	9.9	10.3	12.6	11.9	12.6	15.3
Edible fiber	g	8.1	21.9	22.5	27.0	25.3	27.0	32.4

CONCLUSION

Snack bars made from 70% extruded tuber and 30% black-soybean may serve as a healthy snack alternative for improving the fiber daily need up to 27%. This research proves that the indigenous crops might be processed by using extrusion to provide various essential nutrients to the community.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Bread Made from Red-Bean, Soybean, and Corn Flour: An Acceptance and Potential Nutritive Supplementary Product for Pregnant Women

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SUMMARY

Maternal mortality could be controlled by supplementary bread made from local ingredients. This study aimed to analyze the effect of substitution of wheat flour with a mixture of red-bean, soybean, and corn flour on the organoleptic and nutrients content of bread. The local flour was made from red-bean, soybean, and corn flour mixed with 1:1:1 ratio. The 10% substitution of mixed flour was the best supplementary product in terms of taste and colour. In terms of nutrient content, it contained 153 kcal of energy and 5g of protein. In conclusion, this bread had the potential to be used as supplementary food for pregnant woman.

Keywords: Corn, Pregnant women, Red-Bean, Soybean, Supplementary product

INTRODUCTION

The Indonesian goverment has targeted to reduce 5.5% of the annual maternal mortality rate. To achieve that, a specific intervention is done by providing food supplementation (1). The government has made a policy to support underweight toddlers and pregnant women with chronic energy deficiency by giving an intervention in the form of biscuits. However, the program had not been implemented maximally (2). Local food supplementation such as red-bean, soybean, and corn can also be processed into flour and made into bread. Flour from these local ingredients is potential to substitute the wheat flour which has high glycemic index (3). The creation of bread with low glycemic index has beneficial effects on pregnant women to alleviate the level of plasma glucose, without causing adverse effects on the newborns (4). This study aimed to analyze the effect of substitution of wheat flour with a mixed flour on the organoleptic and nutrients content of bread.

MATERIALS AND METHODS

The design of the research was a true experiment using Completely Randomized Design with two replications consisting of four formulas (Table I). Mixed flour was made with 1:1:1 ratio. F0 as the standard formula; F1, F2, F3 was the standard formula added with 10%, 20%, and 30% of mixed flour. To get the best formula, 30 selected panelists conducted the organoleptic test. Furthermore, a proximate test was carried out to estimate the nutrients content of each bread, which was done at Saraswanti Laboratory, Bogor, Indonesia.

Table I: Formulation of Bread

Ingredient	Proportion of Ingredient			
	F0 (0%)	F1 (10%)	F2 (20%)	F3 (30%)
Mixed flour (g)	0	57.6	115.2	172.8
Wheat flour (g)	576	518.4	460.8	403.2
Margarin (g)	60	60	60	60
Egg yolk(g)	15	15	15	15
Milk (g)	300	300	300	300
Sugar (g)	140	140	140	140
Yeast (g)	1	1	1	1
Salt (g)	16	16	16	16
Milk powder (g)	20	20	20	20

RESULTS AND DISCUSSION

The organoleptic test played an important role in supplementary bread development by substitution of red-bean, soybean, and corn flour for dough. The results of the organoleptic test showed that bread substitution with 10% mixed local flour was significantly better in taste and colour than other formulas. There were no significant differences between F0 and F1 in aroma and texture (Figure 1a). The hedonic test revealed that the panelists prefer bread that has similar characteristics to F0 for daily consumption. The panelists accepted

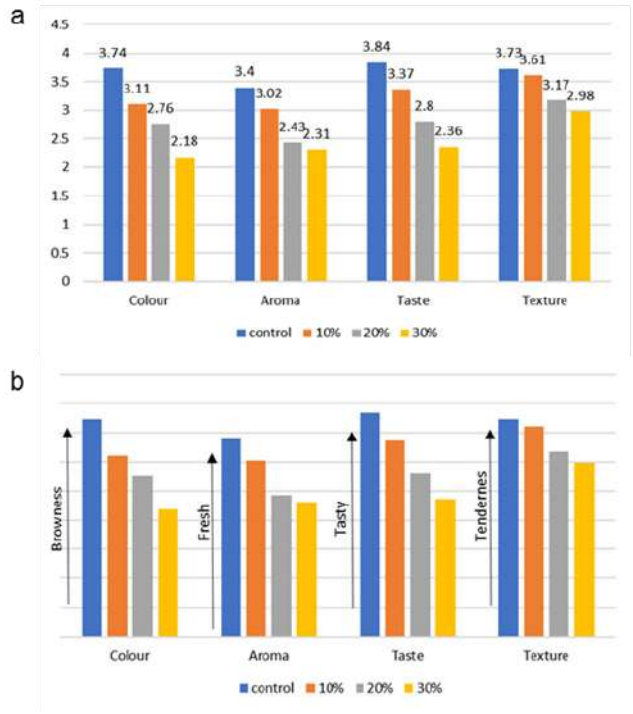

Fig.1: Organoleptic Test (a) Hedonic Test, (b) Hedonic Quality Test

F0 because of the taste, colour, texture, and aroma respectively. The F2 and F3 produced products with low preference. Those formulas showed discoloration, hard crush, unpleasant aroma and taste (Figure 1b). The mixed flour absorbed water more easily. This condition gave an impact on the smooth crust and crumb of bread (5).

ANOVA test showed that substitution of mixed flour did not have a significant effect on the water content ($p>0.05$). Meanwhile, it has a significant effect on ash content, fat, protein, and carbohydrate ($p<0.05$) (Table II). Based on the Duncan test, substitution of mixed flour to bread could increase the nutritional value of bread. The study showed that 10% substitution of mixed flour made a significant difference on fat and ash, but not on protein and carbohydrate. Nutrient content showed that 50g of supplementary bread contained 153 kcal of energy, 4g of fat, 5g of protein, and 23.8 g of carbohydrate.

CONCLUSION

In conclusion, based on the organoleptic test, the best formula was F1 with 10% substitution of mixed flour (red-bean, soybean, and corn). This product could potentially be used as an alternative of supplementary feeding for pregnant woman.

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Table II: Nutrient Content of Bread

Composition	Treatment			
	F0	F1	F2	F3
Water (%)	32.82 ± 0.31 [a]	32.89 ± 0.70 [a]	33.18 ± 0.46 [a]	33.19 ± 0.51 [a]
Ash (%)	1.00 ± 0.07 [a]	1.09 ± 0.04 [b]	1.23 ± 0.02 [c]	1.33 ± 0.03 [d]
Fat (%)	7.42 ± 0.12 [a]	8.19 ± 0.36 [b]	8.54 ± 0.07 [c]	8.63 ± 0.16 [c]
Protein (%)	10.23 ± 0.15 [a]	10.28 ± 0.17 [a]	10.54 ± 0.24 [a]	10.92 ± 0.31 [b]
Carbohydrate (%)	45.94 ± 0.32 [a]	46.51 ± 1.20 [ab]	47.55 ± 0.27 [bc]	48.54 ± 0.93 [c]

EXTENDED ABSTRACT

Fatty Acid Profiles of Virgin Coconut Oils from Bangka

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SUMMARY

High-temperature extraction is a method commonly used to extract Virgin Coconut Oil (VCO). This study observed the fatty acid profiles of VCO extracted through heating. The samples are commercial VCO as control and VCO extracted from local yellow and green coconuts obtained from Bangka Island. GCMS was used to determine the fatty acid profiles. The results indicate that VCO extracted from yellow coconut has the best fatty acid profiles with the highest percentage of lauric acid compared to the commercial VCO and green coconut VCO.

Keywords: Fatty acid profiles, Lauric acid, Virgin coconut oil

INTRODUCTION

Virgin Coconut Oil (VCO) has a high content of polyphenols and medium-chain fatty acids (1). VCO also contains alkaloids and saponin, and this encourages further research on its main components (2). Through an in vivo study, VCO has shown the ability to improve brain antioxidant profiles in rats (3) and improve breast milk production when used as an ointment for oxytocin massage in post-partum mothers (4). Moreover, VCO is easy to produce at the household level, especially in Indonesia, where the coconut is an important commodity and is widely consumed (5). Therefore, this study aimed to observe the fatty acid contents of VCO produced from locally harvested coconuts on Bangka Island.

MATERIALS AND METHODS

Virgin coconut oils were extracted from the green and yellow coconuts from local farmers in Bangka. First, the VCO was extracted using a hot extraction method by pressing the freshly grated coconut to yield the coconut milk. This step was followed by heating the coconut milk at a high temperature (100°C) for oil separation from the rest of the yield. This study was a qualitative-comparative study to examine the profile of fatty acids in virgin coconut (VCO). Fatty acid profiles were examined using Gas Chromatography-Mass Spectrometry (GCMS). Heating was used to separate the VCO content, and the components were entered into a column with inert gas. The separated components were then quantified using a mass-spectrometry. The samples consist of VCO from the yellow and green coconut, along with commercial VCO. Then, the three samples were compared to the national standard code number SNI 7381-2008 for VCO.

RESULTS AND DISCUSSION

The VCO samples were extracted through pressing and high-temperature heating at 100°C to separate the oils from other components. The fatty acid profiles of the VCO samples were then compared to the national standard of VCO production. The commercial control VCO met the national standard except for lauric acid and myristic acid, which were below the national standard. However, similar results were obtained from VCO from yellow and green coconuts as they contained <16.8% of myristic acid. On the other hand, for palmitic acid con The VCO samples were extracted through pressing and high-temperature heating at 100°C to separate the oils from other components. The fatty acid profiles of the VCO samples were then compared to the national standard of VCO production. The commercial control VCO met the national standard except for lauric acid and myristic acid, which were below the national standard. However, similar results were obtained from VCO from yellow and green coconuts as they contained <16.8% of myristic acid. On the other hand, for palmitic acid content, only the green coconut did not meet the national production standard for VCO.

Among the three samples, the yellow coconut has the highest lauric acid content. Lauric acid is virgin coconut oil's main fatty acid compound. It is a medium-chain fatty acid that defines VCO's unique health benefits. VCO extracted from yellow coconut showed the highest number of lauric acids at 47.7%. This suggests the potential health benefit of VCO as lauric acid can be

Table I: Fatty Acid Profiles of Virgin Coconut Oil

Fatty Acid Composition	(%)			
	Commercial VCO	Yellow Coconut VCO	Green Coconut VCO	National Standard
Capryliic Acid (C8:0)	7.887	8.886	9.015	5.0-10
Capriic Acid (C10:0)	6.094	6.828	6.819	4.6-10
Lauriic Acid (C12:0)	43.367	47.663	47.503	45.1-53.2
Myristiic Acid (C14:0)	15.456	15.501	15.425	16.8-21
Palmitiic Acid (C16:0)	8.929	7.903	7.396	7.5-10.2
Steariic Acid (C18:0)	3.508	3.369	3.152	2.0-4.0
Oleiic Acid (C18:1)	7.409	6.176	5.311	5.0-10
Linoleiic Acid (C18:2)	1.971	1.214	1.112	1.0-2.5
Alfa-linoleiic Acid (C18:3)	0	0	0	0-0.2

directly used as an energy source in the human body without going through re-esterification or degradation processes. Hence, it is more stable (1).

CONCLUSION

In conclusion, the VCO extracted from the yellow coconut through high-temperature heating has the best fatty acid profiles and meets the national standard except for the myristic acid number. Furthermore, the yellow coconut VCO sample had the highest lauric acid content, which indicates the potential for more health benefits.

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EXTENDED ABSTRACT

The Effect of Ultrasound Treatment on the Quality of Pineapple (Ananas comosus)

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SUMMARY

Pineapple contains a lot of sugars. Therefore, it is not recommended for people with limited sugar consumption. The reduction in total sugar content (TSS) was carried out using ultrasound wave. The observed parameters were TSS, pH, vitamin C and total color difference (⊗E*). Ultrasound was able to reduce TSS and acidity of pineapple without significantly affecting the color of pineapple. The largest decrease of TSS was approximately 29%. The best treatment was using ultrasound wave at frequency of 20 kHz for 30 minutes with TSS of 10.87%, pH at 3.63, vitamin C of 12.67 mg/100g and ⊗E* of 3.76.

Keywords: Acidity, Colour, Pineapple, Soluble sugar, Ultrasound

INTRODUCTION

Pineapple contains a lot of nutrients; however, it is not recommended for consumers with limited sugar intake. The selected technology in food processing should be environmentally friendly. The involvement of ultrasound in food processing has long been applied. A few researchers had performed experiments on ultrasound for dehydrating pineapple both in single application and combined with other methods (1,3-4). None of the research focused on decreasing TSS. Ultrasonic wave generates alternating low- and high-pressure waves in liquids, leading to formation and violent collapse of small vacuum bubbles called cavitation. Factors affecting the performance of ultrasonication include frequency, temperature, contacting time and food properties. A study reported that ultrasound frequency had an indirect effect on the lycopene degradation in tomato puree (5). This study evaluated the effect of ultrasound wave on some quality parameters of pineapple before and after ultrasonication.

MATERIALS AND METHODS

Pineapple of queen variety was obtained from pineapple growers in Prabumulih district, south Sumatera. The peeled pineapple was put in the processor bath of ultrasonic processor that had been filled with distilled water. The frequency and contacting time were set according to the experimental design. The treated pineapple was analysed for its physical and chemical characteristics (TSS by a refractometer, pH by a pH meter, and vitamin C by titration method with the iodine solution, total color difference by a color reader). The research was conducted using a factorial randomized design. The experiments consisted of two factors: An A Factor was the ultrasound frequency (A1=20 and A2=40 kHz), and B factor was the sonication time (B1=10, B2=15, B3=20, B4=25, B5=30, B6=40 minutes). The HSD (Honestly Significantly Difference test) at 5% was used to analyse the significant difference treatments.

RESULTS AND DISCUSSION

The average TSS content of all treated pineapple can be seen in Figure 1. ANOVA showed that the decrease in total sugar content was not significantly different. This was presumably because the pineapple was not sliced, causing the intensity of the ultrasonic waves not to penetrate maximally into the flesh of the fruit.

The effect of contact time on the pH is shown in Table I. The more gas bubbles that are formed due to a longer contact, the more cavitation energy that results in cell damage (vacuoles). Organic acids contained in pineapples such as citric acid, malic acid and oxalic acid which are water soluble were released.

The results showed that the average ΔE* of treated whole fresh pineapple ranged from 3.76 to 11.50. ANOVA showed that the ultrasound frequency, contact time and the interaction between the two treatment factors had no significant effect on ΔE* of treated whole fresh pineapple.

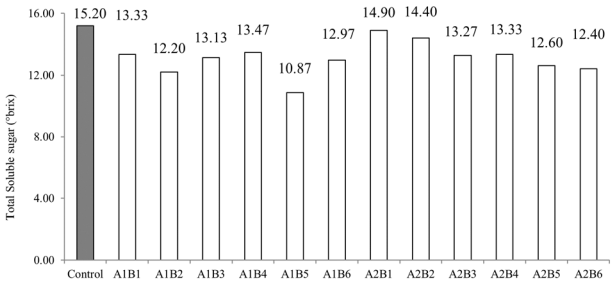

Fig.1: TSS content (°Brix) of treated pineapple

Table I: HSD test (5%) for the effect of contact time on pH of treated pineapple

Contact time	pH
B1 (10 mins)	3.47[a]
B2 (15 mins)	3.53[ab]
B3 (20 mins)	3.63[ab]
B4 (25 mins)	3.65[ab]
B5 (30 mins)	3.68[ab]
B6 (40 mins)	3.78[b]

Values followed by the similar letter of the superscript are not statistical significantly different at P>0.05, HSD 5%=0.26

The results showed that treated pineapple contained an average of 10.33 mg/100g of vitamin C to 12.67 mg/100g, while the vitamin C content of pineapple without treatment (control) was 14.08 mg. /100g. Ultrasound frequency, contact time and interaction between the two factors had no significant effect on vitamin C of treated pineapple.

CONCLUSION

Ultrasound wave was not significantly different in decreasing TSS and vitamin C, but it was significantly different in increasing pH. Based on the largest TSS reduction, the recommended ultrasound treatment for pineapple was ultrasound frequency at 20 kHz for 30 minutes of contact time which could reduce total soluble sugar content from 15.20 °Brix into 10.87 °Brix.

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EXTENDED ABSTRACT

Potentials of Fiber, Antioxidant Activity, and Prebiotic Property of Three Species of Seaweed from Waters of Indonesia: a Narrative Review

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SUMMARY

Seaweed is an abundant commodity in Indonesia which has health benefits for health. The study purpose is to provide describe the nutritional potential of *Ulva lactuca, Sargassum polycystum* and *Eucheuma cottonii*, as a reference in the functional food development. This research is a narrative review using 5 steps. The selection includes database and keyword filtering, article collection, inclusion criteria determination, and a review process of the selected 13 publications. *Eucheuma cottonii* contains dietary fiber, PUFA, carrageenan, vitamin C, higher Na, and stronger antioxidant activity. In conclusion, seaweed has more potential to be a more acceptable developed product that can improve the nutrition of the community.

Keywords: Antioxidant, *Eucheuma cottonii*, Seaweed, *Sargassum polycystum, Ulva lactuca*

INTRODUCTION

Seaweed is abundant. *Ulva* sp, *Sargassum* sp and *Eucheuma* sp are types of seaweed that dominate the Indonesian waters. The results of the previous study stated that seaweed is mostly used in the pharmaceutical and feed industries, while processed food products were still limited as food additives. In addition to the high fiber content, its bioactive content has the potential to be developed as a functional food (1). However, data on the comparison of chemical composition and nutritional content between the three species is very limited. So, a narrative review is needed as a basis for selecting the right raw materials. This study aims to provide information on fiber content, PUFA, antioxidant activity, prebiotic properties, vitamin C, minerals in the types *Ulva lactuca, Sargassum polycystum* and *Eucheuma cottonii* that have been studied to see its potential in its development into functional food, especially for non-communicable diseases.

MATERIALS AND METHODS

The narrative review method used 5 steps which include database and keyword filtering, article collection, inclusion criteria determination, and a review process. The research was carried out by tracing several research articles which were experimental studies, especially those analyzing the nutritional and phytochemical content of the three types of seaweed. The articles reviewed were obtained from online scientific databases (PubMed, Google Scholar and ClinicalKey) using terms or phrases relevant to the topic in the last 10 years (2012-2022). The search was carried out on national and international journals that can be accessed openly. The inclusion criteria were research using seaweed from Indonesian water and in the form of dry weight basis. Research articles were not included if the research method is an observational study, literature review, systematic review, and meta-analysis. Based on these criteria, from 25 articles published, 13 articles matched the criteria.

RESULTS AND DISCUSSION

The result shows that the total dietary fiber contents of *E. cottonii* were higher than those of *S. polycystum* and *U. lactuca*. This value is high compared to the fiber content of seaweed in general, which is 30-40% dry weight (2). Fiber is needed by the body to avoid the risk of noncommunicable disease. In addition, the provision of dietary fiber in diabetics is one of the dietary therapies that can be done to control blood glucose. A lower IC50 value indicates a higher antioxidant activity. Successively *E.cottonii* had the strongest antioxidant activity and a higher amount of PUFA than *U.lactuca*. Fresh *E.cottonii* showed strong antioxidant activity (64.73±1.61) (3). *E.cottonii* compounds have a prebiotic function, namely carrageenan. Carrageenan extracts of *E. cottonii* and *S. polycystum* were shown to reduce lipid levels in the

serum of hypercholesterolemic rats (4). The chemical composition is shown in Table I.

Table II shows that *E. cottonii* contains vitamin C and it is higher than other species of *Eucheuma* (5). *S. polycystum* had the highest total phenol. Phenolic compounds are reported to have antioxidant characteristics. *U. lactuca* contains a larger amount of Ca, even higher than other minerals, followed by *S. polycystum*. Calcium is an essential element and has a higher value in seaweed than land foods. The highest Fe and Na contents were *S.polycystum* and *E.cottonii*, respectively. Differences among these seaweeds are influenced by habitat differences, the characteristics of seaweed (*E. cottonii* is easier to grow), the content of bioactive components (natural pigment, phenolic compound, sulfated polysaccharides), and also environmental factors such as light intensity that affects the photosynthesis process (1). Based on this information, product development can be directed at innovating ready-to-eat/drink foods and beverages that are high in fiber, prebiotics/sinbiotics or low-fat products by selecting a processing that minimizes antioxidant damage.

CONCLUSION

In conclusion, among the studied Indonesian seaweeds, red seaweed (Rhodophyta) *Eucheuma cottonii* has the highest dietary fiber and antioxidant capacity. Further, clinical trials are urgently required to expand the local seaweed utilization which might improve the community nutrition.

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Table I: Nutrient content and chemical composition of seaweed varieties

Nutrient Content	Unit	*Eucheuma cottonii*	*Ulva lactuca*	*Sargassum polycystum*	References
Water	%bb	22.47	ND*	ND*	Astawan *et al.* (2004); Rasyid A (2017); Sumandiarsa *et al.* (2020) Damongilala *et al.* (2013); Prasedya *et al.* (2019) Adharini *et al.* (2019); Pangestuti *et al.* (2021) Simatupang *et al.* (2021); Santoso *et al.* (2006); Liem (2013); da Costa *et al.* (2018); Eka Wati *et al.* (2020)
Ash	%bb	29.97	11.2	3.41	
Fat	%bb	0.28	0.19	0.04	
Protein	%bb	5.91	13.6	0.62	
CH	%bb	63.84	58.1	8.30	
Total dietary fiber	%bb	78.94	28.4	69.3	
Soluble dietary fiber	%bb	23.89	ND*	10.7	
Insoluble dietary fiber	%bb	55.05	ND*	58.6	
Antioxidant	IC_{50} (ppm)	16.44	88890.55	99	
PUFA	%	8.6	4.79	ND*	
Prebiotic as carrageenan	%	15.8	ND*	ND*	

*ND: no data

Table II: Total phenol, vitamin c, and mineral content in seaweed varieties

Seaweed Varieties	Phenol (mg GAE/g extract)	Ca (mg/100 g)	Fe (mg/100 g)	Na (mg/100 g)	Vitamin C (mg/100 g)	References
Eucheuma cottonii	141	466.46	14.52	9311.85	3.59	Adharini *et al.* (2019); Purbosari *et al.* (2022); Rasyid A (2017)
Ulva lactuca	5.33	1828	14	364	ND*	
Sargassum polycystum	173.6	1806	50	2269	ND*	

*ND: no data

EXTENDED ABSTRACT

A Preliminary Study on Protein and Mineral (Ca, P, Fe, and Zn) Content of Chicken Feet Porridge as Food for Pregnant Women

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SUMMARY

The pregnancy period determines the nutritional status of newborn babies. Providing additional food is one of the strategies to support the nutritional adequacy of pregnant women. Chicken feet porridge was made by washing and cutting, boiling, and crushing or stewed chicken feet bones. Analysis using Kjeltech and Inductively Coupled Plasma–Optical Emission Spectrometry (ICP OES) showed that chicken feet porridge contained 10.4% protein, 611.2 mg calcium, 0.85 mg iron, 1.08 mgzinc, and 284.5 mg phosphor in 100 g sample. This product's calcium content is expected to support the fulfilment of pregnant women's calcium needs.

Keywords: Chicken feet, Minerals, Nutritional status, Pregnancy, Protein

INTRODUCTION

The pregnancy period is one of the golden periods related to newborns' nutritional status (1). Various efforts to support the fulfilment of pregnant women's nutritional needs have been carried out, such as providing additional food. Food supplementation during pregnancy is considered effective in reducing the risk of malnutrition (2). Although providing supplementation to pregnant women has succeeded in achieving the target, the nutritional problems of low birth weight babies have not decreased. Therefore, the provision of food products needs to be reviewed. Chicken feet contain amino acid glycine, L-serine, L-proline, L-glutamic acid, L-alanine, minerals calcium, and phosphorus which are good for supporting growth and development (3). Chicken feet porridge is considered to be a product that can be combined with various foods, as well as to be able to support nutritional improvement. Therefore, this research was aimed to analyse the nutrient content of chicken feet porridge.

MATERIALS AND METHODS

Chicken feet that were used are broiler chicken feet from PT Ciomas Adisatwa. Chicken feet porridge was made through several processes, including washing and cutting, boiling with spices to reduce the unpleasant aroma, and boiling in a pressure cooker for 1.5 h. Protein content of chicken porridge was analysed using Kjeldahl method and minerals content were analysed by ICP OES. Descriptive analysis using mean calculation was performed to find an expected value of the sample. The amino acid content in this preliminary study was not analysed and will be carried out in further studies related to developing the product formulation. This preliminary study did not use a control sample and only used pure chicken feet porridge samples and no addition of other raw materials other than chicken feet. There was no control sample because this preliminary research is expected to be an additional reference for future research.

RESULTS AND DISCUSSION

Analysis of protein and inorganic minerals such as calcium, iron, zinc, and phosphorus was carried out because, based on previous research, these nutritional components play a significant role in supporting pregnancy health, such as reducing the risk of pregnancy problems and supporting fetal bone growth (4). The results showed that chicken feet porridge contained 10.4% protein, 611.2 mg of calcium, 0.85 mg of iron, 1.08 zinc, and 284.5 mg of phosphor in a 100 g sample. Table I shows the protein and mineral content of chicken feet porridge. The ratio of calcium and phosphorus in this product was about calcium: phosphorus = 2:1. This result met the requirements for processed food according to the Regulation of the BPOM regarding claims for processed food. The required calcium and phosphorus ratio is 1-2:1. By following BPOM regulations, this chicken feet porridge processed food turned out to be eligible as a processed food source of calcium. Compared to the Recommended Dietary Allowance for second-trimester

Table I: Protein and minerals content of chicken feet porridge

Parameter	Unit	Average nutrient content	Method
Protein	%	10.38	Kjeldahl
Phosphorus (P)	mg/kg	2849.51	ICP OES
Zinc (Zn)	mg/100 g	1.08	ICP OES
Iron (Fe)	mg/100 g	0.85	ICP OES
Calcium (Ca)	mg/100 g	611.2	ICP OES

pregnant women aged 19-29, the protein, iron, zinc, and phosphorus content in 100 g of porridge did not meet the 10% daily adequacy. Previous research has not sufficiently examined chicken feet porridge. However, the low protein content in this formula can be caused by protein denaturation after heating (5). Treatment experiments with several temperatures and cooking time conditions are suitable for finding the best processing mechanism for chicken feet porridge to minimize loss of nutritional content.

CONCLUSION

In conclusion, this chicken feet porridge is a good source of calcium for supporting the fulfillment of calcium for pregnant women. However, the formula must be re-developed because protein, zinc, iron, and phosphorus content are still considered insufficient to support the fulfillment of 10% daily nutritional adequacy.

ACKNOWLEDGEMENT

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EXTENDED ABSTRACT

Edible Insects as an Alternative Source of Protein: A Mini Meta-Analysis

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SUMMARY

The increase of global population will increase food consumption. Edible insects might solve this problem as a potential source of protein. This study aimed to evaluate and analyze edible insects as a protein source using quantitative review/meta-analysis methodology. The steps of this research include selecting, screening, extracting, analyzing data quality, processing and interpreting data. Twenty studies were selected from a thorough review of 512 selected papers. Hedges'd cumulative effect size showed that edible insects contain significantly higher protein (38.046), fat (65.581) and ash (11.403) than beef with p-value <0.001. This study highlighted the potential of edible insects as a protein source.

Keywords: Alternative protein, Edible insects, Future food, Hedges'd, Quantitative review

INTRODUCTION

Global population is expected to reach 9.7 billion by 2050 (1) and the increase will be in line with the increment of food demand by up to 75%. This phenomenon can lead to increment of food production in various fields, including livestock sector (2). Protein from livestock is limited due to limited farming resources such as water and land use as well as feed conversion. Therefore, new protein sources are needed. Insects are one of natural resources that has the potential to be an alternative source of protein. In Indonesia, some insects have been consumed by local communities (3). Furthermore, the production of insects results in less gas emissions and land use compared to other protein sources such as meat and beans. So, they are also more environmentally friendly (4). This study aimed to evaluate and analyze edible insects as a source of protein using quantitative review method.

MATERIALS AND METHODS

Literature search was carried out from January to June 2022 through literature databases. Correspondence to the authors was conducted to retrieve the inaccessible full text articles. Further, the articles were selected based on inclusion criteria and irrelevant or incomplete articles were excluded. The inclusion criteria for the articles were: (1) original research, (2) published in 2022, (3) examining the nutritional content, (4) showing complete data for the study (number of experimental unit, mean and standard deviation), (5) published in Scopus-indexed journals.

The parameters were macronutrient (fat, protein) and micronutrient (ash, Ca, Fe, Zn). For further analysis, the units of measurements were equalized. The value of effect size Hedges'd was used and the interpretation was carried out using Cohen's benchmark. Furthermore, a heterogeneity analysis with publication bias was done using a fail-safe number (NR). OpenMEE application was used to calculate synthesized data.

RESULTS AND DISCUSSION

A total of 512 studies were obtained from database search (Figure 1). From the 512 articles, 258 were excluded due to duplication, 112 articles were excluded because of irrelevant topics, 7 articles were excluded because of incomplete data and 15 articles were not included because the full text are unavailable. Only 20 articles were used for data coding and statistical data analysis.

Based on the cumulative effect size (d++, ±95% CI), edible insects contain significantly higher protein, fat, and ash than beef with the sample size varies from 71, 57 and 56 studies respectively (Table I). This result is in line with the systematic review from (5) that showed the high content of nutrition in common edible insects (e.g. caterpillars, grasshoppers, cricket, etc), especially in protein.

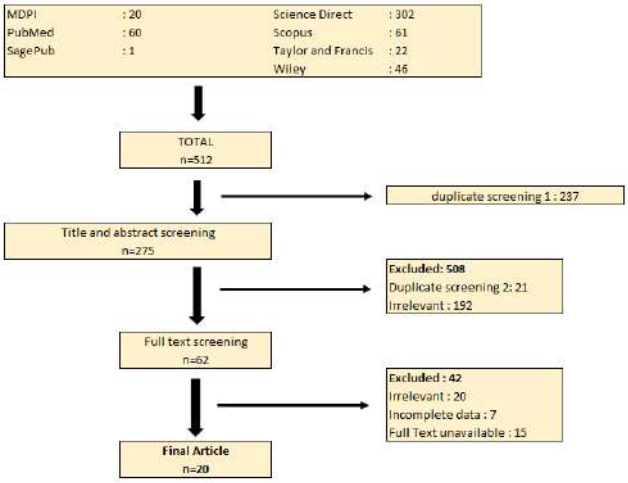

Fig. 1: Screening and selection process of the articles

CONCLUSION

Meta-analysis of studies based on 2022 data showed the better nutritional quality of edible insects than beef. This study highlighted the potential of edible insects as a protein source in the future. Further research is needed to promote local edible insect products as nutritious foods.

ACKNOWLEDGEMENT

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Table I: Cumulative effect size of protein, fat and ash of edible insects compared to beef

Nutritional Components	Unit	d++	%95 CI		N	P-value	I^2 (%)	Xe	Xc
			Lower	Upper					
Protein	%d.m	38.046	33.764	42.329	71	<0.001	99.21	41.83	24.69
Fat	%d.m	65.581	56.476	68.686	57	<0.001	98.71	31.79	2.77
Ash	%d.m	11.403	9.931	12.875	56	<0.001	95.34	4.03	1.29
Ca	%d.m	49.492	33.184	65.800	12	<0.001	82.42	390.52	6.88
Fe	%d.m	25.285	16.328	34.242	12	<0.001	84.06	45.87	2.52
Zn	%d.m	41.233	26.920	55.547	12	<0.001	86.56	61.36	3.14

d++: hedges'd cumulative effect size. N: studies size. d.m: dry matter. Xe: mean value of edible insects. Xc: mean value of beef. I^2: heterogenity

EXTENDED ABSTRACT

Essential Fatty Acid, Phospholipids, and Morphological Characteristics of Bone Marrow Microcapsules

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SUMMARY

The nervous system grows and develops at fastest rate during the first thousand days of life. Bone marrow microcapsules consist of nutrients such as fatty acids, amino acids, and micronutrients that promote physical growth and brain development. This study aimed to assess the essential fatty acids, phospholipids, and morphological properties of encapsulated Balinese cow bone marrow. This study used spray drying technique and three encapsulants including milk powder, maltodextrin, and Arabic gum. Most phospholipids were found in bone marrow encapsulated with milk powder. In addition, all formulas had a round shape and smooth surface.

Keywords: Balinese cow, Bone marrow microcapsules, Essential fatty acids, Phospholipids, Spray drying

INTRODUCTION

Cow bone marrow has numerous health benefits because of its abundant lipid, vitamin, and mineral content. The nutrients can support growth and brain development (1). High lipid content within bone marrow alters quality, odor, and taste. Thus, bone marrow requires advanced processes such as microencapsulation using spray drying technique. It can preserve the quality and aroma. Besides, microencapsulation can also protect the active substance or sensitive ingredient. The purpose of the study was to evaluate the nutrients content of bone marrow microcapsules (essential fatty acids and phospholipids) which provide several benefits to nervous system and also ro evaluate its morphological characteristic.

MATERIALS AND METHODS

The Balinese cow's bone marrow was taken from Tapos abbatoir (Depok city, Indonesia). The trial and error method was used in this study to determine the formula of microcapsules. Formula I (FI) contained only milk powder as an encapsulant, whereas Formulas II (FII), III (FIII), and IV (FIV) consisted of milk powder and maltodextrin (50%:50%), milk powder, and Arabic gum (50%:50%), and combination of milk powder, maltodextrin, & Arabic gum (50%:25%:25%), respectively. All formulas used the same amount of bone marrow, coatings, and water (1:1:10). The spray-drying method was used to encapsulate bone marrow. In brief, the coatings and water were homogenized (26.000 rpm, 5 minutes) before being combined with the bone marrow and homogenized again (22.000 rpm, 6 minutes). Then, the emulsion was dried using a spray dryer (inlet and outlet temperature 180^{o}C & 80^{o}C). ANOVA and Duncan test ($p<0.05$) were used to examine the differences.

RESULTS AND DISCUSSION

Each formula of Balinese cow bone marrow microcapsules had different fatty acid composition. Formula I and IV had the greatest content of PUFA, omega 3, and 6 (Table I). Formula IV also had the highest DHA content. The fatty acid composition of Bali cattle bone marrow microcapsules was also affected by powdered milk used as a shell (1).

Most phospholipid compounds were found in formula A which was coated only with milk powder (Fig 1). The presence of maltodextrin and gum arabic in microcapsules did not have a significant effect on phospholipids content. Furthermore, the identification of sphingomyelin derived from Bali cattle bone marrow was intriguing in this study. Sphingomyelin is a type of phospholipid currently being studied because it has many health benefits, particularly for nerve function (2). Sphingomyelin is found in all microcapsules formulas

Table I: Essential fatty acid content of bone marrow microcapsules

Fatty acids	FI (%)	FII (%)	FIII (%)	FIV (%)
PUFA	1.26±0.01[a]	0.75±0.001[b]	0.658±0.003[c]	0.761±0.004[b]
Omega 6	1.01±0.00[a]	0.591±0.001[c]	0.509±0.002[d]	0.602±0.004[b]
Omega 3	0.24±0.01[a]	0.152±0.000[b]	0.143±0.000[c]	0.151±0.000[b]
DHA	0.02±0.00[b]	0[c]	0[c]	0.032±0.000[a]
AA	0.03±0.00[a]	0.016±0.000[b]	0.009±0.000[c]	0.016±0.000[b]
EPA	0.03±0.000[a]	0.017±0.001[b]	0[c]	0[c]

Notes: PUFA= Polyunsaturated fatty acids, DHA= Docosahexaenoic acids, AA= Arachidonic acids, EPA= Eicosapentaenoic acids, FI= encapsulated with 100% milk powder, FII= milk powder: maltodextrin 50%:50%, FIII=milk powder: Arabic gum 50%:50%, FIV= milk powder: maltodextrin: Arabic gum 50%:25%:25%.

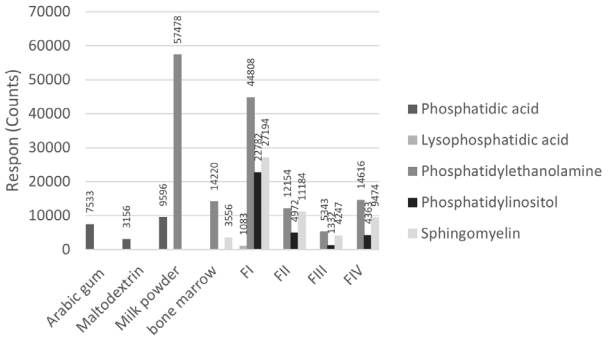

Fig. 1: Phospholipids content of bone marrow microcapsules
Notes: FI= encapsulated with 100% milk powder, FII= milk powder: maltodextrin 50%:50%, FIII=milk powder: Arabic gum 50%:50%, FIV= milk powder: maltodextrin: Arabic gum 50%:25%:25%.

because it is found in the cow bone marrow.

All formulations of microcapsule had a spherical shape with a smooth surface and no holes (Fig.2). Spray-dried microcapsules with encapsulated walls containing polysaccharides and protein had a distinct surface, due to material origin, atomization process, and drying. The utilization of a polysaccharide and protein mixture resulted in a good microcapsule morphology (3-5).

CONCLUSION

The highest essential fatty acids and phospholipids content was found in microcapsules encapsulated with milk powder and mixed of milk powder and maltodextrin. Bone marrow microcapsules had a round shape, smooth surface, and no pores.

ACKNOWLEDGEMENT

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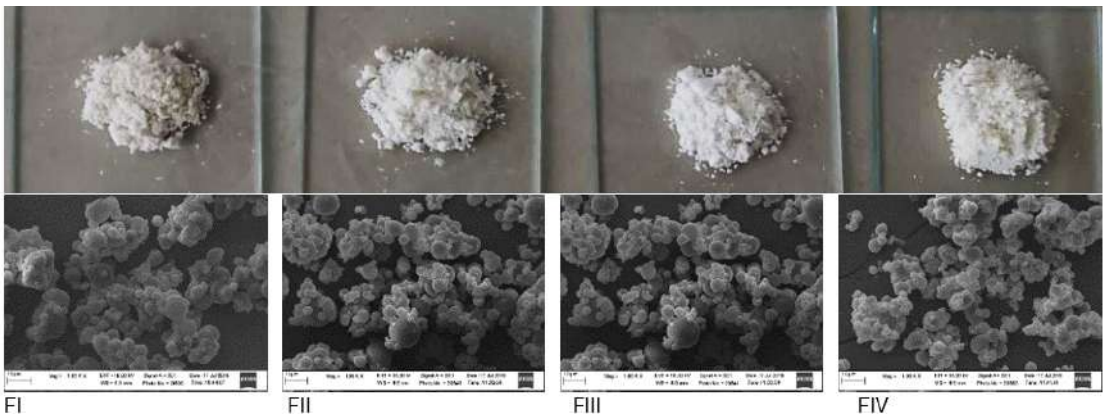

Fig. 2: Scanning electron microscopy of bone marrow microcapsules (1000x magnitude)
Notes: FI= encapsulated with 100% milk powder, FII= milk powder: maltodextrin 50%:50%, FIII=milk powder: Arabic gum 50%:50%, FIV= milk powder: maltodextrin: Arabic gum 50%:25%:25%.

EXTENDED ABSTRACT

Total Flavonoids and Total Phenolic in Nipah (*Nypa fruticans* Wurmb) Fruit Extract as a Candidate for Hyperglycemic Control

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SUMMARY

Nipah fruit is a functional food containing polyphenols, tannins, saponins, and alkaloids. Those bioactive components can improve glucose transport and enzymes in glucose metabolism. This study aimed to analyze the total flavonoids and phenolics in the Nipah fruit extract. Qualitative analysis was conducted using spectrophotometric methods. The results showed that flavonoid contents in unripe and ripe were 56.85 mg QE/g and 42.8385 mg QE/g, respectively. The total phenolic contents in unripe and ripe nipa fruit extract were 29.27 mg GAE/g and 28.25 mg GAE/g. Therefore, unripe Nipah fruit extract contains higher total phenolic and flavonoids than ripe Nipah fruit extract.

Keywords: Total flavonoid content, Total phenolic content, Nipah fruit extract, Functional food

INTRODUCTION

The extract of Nipah fruit contains of bioactive compounds such as flavonoids, polyphenols, tannins, and alkaloids (1). These compounds can inhibit glucose absorption in the intestine. Low glucose absorption affects the binding of inhibitors to enzymes resulting in less interaction with food, and suppressing blood sugar levels. In additin, the inhibition of glucose in the small intestine provides a selective inhibition of glucose transport, which suppresses postprandial hyperglycemia (2).This study aims to determine the total flavonoids and total phenolics in the Nipah fruit extract.

MATERIALS AND METHODS

The Nipah fruit used in this research was collected in West Aceh. The samples were washed under running water, thinly sliced, and dried in the oven for two days at 50^{o}C before being air-dried. After drying, the samples were grinded using a warring blender. The extraction process was carried out at the Pharmacology LAB of the Faculty of Veterinary medicine, Universitas Syiah Kuala. Nipah fruit powder was macerated for three days in a 95% ethanol solvent before being extracted in a rotary evaporator. Evaporation of nipah fruit extract used a Butchi brand rotary evaporator with a temperature of 60^{o}C at a pressure of 80 psi with a rotation of 40 rpm. The Spectrophotometric method was used to determine the Nipah fruits total flavonoids and phenolic contents. The measurement was carried out using a spectrophotometer at wave lengths 725 NM and 735 NM.

RESULTS AND DISCUSSION

The Phytochemicals content of nipah (*Nypa frutican* Wurmb), is shown in Table I. Table II shows that the extract of unripe Nipah fruit has a more significant total flavonoid concentration than that of ripe Nipah fruit. In addition, the extract of unripe Nipah fruit has a higher total phenolic content than its ripe counterpart.

Bioactive compounds in Nipah, such as flavonoids and polyphenols, can help patients with diabetes in managing their blood sugar levels (1). Flavonoid is a bioactive chemical associated with a wide range of health benefits. Flavonoid has antidiabetic properties. One type of flavonoid can target several molecules that control many pathways, including cell proliferation, insulin production, apoptosis reduction, and regulation of glucose metabolism in the liver through hyperglycemia (3). Phenolic intake contributes to a decrease in blood glucose levels in diabetic patients or people at risk for diabetes (4).The decrease in blood glucose levels can be

Table I: The phytochemicals content of nipah (*Nypa frutican* Wurmb)

No	Phytochemicals	Result (+/-)	
		Unripe Nipah extract	Ripe Nipah extract
1.	Polyphenol	+	+
2.	Tannin	+	+
3.	Quinone	-	-
4.	Saponin	+	+
5.	Triterpenoid	+	+
6.	Steroid	-	-
7.	Alkaloid	+	-
8.	Flavonoid	-	+

Table II: Total flavonoids and phenolic content in nipah fruit extract

Extract	Flavonoid Content (mg QE/g extract)	Phenolic Content (mg GAE/g extract)
Unripe nipa fruit	56.85± 0.05	29. 27 ± 0.03
Ripe nipa fruit	42.83 ± 0.05	28.25 ± 0.03

caused by soluble or bound phenolic extracts inhibiting amylase glucosidase activity, depending on the amount provided (5). According to the findings of this study, further research on the effect of nipah fruit extract on blood glucose levels is required.

CONCLUSION

The total flavonoid content in the extract of nipah fruit demonstrated higher composition than the total phenolic content. Therefore, the extract of unripe nipah fruit exhibits higher flavonoids and phenolic content than the ripe fruit.

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EXTENDED ABSTRACT

Administration of Milk-Based Drinks (MDs) Containing Lactic Acid Bacteria (LAB) for Improving Calcium Femur Level of Rats' Offspring

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SUMMARY

This study evaluates the effect of administration of two popular MDs in Indonesia containing *Lactobacillus casei* Shirota strain (M-LcS) and four strain bacteria (M-FS) (*Lactobacillus rhamnosus, Lactobacilus paracasei, Lactobacillus delbrueckii* subsp*, Bulcarigus*, and *Streptococcus thermophilus*). Twenty four Sprague Dawley rats were randomly diveded into one negative control group (A1) and three undernourished group: positive control (A2), M-LcS (A3) and M-FS (A4). Calcium femur levels of M-LcS and M-FS group were significantly higher than the control group (A1). This study concluded that the MDs had a potential effect to improve calcium femur level of the rats' offspring in undernourished pregnant rats.

Keywords: Calcium, Femur, Stunting, Rats, Undernourished

INTRODUCTION

Chronic energy deficiency (CED) during pregnancy has a negative effect on fetal growth and development, such as birth defects, low birth weight (LBW), and stunting. According to the Millennium Challenge Account Indonesia, the nutritional status of the fetus throughout pregnancy will become clear when the child is two years old (1). Probiotics could be an alternative intervention to improve pregnancy outcomes. Several studies showed that the LAB can improve weight gain during pregnancy (2) and increase the availability of minerals such as calcium, magnesium, and phosphorous in vitro study (3). There are two well-known milk-based drinks (MDs) containing LAB. The first has a single strain of LAB (M-LcS) and the other contains a combination of four strains of LAB (M-FS). This study evaluated the effects of MDs containing LAB on the offspring's calcium femur and femur length.

MATERIALS AND METHODS

The detailed procedures have been provided in previous publications (4). The female rats used in this study were six to eight weeks old (150–200 gram). Up to 1.5 mL/day of MDs were administered by oral gavage from day 0 of pregnancy (D0) until day 19 of pregnancy (D19). At the D19, pregnancy outcomes were measured based on the femur length and calcium femur level. Birth length and femur length were measured using software Java ImageJ. Calcium femur level was measured by spectrophotometer at 422.4 nm. Birth length and calcium femur level of the offspring were then processed using Ms.Excel 2013. The results are shown as mean ± standard deviation (SD). One-way ANOVA was used to assess statistical significance continued with Duncan Multiple Range Test (DMRT) to see the mean differences with a significance limit set at 5%. All the statistical analysis was done using SPSS software version 16.0.

RESULTS AND DISCUSSION

Data of birth length and calcium femur level of the rats' offspring is shown in Table I. Administration of MDs containing LAB significantly affected the birth length, femur length, and calcium femur level. The lowest birth length can be seen in the A3 group but it had the highest calcium femur level.

The administration M-LcS affected the gestational weight gain in rats and also the birth weight and birth length of the offspring (4). As Table I indicates, the lowest birth length is in the A3 group because the A3 group had the lowest weight gain during pregnancy

Table I: The birth length, femur length, and calcium femur level of the rat's offspring

Group	Birth length (cm)	Femur length (cm)	Calcium femur (%)
A1	4.37 ± 0.54^{b}	$0.25 \pm 0.04^{a,b}$	31.37 ± 6.33^{a}
A2	4.24 ± 0.71^{b}	0.29 ± 0.05^{b}	$35.95 \pm 2.80^{a,b}$
A3	3.76 ± 0.93^{a}	0.22 ± 0.06^{a}	42.49 ± 7.31^{c}
A4	4.39 ± 0.47^{b}	0.29 ± 0.06^{b}	36.30 ± 2.73^{b}
*p**	0.001*	0.001*	0.000*

*ANOVA one-way analysis, significant at p<0.05

and then affected the birth length of the offspring. Nutrition of mother during pregnancy directly affected the baby's growth and development. Administration of MDs containing LAB also affected the offspring's calcium level (p=0.000). The A3 group had the highest calcium femur level (42.49 ± 7.31). *L.casei* $1x10^{9}$ CFU/mL improved calcium uptake and transport in vitro to improve the calcium femur level. The mechanism is by increasing the calcium transport gene so that it can help to transport calcium effectively (5). The M-FS group (A4) had the second highest calcium femur level but was not significantly different compared to the A0 and A1 (control group). This might be because the different dose of the M-FS is not enough to significantly increase calcium uptake and transport during pregnancy. It was noted that M-FS contains $7.2x10^{7}$ CFU/mL total LAB and M-LcS contains $1x10^{9}$ CFU/mL total LAB. The different results might be caused by the dose of M-FS and M-LcS.

CONCLUSION

In conclusion, the administration of M-FS can significantly improve the calcium femur level of the rats' offspring. Future research is needed to develop food products containing the mixture of all these LAB to improve weight gain during pregnancy and calcium femur level in the rats' offspring.

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EXTENDED ABSTRACT

Characteristics of Bread from Purple Sweet Potato Flour with the Addition of Hemicellulase Enzyme

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SUMMARY

The use of hemicellulase enzymes can improve the quality of bread products made from PSPF (purple sweet potato flour). Evaluation of the effect of wheat flour substitution with PSPF (0, 25%, 50%, and 100%) and hemicellulase enzyme addition (0%, 0.025%, 0.05%) has been conducted on the texture, chemical, and sensory characteristics of breads. The results of this study showed that the substitution of 25% PSPF by 25% and the addition of 0.05% hemicellulase produced bread with acceptable texture and sensory characteristics which had anthocyanin and crude fiber content of 26.44% and 3.44% respectively.

Keywords: Breads, Hemicellulase, Purple sweet potato, Texture characteristics

INTRODUCTION

Utilization of purple sweet potato flour (PSPF) as a substitute for wheat flour (WF) in bread making can produce bread with better nutritional value due to its carbohydrate, dietary fiber, vitamin, and mineral contents; it also gives an attractive purple color to the bread. However, PSPF lacks gluten and is heavy in fiber, giving the resulting bread a hard texture and low baking expansion (1). Therefore, the use of hemicellulase enzymes is needed to improve the texture and structure of bread. It could hydrolyze fiber to produce short chains sugar molecules which are then used by yeast (*Saccharomyces cerevisiae*) during fermentation process, and results in higher CO_2 production (1). However, the texture and consumer preferences of bread have not been fully studied. This study aims to evaluate the characteristics of bread made from a composite flour consisting of WF and PSPF with the addition of hemicellulase enzymes.

MATERIALS AND METHODS

PSP tubers obtained from Phak Phak Barat Regency farmers in North Sumatra Province were used in making PSP flour. The bread dough formulations include composite flour consisting of PSPF and WF with the percentage ratio of 100:0; 75:25; 50:50; 0:100. Other ingredients were 8g instant yeast, 24g skim milk, and 32g sugar,6g salt, 40g shortening, and 240ml water. Hemicellulase enzymes were then added with concentration which varied from 0%, 0.025%, and 0.05%. The method used for making white bread dough was the straight dough (2). The resulting bread was then analyzed for its texture characteristics using a texture analyzer (1), crude fiber content (3), anthocyanin content (4) and consumer preference test. Each parameter was measured in triplicate. Two-way ANOVA and Duncan Multiple Range Test was performed to analyze the data and Significant differences were set at $p<0.05$.

RESULTS AND DISCUSSION

There is not any significantly difference in cohesiveness value of all breads as affected by the interaction of PSPF and WF ratio and hemicellulase concentration (Table I). Increased substitution of WF with PSPF and higher concentration of hemicellulase resulted in bread with significantly ($P<0.05$) lower elasticity, gumminess, and springiness value but higher adhesiveness values. This is related to the reduced amylose and gluten content in bread substituted with PSP flour so that the resulting bread texture is harder (1).

There are significant differences ($P<0.05$) in the value of % deformation, hardness, crude fiber, and anthocyanin content of the bread as affected by interaction of PSPF and WF ratio and hemicellulase concentration (Table II).

The interaction between the ratio of PSPF: WF and the concentration of hemicellulase will reduce the % deformation and hardness of the bread. This is because the damaged starch is caused by enzymes that form cross-links with proteins and cause crumb hardening (1). The more percentage of PSPF will increase the content of crude fiber and anthocyanins, but with the addition of hemicellulase enzyme, they will decrease because the hemicellulase enzyme can degrade fiber and anthocyanin components during the bread fermentation process. Statistically, the interaction between PSPF/WF

Table I: The effect of PSPF and WF ratio and hemicellulase concentrations on texture properties of breads

PSPF : WF	Hemicellulase Concentration (%)	Texture Properties				
		Cohesiveness (-)	Adhesiveness (-)	Chewiness (-)	Springiness (-)	Gumminess (N/m^2)
100:0	0.000	0.24±0.05	-26.60±1.83^{h}	96.60±1.77^{h}	2.56±0.23^{f}	34.06±7.62f
	0.025	0.22±0.06	-14.68±1.06i	47.47±2.77^{j}	2.93±0.19^{e}	18.27±5.97^{h}
	0.050	0.26±0.04	-13.09±1.41^{i}	68.98±9.50^{i}	3.49±0.11^{d}	21.88±1.33^{g}
75:25	0.000	0.28±0.07	-50.66±5.37^{f}	199.73±13.96^{e}	2.88±0.06^{e}	49.50±2.38^{e}
	0.025	0.21±0.02	-40.19±2.50^{g}	132.23±34.44^{g}	2.67±0.02^{f}	45.63±8.73^{e}
	0.050	0.24±0.03	-65.35±6.44^{e}	170.82±6.82^{f}	3.31±0.21^{d}	48.65±8.16^{e}
50:50	0.000	0.25±0.04	-89.97±10.40^{d}	304.88±12.28^{d}	3.31±0.21^{d}	76.78±2.08^{c}
	0.025	0.21±0.03	-72.30±4.85^{e}	243.45±5.98^{g}	3.23±0.16^{d}	69.33±1.00^{d}
	0.050	0.24±0.01	-69.19±6.17^{e}	264.98±12.79^{e}	3.26±0.91^{d}	69.46±7.75^{d}
0:100	0.000	0.24±0.02	-251.65±18.82^{c}	1410.70±12.92^{c}	7.58±0.07^{b}	177.80±1.78^{b}
	0.025	0.25±0.01	-285.43±6.30^{b}	1814.72±75.55^{a}	8.42±0.10^{a}	205.38±5.35^{a}
	0.050	0.26±0.03	-308.51±10.32^{a}	1557.77±74.71^{a}	6.31±0.18^{c}	201.79±8.30^{a}

PSPF = Purple Sweet Potato Flour, WF = Wheat Flour. The value in table is the mean ± SD. Different letters that follow the numbers in a column are significantly different (p<0.05)

Table II: The effect of PSPF and WF ratio hand hemicellulase concentrations on % deformation, hardness, crude fiber content, and anthocyanin content of bread

PSPF : WF	Hemicellulase Concentration (%)	% deformation	Hardness (N/m^2)	Crude Fiber Content (%)	Anthocyanin Content (%)
100:0	0.000	58.72±3.74^{a}	803.33±20.65^{a}	5.89±0.03^{a}	66.56±3.63^{a}
	0.025	56.05±7.92^{a}	760.17±55.30^{ab}	5.81±0.04^{a}	63.66±3.81^{a}
	0.050	54.95±5.36^{a}	750.67±24.23^{b}	5.72±0.05^{a}	61.62±4.81^{a}
75:25	0.000	48.59±6.04^{b}	311.83±12.88^{c}	4.95±0.19^{b}	53.19±4.00^{b}
	0.025	45.59±7.57^{c}	323.67±35.97^{c}	4.79±0.13^{b}	50.28±1.00^{b}
	0.050	44.72±3.97^{c}	293.00±27.83^{c}	4.41±0.09^{b}	48.84±2.30^{b}
50:50	0.000	51.92±4.52^{c}	218.83±17.85^{d}	3.43±0.21^{c}	28.48±1.81^{c}
	0.025	47.33±3.49^{c}	204.33±7.02^{e}	3.42±0.15^{c}	26.46±0.51^{c}
	0.050	44.86±5.73	194.33±15.24^{e}	3.24±0.25^{c}	25.29±2.31^{c}
0:100	0.000	64.36±2.52^{a}	143.74±7.26^{f}	3.21±0.33^{c}	n.a.
	0.025	57.96±5.48^{a}1^{a}	85.00±8.89^{g}	3.16±0.12^{c}	n.a
	0.050	56.46±11.23	81.17±10.10^{g}	3.04±0.09^{d}	n.a.

PSPF = Purple Sweet Potato Flour, WF = Wheat Flour. n.a.=not analyzed. The value in table is the mean ± SD. Different letters that follow the numbers in 1 column are significantly different (p<0.05).

Table III: The effect of PSPF and WF ratio and hemicellulase concentrations on consumer preference of bread

PSPF : WF	Hemicellulase Concentration (%)	Consumer Preference			
		Color	Aroma	Taste	Overall Acceptance
100:0	0.000	5.54±0.01	5.29±0.14	5.07±0.07	5.89±0.14
	0.025	5.48±0.12	5.24±0.08	5.05±0.02	5.71±0.08
	0.050	5.56±0.05	5.28±0.07	5.30±0.92	5.74±0.21
75:25	0.000	4.93±0.45	5.34±0.08	5.37±0.10	5.36±0.10
	0.025	4.90±0.05	5.34±0.29	5.44±0.31	5.35±0.16
	0.050	4.91±0.04	5.37±0.14	5.40±0.18	5.31±0.11
50:50	0.000	5.12±0.02	5.24±0.05	5.06±0.20	5.21±0.23
	0.025	5.28±0.03	5.17±0.14	5.21±0.06	5.10±0.15
	0.050	5.30±0.06	5.27±0.18	5.28±0.59	5.13±0.12
0:100	0.000	5.61±0.02	5.15±0.18	4.90±0.21	5.07±0.18
	0.025	5.50±0.17	5.03±0.21	4.80±0.12	5.09±0.20
	0.050	5.65±0.04	5.04±0.14	4.94±0.33	4.98±0.16

PSPF = Purple Sweet Potato Flour, WF = Wheat Flour. The value in table is the mean ± SD.

ratio and hemicellulase enzyme concentration did not give a significant variation (P>0.05) in all parameters of consumer preference (Table III). The value of consumer acceptance is in the range of 4.80-5.89 which indicates that the purple sweet potato bread product is acceptable.

CONCLUSION

PSPF substitution and the addition of hemicellulase affect the quality of bread. The use of purple sweet potato flour in total (100%) and the addition of 0.025% hemicellulase enzyme in bread making resulted in bread with acceptable texture, higher fiber, and anthocyanin content. This result can increase purple sweet potato utilization.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Sensory Acceptance, Antioxidant Activity, and Dietary Fiber Content of Tekwan Supplemented with Cassava Leaf Powder

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SUMMARY

Cassava leaf powder (CLP) has the potential as a food supplement in Tekwan product. This study aims to determine the effect of addition of CLP processed by different methods (without soaking-without steam blanching, soaking-without steam blanching, soaking-steam blanching) on acceptability, dietary fiber content, and antioxidant activity of Tekwan. This research is an experimental, completely randomized design with 1 factor, Tekwan formulation, compared to 3 Tekwan samples; T1=Tekwan+CLP1; T2=Tekwan+CLP2; T3=Tekwan+CLP3. The results showed that Tekwan T2 had the highest acceptability score, while Tekwan T1 contained the highest total dietary fiber and antioxidant activity among the other Tekwan.

Keywords: Antioxidant activitiy, Cassava leaf powder, Dietary Fiber, Sensory zcceptance, Tekwan

INTRODUCTION

Cassava leaves are rich in vitamins and minerals (1). Cassava leaves can be processed into cassava leaf powder through a drying process (2). Before drying, fresh cassava leaves were processed with different treatments, namely without steam blanching (CLP1), soaking-without steam blanching (CLP2) and soaking-steam blanching (CLP3). Cassava leaf powder has the potential as a supplement for tekwan products. Tekwan is a snack made from fish fillet and tapioca powder, which can become a source of protein (3). The addition of cassava leaf powder to tekwan is thought to have an effect on the sensory, dietary fiber and antioxidant activity of tekwan. Research on the effect of cassava leaf powder supplementation on tekwan products has never been conducted before. Therefore, this study was done to determine the effect of the addition of CLP which was processed by different methods on acceptability, dietary fiber content and antioxidant activity of tekwan.

MATERIALS AND METHODS

Fresh cassava leaves were washed and divided into 3 groups: dried at 80 °C (CLP1); soaked for 6h, then dried at 80°C (CLP2); soaked for 6h, steam blanched for 5 minutes, then dried at 80°C (CLP3). The research was a Completely Randomized Design with 1 factor, tekwan formulation (Table I).The tekwan samples were analyzed for their dietary fiber content using AOAC methods and antioxidant activity was evaluated using DPPH assay. Statistical data analysis used Kruskall Wallis and Mann Witney test. Statistical results of p-value<0.05 were considered as significantly different using software SPPS version 22.

Table I: Tekwan formulations

Ingredients (g)	Formulations Tekwan (g)		
	Tekwan T1	Tekwan T2	Tekwan T3
Fillet fish (*Chirocentrus dorab)*	100	100	100
Tapioca	50	50	50
CLP1	3	0	0
CLP2	0	3	0
CLP3	0	0	3
Salt	3.75	3.75	3.75
Ice water	57.68	57.68	57.68

RESULTS AND DISCUSSION

The sensory acceptance of Tekwan-Cassava leave powder is presented in Table II. The results show that Tekwan CLP2 had the highest score based on color (4.73) and overall acceptance (4.85).

The amount of cassava leaf powder added to each tekwan formulation was the same, 3 grams. Based on observations, the increase in green color in tekwan is tekwan CLP2> tekwan CLP1> tekwan CLP3. The greener the color of the tekwan, the lower the panelists' acceptance. The green color of tekwan is thought to come from the green color of cassava leaf powder which contains chlorophyll. Overall, the panelists gave the highest score to the tekwan CLP2. This indicates that tekwan with the addition of cassava leaf powder processed by the soaking-drying process is the most preferred tekwan compared to other tekwan products. Dietary fiber content and antioxidant activity of CLP

tekwan can be seen in Table III.

The results showed that there was not any significant difference (p>0.05) in total dietary fiber content and antioxidant activity between tekwan CLP1, tekwan CLP2 and tekwan CLP3. Tekwan CLP1 is the tekwan that contains the highest total dietary fiber (7.03%) and antioxidant activity (86.91%) compared to tekwan CLP2 and tekwan CLP3. Tekwan CLP1 is tekwan with the addition of cassava leaf powder through a process without soaking-without steam blanching. The thermal process (steam blanching) can reduce the total antioxidant activity of tekwan CLP2 and tekwan CLP3. This is supported by research by another study which revealed that blanching process can reduce the total antioxidant activity of dried blanched peels at 70 °C (4). We think that the decrease in antioxidant activity was caused by the loss of phenolic compounds in cassava leaf powder.

Table II: Sensory acceptance of tekwan- cassava leave powder

Sensory Parameter	Tekwan Samples			
	Tekwan CLP1	Tekwan CLP2	Tekwan CLP1	P-value
Taste	3.15±0.840[a]	3.12±0.922[a]	3.42±1.013[a]	0.169
Colour	3.12±0.415[b]	4.73±0.482[c]	2.28±0.524[a]	0.000
Aroma	3.70±0.850[a]	3.70±0.869[a]	3.78±0.958[a]	0.748
Texture	3.73±0.686[a]	3.68±0.792[a]	3.78±0.691[a]	0.688
Overall	3.63±0.780[a]	4.85±0.404[b]	3.62±0.846[a]	0.000

Mean scores in each sensory quality parameter with the different superscripts are significanly different (p<0.05)
5 point sensory scale was used for liking of Tekwan-Cassava Leave Powder (1 = dislike very much, 2 = dislike slightly, 3 = neither like nor dislike, 4 = like slightly, 5 = like very much)

Table III: Dietary fiber Content and antioxidant activity of tekwan

Characteristics	Tekwan Samples			
	Tekwan CLP1	Tekwan CLP2	Tekwan CLP1	P-value
Total dietary fiber (%)	7.03±0.21[c]	2.63±0.06[a]	5.06±0.13[b]	0.102
Insoluble dietary fiber (%)	0.18±0.21[a]	0.17±0.09[a]	0.27±0.07[a]	0.102
Soluble dietary fiber (%)	6.72±0.19[d]	2.42±0.02[a]	4.79±0.06[c]	0.867
Antioxidant activity (%)	86.91±0.27[c]	85.70±0.18[a]	86.28±0.62[bc]	0.123

*All characteristics are expressed on a dry weight basis of a sample.
**The values are mean ± standard deviation of double replicate, which do not different significantly with the same superscript letter in the row ($p > 0.05$).

CONCLUSION

Tekwan CLP2 added with cassava leaf powder through the soaking process had the highest acceptability score based on color and overall acceptability. Tekwan CLP1 contained the highest total dietary fiber content and antioxidant activity among other CLP tekwan.

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EXTENDED ABSTRACT

Effect of Soymilk Substitution on Nutrient Profile, Oxidative Stability, and Sensory Preference of Malay Chicken Curry

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SUMMARY

Frequent consumption of food cooked with large amount of coconut milk might bring detrimental health effects. This study aimed to determine the effect of substitution of coconut milk with soymilk in Malay chicken curry. Five ratios of coconut milk:soymilk were used (100:0, 75:25, 50:50, 25:75, 0:100). Nutrient profile, oxidative stability, and sensory preference were analysed. Increased use of soymilk lowered total fat, saturated fat and calorie contents, prolonged oxidative stability, and caused insignificant differences in sensory preference. This study showed that soymilk can be used to substitute coconut milk in local cuisines, beneficial for consumers aiming to lower fat and energy intakes.

Keywords: Coconut milk, Curry, Saturated fats, Soymilk, Total fat content

INTRODUCTION

Coconut milk contains high fat with a high percentage of saturated fatty acids, especially the medium-chain length (1). It is commonly used in Asian cuisine, including in curry that is famous especially in Southeast and South Asia. Curry is usually cooked with meat or poultry, coconut milk and a combination of spices. Highly frequent consumption of those dishes may cause abundant intake of fat that is associated with increased body weight, which may bring further health effects (1). A previous study performed on nasi lemak showed that substitution of coconut milk with soymilk up to 25% resulted in no significant difference in sensory preference as compared to control sample and the product had acceptable shelf life (21 h) at ambient temperature (2). Therefore, this study explored the effect of substituting coconut milk with soymilk on nutrient profile, oxidative stability, and sensory preference of Malay chicken curry.

MATERIALS AND METHODS

Soymilk and coconut milk were produced in the laboratory. Five substitution ratios of coconut milk with soymilk were applied in production of Malay chicken curry samples: 100:0 (control), 75:25, 50:50, 25:75, and 0:100. Samples were then analysed for their nutrient profile (moisture content, ash content, total protein content, total fat content, total carbohydrate content and calorie content). Samples were also analysed for their oxidative stability at ambient temperature using thiobarbituric acid (TBA) value read at 538 nm with a spectrophotometer. Sensory evaluation of samples was performed by 30 panellists using ranking preference test. All samples were subjected to fatty acid analysis using gas chromatography and fatty acid methyl esters as standards. Data were analysed with one-way ANOVA followed by Tukey's HSD test, while the results of sensory preference test were analysed with the Friedman's test. All statistical analysis were performed at 95% confidence interval.

RESULTS AND DISCUSSION

Table I shows that substitution of coconut milk with soymilk in Malay chicken curry did not significantly affect the samples' moisture, ash, protein and carbohydrate contents. However, it caused significant differences in total fat and calorie contents among samples.

Higher amount of soymilk used to substitute coconut milk resulted in reduction of total fat content, leading to similar declining trend in calorie content. According to (3), coconut milk contained about 35% of fat, while (4) reported soymilk contained only 1-3% of fat, depending on the ratio between bean and water used. Hence, lower total calorie content could be seen in samples with higher ratios of soymilk. Furthermore, samples with higher ratios of soymilk had more unsaturated fatty acids as compared to saturated fatty acids. Soymilk is known to contain relatively high amount of unsaturated fatty acids, such as α-linolenic acids and omega-3 essential fatty acids, which are beneficial for health (5).

Table I: Nutrient profile of Malay chicken curry produced with different ratios of coconut milk and soymilk

Ratio of coconut milk:soymilk	Moisture (g/100 g)	Ash (g/100 g)	Protein (g/100 g)	Fat (g/100 g)	Carbohydrate (g/100 g)	Calorie (kcal/g)	Saturated fatty acids (% total fat)	Unsaturated fatty acids (% total fat)
100:0	73.20±2.81^{a}	2.54±0.48^{a}	7.36±0.37^{a}	13.40±0.71^{a}	9.48±1.83^{a}	5.94±0.06^{a}	86.79	13.21
75:25	71.46±3.65^{a}	2.68±0.22^{a}	7.41±0.32^{a}	12.35±0.91^{a}	9.62±4.94^{a}	5.69±0.06^{ab}	68.07	31.93
50:50	71.96±2.33^{a}	2.60±0.18^{a}	7.66±0.17^{a}	9.76±0.19^{b}	8.26±2.65^{a}	5.55±0.21^{b}	40.04	59.96
25:75	70.79±3.87^{a}	2.52±0.26^{a}	7.67±0.16^{a}	9.40±0.63^{b}	5.67±2.75^{a}	5.49±0.13^{b}	27.24	72.76
0:100	72.96±1.61^{a}	2.59±0.10^{a}	7.71±0.38^{a}	7.36±0.06^{c}	4.45±4.07^{a}	5.22±0.04^{b}	10.81	89.12

Notes: Mean values with similar superscript letters within a column are not significantly different (p>0.05);
Fatty acid profile analysis was performed for one replicate.

Lower amount of malonaldehyde could be observed in samples with higher ratios of soymilk (Fig.1). Although soymilk contained more unsaturated fatty acids as compared to coconut milk, it is deducted that the bioactive antioxidative compounds contained in soymilk, such as phenolic and flavonoid compounds, helped to protect the sample from oxidation (5).

Results of sensory preference evaluation are displayed in Table II. No significant differences were observed since all samples were processed similarly with only the ratio between coconut milk and soymilk that was different. A colour analysis was also performed (data not reported), which showed decreasing lightness and redness when the ratio of soymilk was increased; however, yellowness of the samples increased when more soymilk was used.

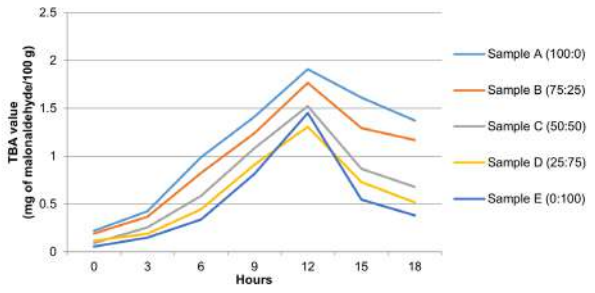

Fig. 1: Oxidative stability of Malay chicken curry at ambient temperature (27±1 °C) as affected by substitution of coconut milk with soymilk

Table II: Total rank of sensory preference test of Malay chicken curry as affected by substitution of coconut milk with soymilk

Ratio of coconut milk: soymilk	Colour	Aroma	Texture	Taste
100:0	74^{a}	80^{a}	88^{a}	68^{a}
75:25	87^{a}	93^{a}	76^{a}	92^{a}
50:50	85^{a}	88^{a}	93^{a}	90^{a}
25:75	104^{a}	100^{a}	95^{a}	97^{a}
0:100	100^{a}	89^{a}	98^{a}	103^{a}

Notes: Values with similar superscript letters within a column are not significantly different (p>0.05)

CONCLUSION

Increased substitution of coconut milk with soymilk in production of Malay chicken curry significantly decreased total fat and calorie content of the samples. The substitution also improved fatty acid profile as well as oxidative stability of the samples when stored at ambient temperature. No significant differences were seen among samples in terms of sensory preference.

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EXTENDED ABSTRACT

Antibacterial Activity of Dairy Kefir for *Escherichia coli, Staphylococcus aureus*, and *Bacillus subtilis*

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SUMMARY

Dairy kefir is a homemade functional beverage from fermented milk using kefir grains. This study aims to determine the activity of goat's milk and cow's milk kefir in inhibiting the growth of *Escherichia coli, Staphylococcus aureus*, and *Bacillus subtillis*. The dairy kefir used was made from cow's and goat's milk varied at 25%, 50%, and 75% concentrations. This research used the well diffusion method with 3 replications. The results were analyzed using two-way MANOVA and showed that all the treatments had a significant effect p-value < α (0.00<0.05). Based on discriminant analysis, it is known that *B. subtilis* has the highest correlation with a correlation value of 0.554 for the type of kefir and 0.994 correlation value for the concentration. Cow's and goat's milk kefir were able to inhibit the growth of test bacteria.

Keywords: Antibacterial activity, Cow's milk kefir, Functional beverage, Goat's milk kefir, Microorganisms' consortium

INTRODUCTION

Kefir is a natural product made from pasteurized milk which is traditionally fermented using a starter called kefir grains. Kefir grains consist of good microorganisms that form a consortium of white- or cream-colored granules. The fermentation process results in kefir containing carbonate, high lactic acid, and low alcohol. Kefir is known to have synbiotic properties because it contains probiotics and prebiotics that interact synergistically (1). Probiotics are living organisms that have a positive effect on health (2) and are not known to cause disease (3). Previous research has shown that probiotics can inhibit the growth of pathogenic bacteria (4). *Escherichia coli, Staphylococcus aureus*, and *Bacillus subtilis* are pathogenic bacteria that can cause disease in humans. The activity of cow's milk and goat's milk kefir against these bacteria is not yet known, so it is important to conduct this research.

MATERIALS AND METHODS

Kefir was made by mixing 1 liter of pasteurized milk with 50 grams of kefir grains in a tightly closed sterile container. The mixture was incubated anaerobically for 24 hours in the dark at room temperature, the lid was opened, and it was stirred every 12 hours. The test bacteria cultures (*E. coli* ATCC 8739, *S. aureus* ATCC 6538, and *B. subtillis* ATCC 6633 were suspended with a transmittance of 25%. A microbial sensitivity test was carried out using the well diffusion method. The concentrations of kefir used were 25%, 50%, and 75% (using distilled water), and kanamycin was used as a positive control. Each test was repeated in 3 replications. The area of the inhibition zone was measured after 24 hours of incubation at 37°C. The data were analyzed using two-way MANOVA with a significant level of 5% followed with descriptive discriminant analysis.

RESULTS AND DISCUSSION

The results showed that cow's milk and goat's milk kefir had inhibitory activity against the growth of *E. coli, S. aureus*, and *B. subtilis* as shown in Table I. Cow's and goat's milk kefir had the highest inhibitory activity at 75 % concentration against the test bacteria, with a wider inhibition zone than the positive control against *S. aureus* and *B. subtilis*. The results of the two-way MANOVA showed the significant effect p(0.00)<α (0.05) in all cases. Data analysis was followed with a descriptive discriminant test and the results are shown in Table II.

Table I: Inhibition area of dairy kefir to *E. coli, S. aureus,* and *B. subtilis*

Type of kefir	Concentration	Area of Inhibition (mm)		
		E. coli	*S. aureus*	*B. subtilis*
Cow's Milk Kefir	**- Control**	9.00	9.00	9.00
	+ Control	20.88	14.70	13.30
	25%	14.58	11.10	9.50
	50%	15.82	14.73	14.40
	75%	18.58	17.77	16.90
Goat's Milk Kefir	**- Control**	9.00	9.00	9.00
	+ Control	17.33	17.73	16.48
	25%	15.30	15.07	15.87
	50%	17.03	17.92	19.77
	75%	17.23	18.98	21.73

Table II. Structure matrix of descriptive discriminant analysis

Variables	Function for cow's and goat's milk kefir groups	Function for concentration group	
	1	1	2
B. subtilis	,554	,329	,944
S. aureus	,352	,228	,858
E. coli	-,085	,875	-,483

Table II shows that the variable *B. subtilis* had the highest correlation with a correlation value of 0.554 (for the cow's milk and goat's milk kefir groups) and 0.994 correlation value (for the 50% and 75% concentration). The results of the discriminant analysis also showed that the mean value of *B. subtilis* for cow's milk kefir was higher than that of goat's milk kefir (16.57>12.62), and the concentration was 75% higher than 50% (19.32>17.08). The inhibition zone formed can be seen in Figure 1.

The antibacterial activity of kefir is due to the presence of a consortium of lactic acid bacteria, acetic acid bacteria, and yeast that can fight pathogen bacteria.

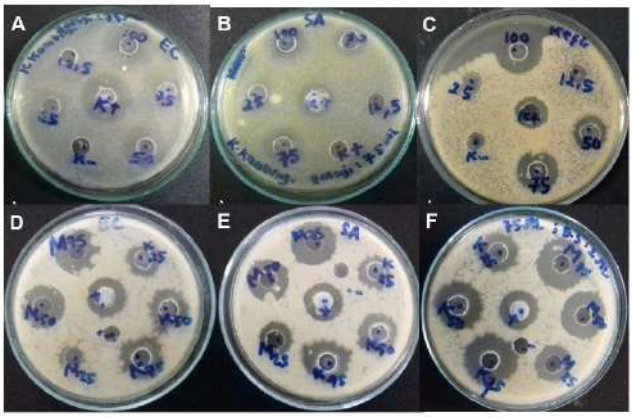

Fig. 1: Inhibition zone formed by kefir A) goat's milk kefir against *E. coli*; B) goat's milk kefir against *S. aureus*; C) goat's milk kefir against *B. subtilis*; D) cow's milk kefir against *E. coli*; E) cow's milk kefir against *S. aureus*; F) cow's milk kefir against *B. subtilis*

Kefir bacteria include probiotics that the body needs. Probiotics can compete with pathogenic bacteria. They have antagonistic properties and inhibit the growth of pathogenic bacteria.

The consumption of probiotics is used to balance the number of good microorganisms and suppress the growth of pathogenic bacteria in humans. This can be used as a solution to reduce the use of antibiotics that can cause resistance to pathogenic microorganisms. The mechanism is also triggered by an increase in bioactive compounds that occur during the fermentation process. Kefir contains active exopolysaccharide compounds, such as bioactive peptides and kefiran. Kefir also contains organic acids, especially lactic acid which have been shown to have anticancer, immune-modulatory activities, and antimicrobial (5).

CONCLUSION

Goat's and cow's milk kefir were able to inhibit the growth of bacteria with the highest inhibitory power at a concentration of 75%. *B. subtilis* is the variable with the highest correlation value for both the kefir type group (cow's milk and goat's milk kefir) and the concentration group (50% and 75%).

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EXTENDED ABSTRACT

Development of Inpari IR Nutri Zinc Instant Rice: Physical Properties, Sensory Characteristics, and Nutrients Content

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SUMMARY

The release of Inpari IR Nutri Zinc biofortified rice variety is an effort to enhance zinc intake among the population in Indonesia. This variety can also be processed into instant products.This study aimed to examine the effect of the processing of biofortified rice-based instant rice on its physical properties, sensory characteristics, and nutritional content in comparison to those of regular rice. The results revealed that Inpari IR Nutri Zinc instant rice had significantly higher volume expansion, non-significantly different level of acceptance, and significantly higher zinc content than the Ciherang one. It showed that this product could become a source of zinc.

Keywords: Inpari IR Nutrizinc, Instant rice, Physical properties, Sensory characteristics, Zinc

INTRODUCTION

The prevalence of zinc deficiency among Indonesia population in 2008 was 64% for adolescents, 60% for children, and 45% for adults (1). Zinc deficiency can weaken the immune system, reduce productivity, and become a risk factor for stunting (2). Therefore, the Indonesian Center for Rice Research in 2019 released Inpari IR Nutri Zinc rice variety, which is the result of biofortification through crossing varieties with a potential zinc content of 3.45 mg/100 g of rice, in order to increase the zinc intake of the Indonesian population (2) In addition to being consumed as regular rice, this new variety has the potential to be developed into instant rice product that is in accordance with the contemporary lifestyle demanding convenience. Thus, this study aimed to develop 'Inpari IR Nutri Zinc' instant rice and analyzed the effect of the convenience rice processing on the physical properties, sensory characteristics, and nutrients content of the rice.

MATERIALS AND METHODS

The rice varieties used in this research were Inpari IR Nutri Zinc and Ciherang varieties. Ciherang variety was used as a comparison because it is widely consumed by Indonesian people. Regular rice was cooked in a rice cooker, while instant rice, before it was ready to be cooked, it went through several stages, namely soaking, washing, cooking in a rice cooker, freezing, thawing, and drying. Furthermore, the samples were tested for physical properties, sensory characteristics (comprised acceptance test that was conducted with 7-point hedonic scale and descriptive sensory evaluation done by 12 trained-panelists), and nutrient analysis estimated by proximate analysis (3) and zinc content. Randomized Block Design was used with 3 replications using 2 treatments (rice, instant rice) and 2 blocks (Inpari IR Nutri Zinc, Ciherang). The data were then statistically analyzed using Two-Way ANOVA and Independent Samples T-Test with 95% confidence level.

RESULTS AND DISCUSSION

Table I shows that Inpari IR Nutri Zinc instant rice had texture and whiteness index that were not significantly different, but had a significantly better volume expansion than Ciherang. This was because Inpari IR Nutri Zinc instant rice had a more porous structure so it could easily absorb water with a faster rehydration time (7.09 minutes), while the rehydration time of Ciherang instant rice was 7.44 minutes. Panelists' acceptance for the color of Inpari IR Nutri Zinc instant rice was not significantly different from their acceptance for all samples and this result was in line with the whiteness index value.

Inpari IR Nutri Zinc instant rice had fewer descriptions of sensory properties of aroma and taste (Fig. 1) because of the low amylose content (16.60%), which resulted in fewer volatile compounds (4). The overall description of sensory properties of aroma and taste of Inpari IR Nutri Zinc showed that instant rice had a lower intensity than that of regular rice because of the loss of volatile compounds of rice during the processes of soaking and

Table I: Physical properties and acceptance test of regular rice and instant rice

Test Parameters	Regular Rice		Instant Rice	
	Inpari IR Nutri Zinc	Ciherang	Inpari IR Nutri Zinc	Ciherang
Physical Properties				
Texture				
Hardness (N)	9.69±0.62^{Aa}	10.73±0.33^{Aa}	8.25±0.18^{Ab}	7.73±0.02^{Ab}
Stickiness (N)	3.85±0.04^{Aa}	4.09±0.08^{Aa}	1.85±0.11^{Ab}	1.66±0.12^{Ab}
Whiteness Index (%)	68.92±0.39^{Aa}	68.43±0.55^{Aa}	69.30±0.83^{Aa}	68.48±0.05^{Aa}
Bulk Density (g/mL)	0.81±0.02^{Aa}	0.76±0.03^{Aa}	0.63±0.01^{Ab}	0.66±0.02^{Ab}
Volume Expansion (x)	2.87±0.07^{Ab}	2.02±0.14^{Bb}	4.20±0.11^{Aa}	3.42±0.16^{Ba}
Acceptance Test				
Color	6.27±0.56^{Aa}	6.41±0.60^{Aa}	6.21±0.67^{Aa}	6.16±0.60^{Aa}
Aroma	5.73±0.77^{Aa}	5.95±0.62^{Aa}	5.14±0.89^{Ab}	5.08±0.92^{Ab}
Texture	6.05±0.74^{Aa}	5.68±0.88^{Aa}	3.46±1.07^{Ab}	3.95±1.02^{Ab}
Taste	5.51±0.87^{Aa}	5.59±0.76^{Aa}	4.43±0.96^{Ab}	4.54±0.93^{Ab}
Overall attributes	6.05±0.62^{Aa}	5.92±0.79^{Aa}	4.35±0.89^{Ab}	4.41±0.79^{Ab}

$^{a-b}$ Different small letters in the same row indicate significant differences (p<0.05) between treatments (regular and instant rice).
$^{A-B}$ Different capital letters in the same row indicate significant differences (p<0.05) between groups (two varieties of rice).

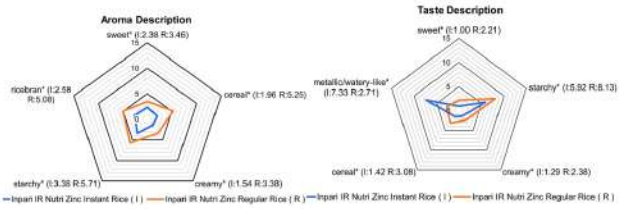

Fig. 1: Description of the aroma and taste attributes of Inpari IR Nutri Zinc
*significant difference (P<0.05) based on the Independent Samples T-Test

washing (5), cooking and drying (5,4), and rehydration with hot water (4). However, the metallic/watery-like taste increased in intensity because instant rice had a higher water content.

Analysis of nutrients content (Table II) discovered that the processing of instant rice caused an increase in the water and carbohydrate content due to the breakdown of the amylopectin structure into short-chain amylose, which was able to absorb more water (5). Instant rice from both varieties experienced a decreased in nutrients content (ash, protein, fat, and zinc). The decreased of nutrients content in instant rice occurred because of the porous structure formed in instant rice that helps nutrients to be easily dissolved during the rehydration

Table II: Nutrients content of regular rice and instant rice

Nutrients Content	Regular Rice		Instant Rice	
	Inpari IR Nutri Zinc	Ciherang	Inpari IR Nutri Zinc	Ciherang
Water (g/100 g)	67.54±1.06^{Ab}	62.13±0.60^{Bb}	76.92±0.48^{Aa}	74.46±0.82^{Ba}
Ash (g/100 g) (db)	0.56±0.03^{Aa}	0.53±0.02^{Ba}	0.29±0.01^{Ab}	0.25±0.02^{Bb}
Protein (g/100 g) (db)	7.98±0.07^{Aa}	7.66±0.22^{Ba}	6.19±0.38^{Ab}	5.98±0.18^{Bb}
Lipid (g/100 g) (db)	0.70±0.02^{Aa}	0.66±0.15^{Ba}	0.37±0.02^{Ab}	0.32±0.02^{Bb}
Total carbohydrate (g/100 g) (db)	90.76±0.06^{Bb}	91.15±0.19^{Ab}	93.14±0.03^{Ba}	93.44±0.16^{Aa}
Zinc (mg/100 g) (db)	3.14±0.03^{Aa}	2.76±0.01^{Ba}	1.47±0.03^{Ab}	1.32±0.02^{Bb}

$^{a-b}$ Different small letters in the same row indicate significant differences (p<0.05) between treatments (regular and instant rice).
$^{A-B}$ Different capital letters in the same row indicate significant differences (p<0.05) between groups (two varieties of rice).

process with water (4,5). Even so, the zinc content in Inpari IR Nutri Zinc instant rice was significantly higher than that in Ciherang one.

CONCLUSION

Inpari IR Nutri Zinc instant rice had significantly higher volume expansion and zinc content than Ciherang. Futhermore, production of instant rice resulted in weaker sensory description and significantly lower in terms of sensory acceptance. This study showed that Inpari IR Nutri Zinc instant rice had potential as an alternative source of zinc.

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EXTENDED ABSTRACT

Zinc and Iron Content of Biofortified Rice Variety Inpari IR Nutri Zinc

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SUMMARY

Inpari IR Nutri Zinc (NZ) is a zinc biofortified variety developed to overcome stunting in Indonesia. This study aimed to analyze the differences of zinc and iron content in NZ and Ciherang varieties by wet ashing method and Atomic Absorption Spectrophotometry with two replications. The results showed that zinc content of NZ rice and cooked rice were significantly higher than that of Ciherang. NZ rice also contains significantly higher iron than Ciherang, while in cooked rice, it was not significantly different. For pregnant women, NZ cooked rice has lower contribution of zinc and iron daily intake than Ciherang.

Keywords: Biofortified, Ciherang, Inpari IR nutri zinc, Iron, Zinc

INTRODUCTION

Rice is a major diet in Indonesia. However, it contains insufficient zinc and iron. Now, Indonesia is dealing with a complex nutritional issue, particularly stunting (24.4%). According to numerous studies, zinc supplementation can lower the prevalence of zinc insufficiency in toddlers with positive effects on growth and mean length increase (1). Inpari IR Nutri Zinc (NZ) is a novel variety developed to add zinc bio-fortification with conventional selective breeding. With a potential 25% greater zinc content than other varieties, this variety was developed to overcome stunting in Indonesia (2). To determine this potential, Ciherang variety was used as a comparison. This non-biofortified variety has been widely cultivated in Indonesia. Exact data on the zinc and iron contents of NZ rice, especially after being cooked, have not been widely reported. The differences on zinc and iron content in NZ and Ciherang varieties were analyzed in this study.

MATERIALS AND METHODS

The research was conducted at IPB University Laboratory from May 2021 to November 2021. Rice samples used were NZ and Ciherang varieties obtained from the Kopkarlitan BB Padi Sukamandi, Subang, West Java. NZ rice was harvested in Purwakarta (May 2021), whereas Ciherang was harvested in Subang (May 2020). To obtain the same level of cooked rice texture, the samples were cooked in a rice cooker with rice to water ratio of 1:3 for NZ and 1:1.8 for Ciherang. The rice and cooked rice were oven-dried and mashed with blender before being analyzed. The mineral content was determined using wet ashing method and Atomic Absorption Spectrophotometry with two replications. The experimental design was a fully randomized, and the data were analyzed with independent sample t-test with 95% confidence interval. The data were reported in parts per million (ppm) on a wet base (wb) and dry base (db).

RESULTS AND DISCUSSION

The results showed that zinc content of NZ either of rice or cooked rice was significantly higher ($p<0.05$) than that of Ciherang (Table I). The iron content of NZ rice was significantly higher than that of Ciherang, while of the cooked rice it was not significantly different. After processing, the zinc and iron content decreased. This is due to the leaching of minerals during washing rice before cooking (3). Average zinc retention rate of zinc biofortified rice was higher than that of non-biofortified rice. This could be related to zinc biofortification, which allows zinc to diffuse deeper into the endosperm layer, making it safer during processing. Iron is mostly found in the aleuron layer, where it is easily degraded and dissolved after washing (4,5).

In Indonesia, pregnant women in the 1st trimester are recommended to consume 600 g/day cooked rice, have zinc adequacy rate 10 mg/day, and iron 18 mg/day. The

Table I: Zinc and iron contents

Sample types	Varieties	Moisture content (%)	Zinc content (ppm)		Iron content (ppm)	
			wb	db	wb	db
Rice	NZ	11.34±0.03[a]	23.55±0.16	27.17±0.18[a]	17.13±0.06	19.77±0.08[a]
	Ciherang	9.95±0.48[b]	19.60±0.08	22.24±0.10[b]	16.35±0.16	18.55±0.18[b]
Cooked rice	NZ	74.04±0.28[a]	6.36±0.00	25.50±0.00[a]	3.44±0.08	13.99±0.35[a]
	Ciherang	61.71±2.12[b]	7.90±0.11	21.36±0.29[b]	5.43±1.66	14.68±4.49[a]

[a-b] Different small letters in the same on dry base column show a significant difference ($p<0.05$) between types of samples. The data was presented in part per million (ppm) on wet base (wb) and dry base (db).

contributions of zinc and iron intake per day from NZ cooked rice were 38% and 12%, while the contributions of Ciherang cooked rice were 47% and 18% respectively. NZ cooked rice contributes less to mineral intake. This is certainly related to the water content of NZ cooked rice which was higher than Ciherang. For a given amount of cooked rice, the mineral content of NZ cooked rice tends to be lower than Ciherang. To obtain a cooked rice texture that is suitable for consumption, NZ rice needed more water than Ciherang. It may be related to the different characteristics, for example water absorption capacity of the two samples. However, it was not analyzed further in this study. It can be said that NZ rice was more "pera" or has lower stickiness than Ciherang. It seems that new varieties of zinc biofortified rice need to be developed to increase the zinc content and obtain "pulen" or fluffy texture.

CONCLUSION

The development of biofortified rice varieties NZ has achieved the goal to increase rice zinc content. Zinc content of NZ rice and cooked rice were significantly higher than that of Ciherang ($p<0.05$). NZ rice also contains significantly higher iron than Ciherang, while in cooked rice it was not significantly different.

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EXTENDED ABSTRACT

High Fibre Instant Noodles Made from *Beneng* Taro Flour (*Xanthosoma undipes*)

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SUMMARY

Beneng taro is an Indonesian indigenous tuber that could be used as an alternative source of carbohydrates. This study aimed to formulate high-fibre instant noodles made from *Beneng* taro flour by using extrusion technology. The best formula was selected based on the sensory and physical evaluation. To increase elongation degree, the developed formula was combined with *Porang* flour (0, 2, and 4%) which was made from *Porang* tuber (*Amorphophallus muelleri*). The best prototype was a formula with 2% Porang flour added. The proximate and fibre analyses confirmed that the selected formula meets the requirements of high-fibre products.

Keywords: *Beneng* taro, Dietary fibre, Extrusion, Noodles, *Porang* flour

INTRODUCTION

Beneng taro is an indigenous tuber from Pandeglang, Banten, Indonesia. It is large and has a distinct yellow colour due to the presence of β-carotene, as well as a higher content of dietary fibre and protein compared to other varieties (1). The use of high-fibre components is critical since many individuals lack fibre, which has been associated with a variety of non-communicable diseases. Nevertheless, the utilization of *Beneng* taro as a fibre source is still limited. *Beneng* taro can be processed into noodles, one of popular staple foods, to increase its use. Since *Beneng* taro flour lacks gluten, additional ingredients, such as *Porang* flour, which has a considerable amount of glucomannan, are required to increase the elasticity and elongation of the noodles (2). The objective of this research was to formulate high-fibre instant noodles made from *Beneng* taro flour as an alternative source of carbohydrates.

MATERIALS AND METHODS

Beneng taro and *Porang* flour were the main ingredients used in this study. A completely randomized design was used in formulating noodles with extrusion technology. There were three levels of *Porang* flour addition: F1 (0% addition of *Porang* flour), F2 (2% addition of *Porang* flour), and F3 (4% addition of *Porang* flour). Physical and sensory evaluations were carried out to select the most suitable prototype. Physical evaluations comprised three replications of an elongation test. Twenty panellists conducted sensory evaluations on a hedonic scale of 1 to 5 with the highest score representing the best acceptance, and ranking test. The chosen formula was then used for proximate and dietary fibre analyses using the enzymatic gravimetry method (3). Analysis of variance and Duncan's Post-hoc were used to analyse the differences in terms of the acceptance and elongation tests. Friedman test was used to analyse the ranking test at 95% confidence interval.

RESULTS AND DISCUSSION

Beneng taro noodles had brownish colour due to taro's browning during extrusion. The result revealed significant differences in elongation (Fig.1). Higher *Porang* flour addition could increase elasticity and elongation of the noodles.

Sensory evaluation showed the differences in aroma between F1 and F3, but no significant differences in other attributes (Table I). The aroma difference was caused by the addition of *Porang* flour that reduced the strong aroma of taro. F2 was chosen as the best prototype based on elongation. Table II displays the value of the nutrition within the chosen formula.

The serving size of the chosen formula was established by comparing it to the serving size of commonly consumed commercial products (80 g). High-fibre foods must include dietary fibre at least 6 g/100 g of solid product, according to BPOM (4). It had <1 g total fat/serving and

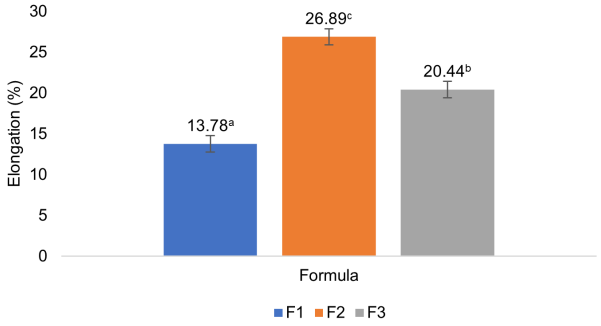

Fig.1: Elongation of Beneng taro instant noodles.
*Significantly different results (p>0.05).

Table II: Overall value of nutrition of the chosen formula

Nutrient	Nutrient/ 100g	Nutrient/ serving	Reference intake*	%Contribution
Energy	345	276	2150	13
Protein	10.61	8	60	13
Fat	1.14	1	67	2
Carbohydrate	73.08	58	325	18
Water	12.39			
Ash	2.78			
Dietary Fibre	7.66	6	30	20

*Reference intake for general group

7.66 g/100 g dietary fibre, meeting the requirements for a high-fibre product. The selected formula had water content of <14.5%, which fulfils the Indonesia National Standard (SNI) for instant noodles. The protein content of the selected formula was 10.61%, above the minimum SNI of 4.0% (5).

CONCLUSION

This research revealed that *Beneng* taro instant noodles with an addition of 2% of *Porang* flour were the best prototype based on the elongation degree. The selected formula could be an alternative staple food high in fibre, which will help to improve daily fibre intake.

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Table I: Sensory evaluation

Formulas	Attribute					Likeness rank
	Colour acceptance	Aroma acceptance	Taste acceptance	Texture acceptance	Overall acceptance	
F1	2.90±0.91^{a}	3.10±0.97^{a}	3.50±0.95^{a}	3.60±1.10^{a}	3.70±0.73^{a}	2.10±0.72^{a}
F2	3.25±0.85^{a}	3.40±0.82^{ab}	3.15±1.09^{a}	3.15±1.27^{a}	3.35±0.81^{a}	2.10±0.91^{a}
F3	3.15±0.99^{a}	3.65±0.59^{b}	3.35±0.93^{a}	3.45±1.19^{a}	3.55±0.76^{a}	1.80±0.83^{a}

Notes: distinct letters showed significantly different results (p>0.05).

EXTENDED ABSTRACT

Development of Nutrition Shake Made from Mung Bean and Corn as a Beverage for Underweight Toddlers

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SUMMARY

Nutrition shake is a nutrient dense beverage made from local ingredients as milk alternative for underweight toddlers. The beverage was made from 10% milk, 25% mung bean, 19% corn, 9% canistel (*Pouteria campechiana*), and 10% ambon banana (*Musa paradisiaca S forma sapientum*). The preference test was conducted by 30 semi-trained panellists and Quantitative Descriptive Analysis (QDA) was also performed by 8 trained panellists. The proximate analysis revealed that the product contained protein 6.4%(wb), fat 2.1%(wb), carbohydrates 31.5%(wb), energy 170 kkal, and dietary fiber 4.97 (g/100g). The product also has completed amino acid with 81% of in vitro protein digestibility. The product has met toddlers' protein need about 25.6%.

Keywords: Local food, Nutrient contents, Nutrition shake, Sensory characteristics, Underweight toddlers

INTRODUCTION

The prevalence of wasting, underweight, and stunting among Indonesian toddlers in 2018 were 3.9%, 13.8%, and 30.8% respectively (1). Stunting, wasting, and underweight can lead to mortality of children under 5 years old and have several impacts on children's future life (2). Nutrition shake which resembles a milkshake is made to improve nutritional status, and used as an additional nutrient daily intake to prevent toddlers from underweight and wasting. Hedonic test was used to asses the preference of panellists in terms of color, flavor, taste, texture, aftertaste, mouthfeel, and overall product's acceptability (3). Quantitative Descriptive Analysis (QDA) provides intensity characteristics of the product on each attribute specifically. The high price and limited domestic production of milk promote the utilization of other indigenous ingredients for formulating the product. This study aimed to formulate a supplementary beverage made from mung bean, corn, canistel and *ambon* banana.

MATERIALS AND METHODS

The product was made from mung bean, corn, canistel, *ambon* banana, sugar, coconut oil, fullcream milk, water, ginger, pandan leaves, and mineral mix. There were four formulas were used obtained from substitution between fullcream milk, mung bean, and corn. Mung bean, corn, and milk on formula 1 (F1) were 25%-14%-15%; formula 2 (F2) were 26%-15.6%-12.5%; formula 3 (F3) were 25%-19%-10%; and formula 4 (F4) were 26%-20.5%-7.5%. The research employed the completely randomized design and data was analyzed using one-way ANOVA and Duncan post hoc test. The preference test was evaluated by 30 semi-trained panellists. A sensory profile was assessed by using Quantitative Descriptive Analysis (QDA) by 8 trained panellists. The chemical properties analyzed were moisture (oven), ash (gravimetry), protein (kjeldahl), fat (soxhlet), dietary fiber (enzymatic gravimetry), carbohydrate (by difference), calcium and iron (ICP-OES), amino acid (HPLC/UPLC/LC-MS), in vitro protein digestibility (4), and viscosity (viscometer). The procedure of making nutrition shake started with filtration of blended boiled corn and soaked mung bean, then mixing with all of the ingredients.

RESULTS AND DISCUSSION

F3 is the most preferred formula according to overall attributes on the hedonic test. The descriptive sensory analysis showed that nutrition shake is sweet; has a yellowish, homogeneity, and smoothness appearance; the viscosity texture is high; the flavor and the taste are dominated by banana.

The F3 was selected based on sensory and proximate evaluation. Preference rate for F3 is considerably high amongst the other three formulas, with slightly higher protein content too. F3 is the most preferred formula.

Table I: The result of nutrition shake's hedonic test

Attributes	Formula (Mean±SD)			
	F1	F2	F3	F4
Color	6.73±0.74[a]	6.54±0.84[a]	6.35±1.17[ab]	5.99±1.32[b]
Flavor	6.05±1.73[a]	6.07±1.26[a]	6.09±1.27[a]	6.37±1.26[a]
Taste	5.48±1.82[b]	6.18±1.45[ab]	6.87±1.65[a]	6.54±1.33[a]
Texture	6.33±1.58[a]	6.15±1.35[a]	5.96±1.66[a]	6.37±1.32[a]
Mouthfeel	6.00±1.51[a]	6.30±1.20[a]	6.59±1.22[a]	6.38±1.29[a]
Aftertaste	5.35±1.64[b]	5.19±1.40[ab]	6.48±1.74[a]	6.21±1.42[a]
Overall	5.94±1.51[a]	6.31±1.31[a]	6.68±1.49[a]	6.53±1.27[a]

a-b: the different letter on the same row showed significant at p <0.05 (one-way ANOVA and LSD post hoc test)

Table II: Nutrient content of nutrition shake per serving size (100 ml)

Nutrient content	Formula (Mean±SD)			
	F1	F2	F3	F4
Moisture (%)	62.33±0.05[b]	62.57±0.03[b]	58.95±0.74[a]	62.63±0.42[b]
Ash (%)	1.06±0.03[ab]	1.03±0.02[a]	1.11±0.00[b]	1.09±0.03[ab]
Protein (%)	5.9±0.85[a]	6.4±0.19[a]	6.4±0.02[a]	6.8±0.28[a]
Fat (%)	2.3±0.01[d]	2±0.00[c]	2.1±0.01[b]	2.0±0.01[a]
Carbohydrate (%)	28.4±0.86[a]	27.8±0.10[a]	31.5±0.77[b]	27.5±0.15[a]

a-d: the different letter on the same row showed significant at p <0.05 (one-way ANOVA and Duncan post hoc test)

Further, the dietary fiber, amino acid profile, minerals (Ca and Fe), in vitro protein digestibility, and physical properties of the selected formula were analyzed. The product contained carbohydrates 31.5%(wb), energy 170 kkal, and dietary fiber 4.97 (g/100g). The product also contained calcium 59.25 mg/100g and iron 5.71 mg/100g, has complete amino acid, 81% in vitro protein digestibility, viscosity 186.75 cP, and water activity 0.97 aw. The product has met the toddlers' protein need about 25.6%. The product has also met the fat requirement standard of pasteurization milk, at 1.5-2.8 g (5), which is 2.1 g.

CONCLUSION

Nutrition shake is a nutrient dense beverage that meets the nutrition daily need intake of a children 4-6 years old as a supplementary beverage (10-20% of RDA in a day). The F3 is the selected formula of the nutrition shake because the preference rate is considerably high and it has a slightly higher protein content amongst the other three formulas.

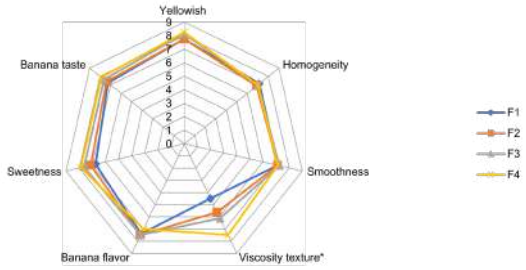

Fig.1: The radar chart of sensory attributes intensity using QDA (ISO 11132:2012)
*Significantly different results (p<0.05)

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EXTENDED ABSTRACT

Changes in Anti-Nutritional Compounds of Germinated Legumes: A Meta-Analysis

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SUMMARY

This research quantitatively reviewed studies related to the effect of germination on legumes antinutrients using meta-analysis approach based on Hedges'd effect size. Out of 1308 studies, 64 studies were included. The result showed the decrease of antinutrients -4.94 (CI=-6.77–-3.11) for total Tannin, -1.32 (CI=-2.25–-0.39) for Condesed Tannin, -15.76(CI=-18.03–-13.49) for Phytate, -4.21 (CI=-5.70–-2.75) for Saponin, -2.68 (CI=-4.11–-1.24) for Polyphenol, -30.01 (CI=41.61–-18.41) for Hemagglutinin, -5.43 (CI=-7.20–-3.30), -4.35 (CI=-6.16–-2.53) for Trypsin Inhibitor, while phenolic content increase 21.27 (CI=15.93–27.26).

Keywords: Antinutrients, Effect size, Germination, Legumes, Meta analysis

INTRODUCTION

Antinutrients are toxic substances or compounds that intervene with nutrients absorption (1). Plant synthesize antinutrients naturally. Thus, in human diet, plant based food is frequently considered as the major source of antinutrients (2). Legumes are important crops for addressing global malnutrition problem and food insecurity. However, the presence of antinutrient which decreases nutrient absorption in human body can hinder the utilization of legumes to combat malnutrition problems. Thus, reduction of antinutrients is important to produce legumes with high nutritional quality. Various studies reported that germination process may help in reducing the antinutrients in legumes. However, studies have presented conflicting results, which reported an increase of antinutrients. The purpose of this study is to quantitatively summarize the evidence from past studies regarding the effect of germination on legumes antinutrients and identify the potential main factor which affects the value of antinutrients in germinated legumes.

MATERIALS AND METHODS

This study used PICO, the abbreviation for Population (P), Intervention (I), Comparison (C), and Objective (O), which is used to structure research questions in meta analysis. The P in this study is germinated legume, germination as I, raw legume as C, and change of antinutrients as O. The literature searching process was conducted in online literature databases, which were Scopus, Taylor & Francis, Science Direct, & Pubmed from December 2021 to March 2022, without restriction in inclusion time. The inclusion criteria is full-text article published in research journals while the exclusion criteria are book chapters, proceeding, editorials, and abstracts. The criteria for eligible studies included for analysis are published in English, sufficient data to calculate standardized mean difference, direct comparison between raw and germinated, and number of studies for each parameter not less than 3. Statistical analysis for effect size and additional parameters were calculated using OpenMEE software.

RESULTS AND DISCUSSION

A total of 1,308 studies are identified from the journal databases (Fig.1). This data indicated that many studies on the effect of germination on antinutrients have been done. After screening process and eligibility assessment, only 64 research articles were included. Based on the eligible research articles, the antinutrients used in this study consisted of tannin, polyphenol, phytate, saponin, polyphenol, hemagglutinin, phenolic content, and trypsin inhibitor. Other antinutrients such as catechin, oxalate, canavanine, phytoestrogen, alpha amylase inhibitor, and chymotrypsin inhibitor were also identified in the screening process. However, due to low number of studies, they were not included in the analysis.

The result of meta analysis showed that antinutrients

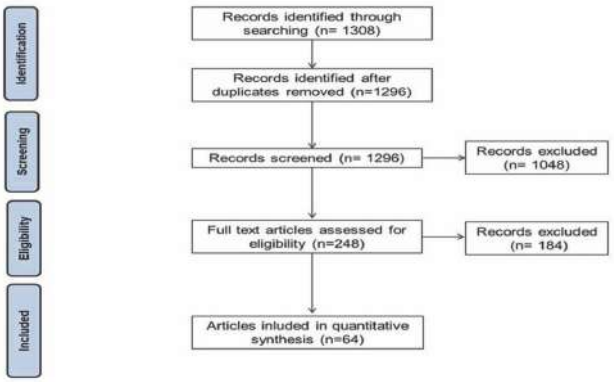

Fig.1: Flow chart of research articles selection process

decrease in germinated legume, except in the case of phenolic content (Fig.2). The highest average percentage reduction was found in Hemagglutinin (64%), followed by phytate (38%), trypsin inhibitor (27%), condensed tannin (26%), polyphenol (25%), total tannin (23%), and saponin (13%). Factors that may contribute to the increase of total phenolic content is prolonged germination, which causes an increase of phenolic acid distribution by starch enzyme hydrolyses (3).

There are two possible mechanisms that can explain the reduction of antinutrients during germination. The first is leaching of antinutrients into the water which possibly happens during soaking process (4) and the other mechanism is degradation of antinutrients by

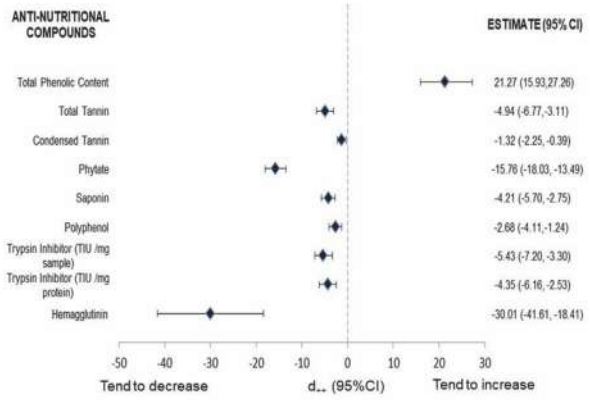

Fig.2: Cumulative effect size and 95% CI of some antinutrients comparing germinated and raw legumes

activated enzyme due to biochemical changes that occur during germination (5). Those mechanism during germination process can be affected by various factors, such as the type of legume, the duration of germination, light, salinity, and soaking process which influence the antinutrient content in germinated legumes.

Due to moderate and high heterogenity found in the studies (I^2=50–95 %), subgroup analysis based on legume species, soaking process, and germination time was carried out to identify the source of heterogeneity. However, the result could not identify the source.

CONCLUSION

The result indicates that germinated legumes have the potential to be a good nutrient source to combat malnutrition due to reduction of antinutrients. However, the source of heterogeneity (I^2=50–90%) could not be determined. Future research should focus on germination process standardization in order to produce nutritious germinated legumes.

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EXTENDED ABSTRACT

Cookies from Velvet Beans Tempeh (*Mucuna pruriens*) as a Potential Snack from Indigenous Legumes: Preference, Nutritional, and Amino Acids Assessments

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SUMMARY

Velvet beans tempeh (*Mucuna pruriens*) has a potential as an indigenous protein source. The aim of this research was to develop cookies from velvet beans tempeh and analyze their preference, nutritional content, and amino acids profile. Cookies were determined by randomized completely design consisting of F1 (50%), F2 (75%) and F3 (100%). The selected cookies (F2) contained 13.74±0.83 (% db) of protein with amino acid score 88.73±10.05. Besides, the mineral content was 5.50±0.67 (mg/100 g) for iron and 2.52±0.06 (mg/100 g) for zinc. The selected cookies (F2) can be claimed as a potential food source of protein, iron and zinc.

Keywords: Amino acids score, Cookies, Nutritional content, preference, Velvet beans tempeh

INTRODUCTION

Legumes has a potential as an alternative protein source. One serving of legumes (90 grams) provides 15% of the Recommendation Dietary Allowance (RDA) for protein intake for adults weighing 70 kg (1). Legumes, such as velvet beans tempeh, contains high protein and calcium and grows well in Yogyakarta, Indonesia (2). Cookies are products preferred by children and also adults and have a long shelf life. Based on data from the Indonesian Food Consumption Survey in 2014 to 2018, the average consumption of cookies in Indonesia is 33.31% (3). The use of velvet beans tempeh in community is not optimal other than soybean tempeh. Flour from velvet beans tempeh has the potential to be developed into a cookie product as a snack for school-aged children. The objective of this research was to develop cookies from velvet beans tempeh and analyze their preference, nutritional content, and amino acids profile.

MATERIALS AND METHODS

This study used completely randomized design. The treatment was the use of composite flour based on velvet beans tempeh which was changed in comparison with wheat flour using three formulas consisting of F1 (50%), F2 (75%) and F3 (100%). The hedonic rating test was conducted to measure the level of preference. The hedonic scale used was 1 to 9 which represents the panelists' preference for product (ISO 8587:1988). The proximate composition was determined using the official AOAC (2005) method. The parameters analyzed were water content, total ash content, crude protein content, fat content, crude fiber and carbohydrate content. Mineral analysis was determined by the official AOAC (2015) using an atomic absorption spectrometer (AAS). Amino Acid Analysis using High Performance Liquid Chromatography (HPLC) Method. Analysis of Cyanide Acid (HCN) using the Turbidimetric Method. Data were obtained through 2 repetitions of the analysis processed using Microsoft Excel 2016 and SPSS 16.0 for Windows.

RESULTS AND DISCUSSION

Based on the overall assessment results, F2 cookies had the highest acceptance rate at 100%, followed by F1 cookies at 93.29% and F3 cookies at 88.57%. Result of hedonic rating test of the cookie is shown in table I.

Based on the results of LSD rank test, there was no significant difference ($p>0.05$) in the perception of the panelists' preference between F1 and F2 for overall assessment. However, there was a significant difference ($p<0.05$) between F1 and F3 and F2 and F3 for overall assessment. The nutritional content of the selected cookies with 75% tempeh flour (F2) was tested by proximate analysis, minerals, and cyanide acid showed in Table II.

In this study, the amino acid score used the pattern of school-aged children's needs based on WHO/FAO/UNU (2007) shown in Table III. Flour from velvet beans

Table I: Hedonic rating test of the cookie

Parameter	F1 ($\bar{x}$±SD)	F2 ($\bar{x}$±SD)	F3 ($\bar{x}$±SD)
Color	7.11^{a}±0.80	7.00^{a}±1.06	7.11^{a}±1.05
Texture	6.37^{b}±1.33	6.14^{b}±1.22	5.51^{a}±0.98
Aroma	6.69^{a}±1.23	6.20^{b}±1.05	5.66^{b}±1.14
Flavor	6.34^{b}±1.33	6.43^{b}±1.04	5.20^{a}±1.05
Mouthfeel	6.26^{b}±1.24	6.09^{b}±1.31	5.06^{a}±0.84
Aftertaste	6.23^{b}±0.94	5.94^{b}±1.26	4.89^{a}±0.93
Overall	6.57^{b}±1.24	6.66^{b}±0.91	5.43^{a}±0.74

Note: Different letters on the same line showed a significant difference ($p < 0.05$).

Table II: Nutritional content of selected cookies (F2)

Parameter	Selected Cookies ($\bar{x}$±SD)	Indonesian National Standard for Cookies*
Moisture (% wb)	2.67±0.11	Max 5
Ash (% db)	2.18±0.10	Max 2.0
Fat (% db)	38.31±1.71	Min 9.5
Protein (% db)	13.74±0.83	Min 5
Carbohydrate (% db)	45.77±2.55	Min 70
Crude fiber (% db)	10.92±0.08	-
Energy (kcal)	519±7.76	Min 400
Calcium (mg/100 g)	43.66±0.70	-
Iron (mg/100 g)	5.50±0.67	-
Zink (mg/100 g)	2.52±0.06	-
HCN (ppm)	<2.00	-

Note: * National Standardization Agency (2011) SNI 01-2973-2011 for cookies

tempeh is deficient in sulfur amino acids, so when it is combined with wheat flour-based composites and rice flour, cornstarch, and eggs are added into the formulation of cookies, the amino acid score further increases.

CONCLUSION

Selected cookies (F2) which consist of 75% flour from velvet beans tempeh can be claimed as a source of protein, iron and zinc. Selected cookies (F2) had the highest acceptance rate at 100%, followed by F1 at 93.29% and F3 at 88.57%. The selected cookies (F2) had amino acid score of 88.73±10.05.

Table III: Amino acid composition of selected cookies (F2)

Amino Acids (mg/kg)	Fluor from velvet beans tempeh	Selected cookies (F2)
Isoleusin	184.3±2.00	161.26±2.32
Leusine	68.51±0.82	185.69±11.23
Lysine	48.74±0.50	88.73±10.05
Sulfur amino acid	67.64±0.13	96.07±2.47
Aromatic amino acid	380.59±3.02	303.25±8.20
Treonine	130.63±0.88	142.06±3.39
Triptophan	92.22±4.71	96.23±14.39
Valine	220.66±2.46	202.11±1.40
Limiting amino acid	Sulfur amino acid	Lysine
Amino Acid Score (%)	67.64±0.13	88.73±10.05

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EXTENDED ABSTRACT

Anti-Ageing and Anti-Diabetic Potential of Watermelon Rind Kombucha: An *In Vitro* Exploration

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SUMMARY

Kombucha is a probiotic drink with a handful of health benefits that could be made from various plant-based ingredients. This study evaluated the antioxidant, total phenolic, anti-ageing, and anti-diabetic potential of kombucha from watermelon rind which contains citrulline and phenolic compounds. The results suggested that watermelon rind kombucha was rich in antioxidant activity and total phenolic content while also showing anti-ageing and anti-diabetic potential based on antiglycation and α-amylase inhibition activity.

Keywords: Anti-ageing, Anti-diabetic, Antioxidant, Kombucha, Watermelon Rind

INTRODUCTION

Fruits contain fibre and phytonutrients in their rinds which nullify the adverse effects of the flesh's sugar and fructose contents. Fruit rinds – as a functional food – have been proven to ameliorate diabetes-related conditions and support healthy ageing (1). However, fruit rinds are usually discarded as waste, as well as watermelon rind that contributes up to 30% of the fruit's mass. Watermelon rind contains citrulline and phenolic compounds with antioxidant, anti-ageing, and anti-diabetic properties related to healthy ageing (1). The antioxidant activity and phenolic compounds in plant-based foods could be increased through fermentation – as in kombucha. Therefore, incorporating watermelon rind into kombucha will result in a functional drink that may prevent metabolic disorders and unhealthy ageing. This research explored the total phenolic content, antioxidant, anti-ageing, and anti-diabetic activity of different watermelon rind kombucha (WRK) formulas.

MATERIALS AND METHODS

WRK was divided into 3 formulas based on the proportion of watermelon rind to water (A=0.5:1; B=1:1; and C=1.5:1). Three hundred mL of each formula were added with 30 grams of sucrose, kombucha starter culture, and a symbiotic culture of bacteria and yeast, each. All samples were then incubated at ±25°C for 12 days. The antioxidant activity of WRK was assessed based on 1.1-diphenyl-2-picrylhydrazyl inhibition. The Follin-Ciocalteu assay was used to quantify the phenolic content (2). The inhibition of α-amylase of each formula was determined based on the reduction of porcine pancreatic α-amylase (3). The antiglycation activity was observed on the glycation between bovine serum albumin and glucose using sodium phosphate buffer as blank (3). The normality test was done using the Shapiro-Wilk method, while the difference of parameters between data was analyzed using Analysis of Variance (ANOVA) and both Tukey's and Dunnett's multiple comparisons test.

RESULTS AND DISCUSSION

Analysis of variance showed significant differences in antioxidant activity ($p<0.0001$), total phenolic content ($p=0.0007$), and antiglycation activity ($p=0.0004$) among WRK formulas ($p<0.05$), with formula C having the best attributes (Fig.1). Those differences may be contributed by the different proportions of the watermelon rind to water. A higher watermelon rind ratio shall result in higher antioxidant activity and total phenolic content of WRK, as it contains citrulline and phenolic compounds. Moreover, the fermentation process has been known to increase the activity of antioxidants, total phenols, and bioactive compounds of plant-based food products (4). WRK showed higher and lower antioxidant activity and phenolic content, respectively, compared to vegetables (2) yet comparable to fruits (5). The antiglycation and anti-diabetic capacities of food products are positively correlated to their antioxidant and phenolic properties (3). Further analysis (Figure 2) revealed significant differences in the α-amylase inhibition activity among WRK formulas ($p=0.0001$) and when compared to acarbose as control ($p<0.0001$). The results illustrated that higher watermelon rind composition will increase the anti-diabetic potential of WRK, presumably through

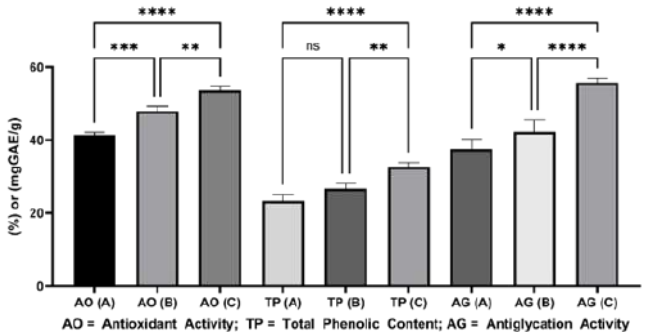

Fig.1: Antioxidant activity, Total phenolic, and antiglycation activity of watermelon rind kombucha formulas
(ns p=0.1794; *p=0.0199; **p=0.0016-0.0024; ***p=0.0007; ****p<0.0001)

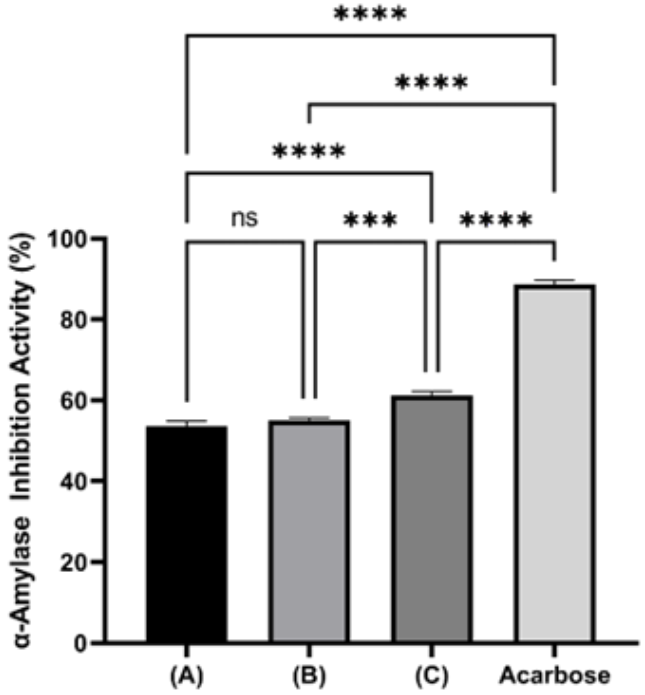

Fig.2: α-Amylase inhibition activity of watermelon rind kombucha and acarbose
(ns p=0.5357; ***p=0.0003; ****p<0.0001)

the mechanism of citrulline and phenolic compounds in improving glycemic control (1). Even though acarbose exhibited superior α-amylase inhibition than WRK, WRK remains a potential anti-diabetic drink. Permatasari et al., (2021) found that although sea grapes kombucha also had lower α-amylase inhibition activity than acarbose, the consumption of sea grapes kombucha significantly improved both metabolic and ageing markers (3), which highlighted the strong anti-diabetic and anti-ageing properties of kombucha.

CONCLUSION

This study found that WRK is a probiotic drink developed from fruit waste with antioxidant activity higher than vegetables and similar to fruits. WRK could be explored further in both clinical and preclinical studies as a potential anti-diabetic and anti-ageing agent with the highest antiglycation and α-amylase inhibition activity of 55.66±1.25% and 61.25±0.90%, respectively.

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EXTENDED ABSTRACT

Development of Ready-to-Use Therapeutic Food (RUTF) Using Locally - Available Protein Sources from Milk, Legumes, or Fish

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SUMMARY

Alternative Ready-to-use therapeutic food (RUTF) could be developed using locally available protein sources. This study aimed to formulate RUTF comparable with standard specifications and suitable for Indonesia. Milk, legumes, or fish were added to provide the formulas with minimum protein content of 10% from total energy. Samples were analysed for sensory acceptance and nutritional compositions. Milk-based RUTF was the most preferred, and the Fish-based RUTF was the least-preferred formula. All RUTFs had slightly higher energy contents with lysine as a limiting amino acid. The addition of vitamin and mineral premix is recommended due to the tendency of lower vitamin and mineral contents below the specifications.

Keywords: Alternative RUTF, Local protein source, Severe acute malnutrition

INTRODUCTION

Ready-to-use therapeutic food (RUTF) is a lipid-based product used as a home-based intervention for managing severely acute malnourishment in under-five children with no clinical complication (1). The peanut and milk-based paste combination is the most used RUTF, called standard RUTF. Several studies developed alternative RUTF using locally available ingredients such as fish, soybean, sorghum, maize, and mung bean. However, until now, in Indonesia, RUTF is still imported (2,3). The alternative RUTF demonstrated no inferior recovery-related outcomes compared to standard RUTF (2). This study aimed to formulate RUTF that is more locally suitable in Indonesia without compromising the criteria for a RUTF recommendation.

MATERIALS AND METHODS

The ingredients were combined into three groups (milk-based, fish-based, and legumes-based RUTF) using linear programming to optimize the nutritional composition constraints and achieve the RUTF specifications (1). Rice, maize, soybean, and mung bean were boiled and dried at 105°C, then milled into flour and mixed with other ingredients, with compositions shown in Table I, until paste-like consistency was achieved.

Table I: Ingredients composition on RUTF formulas

RUTF	Ingredients composition on RUTF formulas					
	F2	F4	F7	F8	F10	F11
Maize (%)	0.00	5.00	7.86	7.86	0.00	5.00
Soybean (%)	0.00	0.00	0.00	0.00	17.50	18.00
Mung bean (%)	0.00	0.00	0.00	0.00	5.00	5.00
Coconut oil (%)	20.00	21.30	0.00	27.30	28.80	0.00
Palm oil (%)	0.00	0.00	27.00	0.00	0.00	28.00
Milk powder (%)	21.50	32.60	0.00	0.00	0.00	0.00
Catfish flour (%)	0.00	0.00	13.93	13.63	0.00	0.00
Other ingredients (%)	58.50	41.10	51.21	51.21	48.70	44.00

F2: Milk-based non-maize; F4: Milk-based with 5% maize; F7: Fish-based with coconut oil; F8: Fish-based with palm oil; F10: Legume-based with coconut oil; F11: Legume-based with palm oil; Other ingredients: rice flour, peanut, and sugar

The samples were analysed for sensory acceptance by semi-trained panellists using 7-scale hedonic scores (1=dislike extremely, 7=like extremely). The selected formulas were analysed for the moisture and ash contents (gravimetric method), protein content (Kjeldahl method), fat content (Soxhlet method), dietary fibre (gravimetric enzymatic method), carbohydrate (by difference), mineral content (inductively coupled plasma-optical emission spectrometry method), fatty acids profile (gas chromatography method), and amino acids profile (high-performance liquid chromatography, liquid chromatography, and ultra-performance liquid

chromatography methods). Data were processed by One-way ANOVA and the significant results ($p<0.05$) were subjected to post-hoc Duncan analysis.

RESULTS AND DISCUSSION

A total of 6 formulas were selected after initial sensory evaluation from 12 formulas (data were not published). Table II shows that the fish-based formulas tended to have the lowest acceptance of each organoleptic attribute due to the highly pronounced fishy flavour, while the Milk-based formula (F2) was the most preferred. A similar result was found in a study using fish ingredients on the RUTF (3). Thus, the following fish-based formulation should involve the pre-treatment process or additional ingredients that can minimize the fishy flavour of the product.

Based on the results above, F2, F8, and F11 were selected for nutritional composition analysis (Table III). All formulas had higher dietary fibre and total energy. Milk-based RUTF had adequate fat, selenium, and omega-6, while fish-based RUTF contained higher macronutrients but complied with the specifications of the selenium and omega-6 fatty acids. Legume-based RUTF provided sufficient protein and omega-3 fatty acid contents. The lower micronutrient contents in this study were inconsistent with (2), which suggested that vitamin and mineral premix should be used in the RUTF formulation to achieve all of the micronutrient specifications.

Lysine was found as a limiting amino acid among all formulas due to the quite high (>20%) use of rice flour (4). Thus, the amount of protein sources (milk and soybean) should be increased, and the amount of peanut and rice should be reduced so that they do not exceed the maximum protein content but could achieve the optimum amino acids score. Combining fish with soy could result in better amino acids score and nutritional composition in the fish-based formula.

Table II: Sensory acceptance scores of RUTF paste products

RUTF	Sensory acceptance scores				
	Colour	Aroma	Texture	Taste	Overall Acceptance
F2	5.56±1.05 ^{a}	5.09±1.30^{a}	5.06±1.50 ^{a}	5.81±1.26 ^{a}	5.81±0.10^{a}
F4	5.50±1.11^{a}	4.91±1.51^{a}	4.25±1.70 ^{b}	5.31±1.61^{a}	5.03±1.51^{b}
F7	3.88±1.24^{b}	4.88±1.29 ^{a}	4.53±1.24^{ab}	3.44±1.48^{c}	3.69±1.33^{d}
F8	4.03±1.33^{b}	4.81±1.51 ^{a}	4.41±1.48^{b}	3.66±1.79^{bc}	4.00±1.44 ^{cd}
F10	4.97±1.23^{a}	4.97±1.33 ^{a}	4.56±1.41^{ab}	4.28±1.61^{b}	4.53±1.27^{bc}
F11	5.16±1.02 ^{a}	5.28±1.17 ^{a}	4.66±1.23^{ab}	4.41±1.43^{b}	4.75±1.02^{b}

Values are displayed as mean ± SD; F2: Milk-based non-maize; F4: Milk-based with 5% maize; F7: Fish-based with coconut oil; F8: Fish-based with palm oil; F10: Legume-based with coconut oil; F11: Legume-based with palm oil; Values in the same column with different superscripts are significantly different (p <0 .05)

Table III: Nutritional compositions of selected RUTF formulas

Parameter	Formula			Standard formula**
	F2	F8	F11	
Moisture Content (%)	1.53	1.51	1.50	2.5 Max
Ash Content (%)	1.47	1.91	1.39	-
Protein Content (g/100g)	12.7	17.9	13.0	12.8-16.2
Fat Content (g/100g)	35.7	37.4	37.6	25.8-36.3
Dietary fibre (%)	6.7	8.3	10.4	Max 5
Carbohydrate (g/100g)	41.8	33.0	36.0	-
Total energy (kcal/100 g)	553	557	556	520-550
Vitamin A (mg/100 g)	0.10	1.67	0.02	0.8-1.1
Selenium (mcg/100g)	31.62	25.29	15.28	20-40
Zinc (mg/100g)	2.04	2.48	2.01	11-14
Iodine (mcg/100g)	13.41	8.60	16.26	70-140
Omega 3 fatty acids (% total energy)	0.03	0.06	0.63	0.3-2.5
Omega 6 fatty acids (% total energy)	7.66	5.26	10.45	3-10
Amino acid score (%)	47.56	59.87	60.36	-

Data were obtained from a single replication; F2: Milk-based non-maize; F8: Fish-based with palm oil; F11: Legume- based with palm oil; Standard based on Joint FAO/WHO/UNICEF Food Standards program 2019

CONCLUSION

The milk-based RUTF was the most accepted formula regarding organoleptic characteristics compared to legume-based and fish-based formulas. Improvement of the methods, premix, and ingredients composition is needed to optimize the amino acid and fatty acid composition and better nutrient composition to compromise the RUTF specification.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to Global Alliance for Improved Nutrition (GAIN) and Indonesian Ministry of Health that supported this study.

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EXTENDED ABSTRACT

Tiwai Coffee: Brightness and Sensory Characteristics and it's Effect on Human Immunity

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SUMMARY

Tiwai onions (*Eleutherine americana* Merr.) can be used to treat several types of diseases, such as hypertension and hypercholesterolemia. Therefore, this study aimed to determine the brightness, sensory, and response of the human immune system after consuming tiwai coffee. The method used was a pre and post-test design in which tiwai coffee was consumed twice daily. The results showed that tiwai coffee had a brightness level with an L* value of 46.96, with its sensory being favored by the panelists. The decrease in inflammation occurred as evidenced by reduced lymphocytes, monocytes and erythrocyte sedimentation rate.

Keywords: Brightness level, Human immune, Sensory characteristics, Tiwai coffee

INTRODUCTION

Tiwai onions (*Eleutherine americana* Merr.) can treat several diseases such as hypertension, diabetes, rheumatism, gout, inflammation, and hypercholesterolemia (1). The Fourier Transform Infra Red (FTIR) results with wave numbers from 2,800 to 3,000 cm-1 indicate that coffee powder has two indentations. However, when combined with tiwai powder (3:1), the absorption curve becomes one, which is 2936.09 cm-1 at an absorbance of 0.14. The predicted indentation is CH bonds (alkanes) (2). Furthermore, developing food sourced from local ingredients is essential in supporting food innovation and availability, including functional food sourced from tiwai and coffee (3). The problem of brightness, taste and health-related function of food is also important, with tiwai coffee being a candidate. This study aimed to determine the intensity of color, sensory, and response of the human immune system after consuming tiwai coffee.

MATERIALS AND METHODS

The coffee beans were roasted for 15 minutes until brown, then ground and sieved through an 80-mesh sieve. The tiwai underwent the same procedure. Furthermore, the intervention material was a mixture of coffee and tiwai (1:3), up to 4g, in a dip bag. The brightness level, beverage sensory, and coffee tiwai intervention were tested. The research approach was pre and post-test design, with 22 respondents consuming tiwai coffee twice a day (morning and afternoon) for 15 days. Blood analysis was conducted in the Prodia Samarinda Clinical Laboratory. Each 1 bag of tiwai coffee was dipped into a glass of freshly boiled water 150 ml. This was performed in the morning and evening when consuming this drink. Pre and post-test intervention data were examined using a t-test, while sensory data and brightness levels were assessed using a one-way analysis of variance with a significance level set at α=0.05. This research was conducted according to the ethical approval from the Health Research Ethics Commission (KEPK) of the Faculty of Medicine, Mulawarman University No. 83/KEPK-FK/IX/2021.

RESULTS AND DISCUSSION

The results showed that green coffee had the highest L* value at 71.25, close to the bright level. In contrast, ground coffee powder exhibited the lowest L* value at 42.81, followed by tiwai powder, which was roasted for 15 minutes with an L* value of 46.21 and its coffee with an L* value of 46.96, as shown in Table I. The combination of a high a* value and a low b* value produces a dull (red) slightly yellow color resulting in a low brightness level, while a low a* and high b* value indicates a bright yellow color as the control (tiwai powder without roasting). The color hedonic scale values for 10 and 15 minutes of roasting on tiwai and coffee were not significantly different, as presented in table II. Respondents with a high category of lymphocytes indicated inflammation decrease by 50%

to normal after the intervention. Furthermore, the mean erythrocyte sedimentation rate (ESR) and monocytes were also reduced after the tiwai coffee intervention, as indicated in Table III. In the monocytes pre-test, 36.40% respondents in the high category became 31.81% in the post-test. Meanwhile, 50.0% respondents in the high category of the erythrocyte sedimentation rate pre-test decreased to 45.45% in the post-test.

CONCLUSION

Tiwai coffee has an a brightness level with L* value of 46.96, and its color, aroma, and taste were acceptable. Drinking tiwai coffee twice a day could decrease inflammation indicated by lowered lymphocytes, monocytes and erythrocyte sedimentation rate.

Table I: Average values of L*, a* and b* Tiwai products

Treatment	L*	a*	b*
Tiwai dried powder (no roasted)	60.85^{c}	11.94	11:45
Tiwai powder (roast for 5 minutes)	56.09^{b}	8.68	11.54
Tiwai powder (roast for 10 minutes)	50.28^{b}	6.29	11.75
Tiwai powder (roast for 15 minutes)	46.21^{a}	3.61	9.11
Coffee powder (roast for 15 minutes)	42.81^{a}	1.88	7.35
Tiwai coffee	**46.96^{a}**	**2.46**	**11.65**

*Different small letters in superscript in columns indicate statistically significant differences at the level α=0.05

Table II: Sensory Hedonic Scale of Tiwai products

Treatment	Color	Aroma	Taste
Tiwai dried powder (no roasted)	3.42±0.21^{a}	3.22±0.45^{a}	3.11±0.32^{a}
Tiwai powder (roast for 5 minutes)	3.85±0.33^{a}	3.46±0.33^{ab}	3.56±0.25^{ab}
Tiwai powder (roast for 10 minutes)	4.43±0.11^{ab}	4.64±0.24^{b}	3.83±0.33^{b}
Tiwai powder (roast for 15 minutes)	4.71±0.41^{b}	4.57±0.12^{b}	4.57±0.36^{b}
Coffee powder (roast for 15 minutes)	4.73±0.15^{b}	4.67±0.43^{b}	4.46±0.35^{b}
Tiwai coffee	**4.67±0.23^{b}**	**4.56±0.26^{b}**	**4.78±0.22^{b}**

*Hedonic scale (1 = dislike very much, 2 = dislike slightly, 3 = neither like nor dislike, 4 = like slightly, 5 = like very much). **Different small letters in superscript in columns indicate statistically significant differences at the level α=0.05

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Table III: The effect of the tiwai coffee intervention on the human immune system

Treatment	Leukocytes (mL)	Basophils (%)	Eosinophils (%)	Neutrophils (%)	Lymphocytes (%)	Monocytes (%)	ESR (mm/hours)
Pre	7.30±0.34	0.56±0.03	3.81±0.40	56.46±1.17	31.93±1.18	7.24±0.25	28.27±2.45
Post	7.34±0.27	0.57±0.05	3.53±0.33	57.32±1.13	31.39±0.93	7.19±0.39	25.82±2.68

EXTENDED ABSTRACT

Effect of Pumpkin Puree (*Cucurbita moschata*) Substitution and Fermentation Time in the Production of Maros Bread (*Roti Maros*)

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SUMMARY

Substituting flour with pumpkin puree in Maros Bread will increase its nutritional content. However, the amount of substitution and fermentation time may affect the bread's properties. This study examines the effect of fermentation time (45 and 60 minutes) and pumpkin puree substitution (0, 20, 35 and 50%) on the sensory and physicochemical properties of Maros Bread. The results showed that 80% wheat flour: 20% pumpkin puree and fermentation for 60 minutes are the best results, with higher moisture, ash, fibre and beta carotene, while it has lower fat, protein, carbohydrate and bread volume rise than the control.

Keywords: Fermentation time, Maros bread, Physicochemical properties, Pumpkin puree, Substitution

INTRODUCTION

Maros Bread or "Roti Maros" is a traditional food that is always sought after by visitors in Maros Regency, Indonesia. Maros Bread uses flour as its main ingredient. However, Indonesia is dependent on wheat imports, purchasing 10.701 million tonnes in 2020 (1). To reduce this, substitution needs to be made with local food sources. Pumpkin (*Cucurbita moschata*) is abundant in Indonesia, with 20-21 tonnes/hectare harvest each year(2). It is good for health and contains beta carotene, various types of vitamins, fibre and minerals(3). In addition, pumpkin consumption is still low at around 5 kg/capita/year(2). The drawback of using pumpkin as a flour substitute is that it may affect the physicochemical properties of the bread. Moreover, the fermentation time of bread dough also has a major effect on the product(4). Therefore, this study was conducted to examine the effect of fermentation time and pumpkin puree substitution on Maros Bread.

MATERIALS AND METHODS

The ingredients used to make Maros Bread are wheat flour, pumpkin, xanthan gum, milk powder, sugar, margarine, bread improver, eggs, water, and yeast. The Maros Bread was made with two factorial designs. The first factor was the ratio of flour and pumpkin puree with four variations: 100% flour (F0), 80% flour + 20% pumpkin puree (F1), 65% flour + 35% pumpkin puree (F2), and 50% flour + 50% pumpkin puree (F3). The second factor was the fermentation time of 45 minutes (T1) and 60 minutes (T2) at room temperature. All samples were then tested with hedonic test to get the best treatment in the parameters of taste, aroma, colour, and texture. Afterwards, the best sample was compared to the control through chemical properties tests in the parameters of moisture, protein, fat, ash, carbohydrates, and crude fibre content. Physical quality tests on the bread volume test and color analysis used colorimeter.

RESULTS AND DISCUSSION

The hedonic test results on all samples showed that the panellists preferred the sample of 80% flour: 20% pumpkin puree and 60-minute fermentation time formulation. The best sample was then tested with the control (no substitution and fermentation time 60 minutes). The chemical test results show significant differences in the parameters of moisture, protein, fat, carbohydrate, fibre, and beta carotene, while the ash and bread volume rise show insignificant results. The average moisture content in control and the best samples respectively are 29.13 and 37.02%, ash content level test were 0.68 and 0.85%, protein content test were 9.79 and 6.41%, fat test were 7.96 and 5.65%, carbohydrate test were 53.03 and 50.04%, crude fibre test were 12.94 and 13.28%, and beta carotene test were 1610.456 µg/100g and 2283.838 µg/100g. Meanwhile, the results of the physical test show that the average value of control and the best sample on the bread volume rise respectively are 16.19% and 13.33% and the colour test results are

L: 70.86 ; a: 0.59 ; b: 22.39 and L: 71.65 ; a: -1.38 ; b: 27.51. The data obtained shows that the best sample had increased amount of moisture, fibre, and beta carotene, and decreased ash, protein, fat, carbohydrates and the bread volume rise. The results were obtained because pumpkin puree have higher moisture, fibre, and beta carotene content than flour, while it also has lower ash, protein, fat, and carbohydrate content than flour. In the bread volume rise test, the best samples have lower volume rise because the substitution made the bread dough have lower gluten formation, thus making the dough have weaker structure to rise more. In the colour test, the best sample has higher b value that indicates the higher presence of beta carotene.

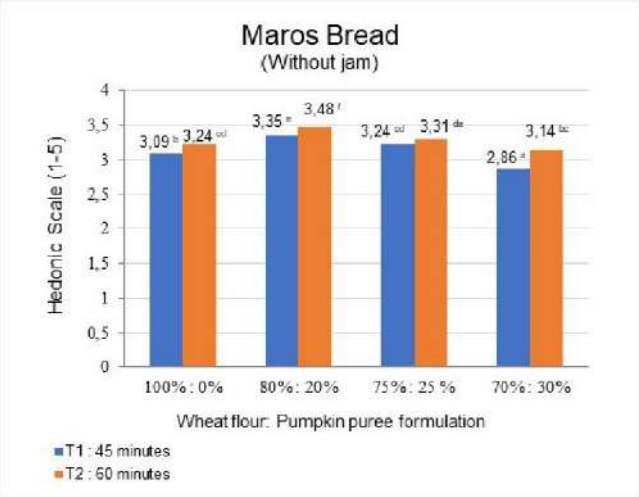

Fig.1: Maros bread organoleptic test result

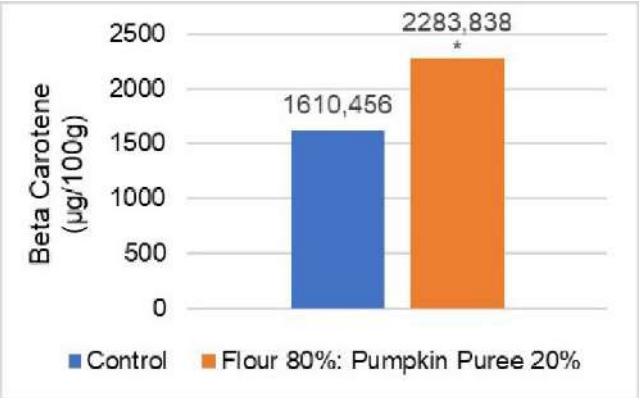

Fig.2: Beta carotene test result

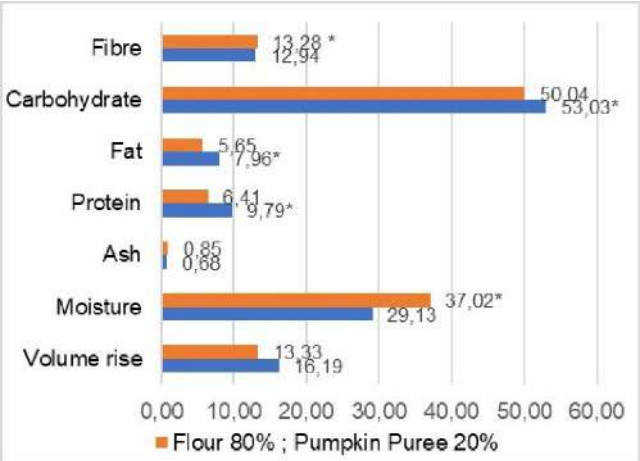

Fig.3: Proximate and bread volume rise test result

CONCLUSION

In conclusion, the data showed that the Maros Bread with 80% wheat flour: 20% pumpkin puree ratio and fermentation for 60 minutes is the best result with higher moisture, ash, fibre, and beta carotene; and lower fat, protein, carbohydrate and bread volume rise than control.

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EXTENDED ABSTRACT

Cocoyam (*Xanthosoma sagittifolium*) Noodles for Dyslipidemia: Physicochemical and Sensory Characteristics

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SUMMARY

Cocoyam is a local food high in fiber which has a potential ingredient to control blood lipid levels. The prevalence of dyslipidemia in Indonesia in 2018 was 28.8%. The purpose of this study was to examine differences in the physicochemical characteristics and sensory properties of dried noodles. This Complete Randomized Design (CRD) research used 4 treatments (ratio wheat flour:cocoyam flour) and 3 replications. The higher proportion of cocoyam flour, the better physicochemical and the worse sensory characteristics of noodle are. The best physicochemical noodle was found at F2 (ratio wheat flour 70%:cocoyam flour 30%), but it was necessary to improve its sensory properties.

Keywords: Cocoyam, Dyslipidemia, Noodles, Physicochemical, Sensory

INTRODUCTION

Dyslipidemia is known as one of the risk factors for the occurrence of cardiovascular diseases such as coronary heart disease. So, the prevention and control of dyslipidemia are important to help reduce the incidence of cardiovascular disease (1). So far, the treatment of dyslipidemia uses lipid-lowering drugs such as statins, azetidinone and nicotinic acid. However, lipid-lowering drugs also have different side effects. Fiber is able to control blood lipid levels and has the effect of lowering LDL cholesterol levels and total cholesterol (2). Indonesia is rich in biological resources, especially tubers that can be used as ingredients in making flour. One of the resources that can be used as an alternative for making flour is cocoyam (*Xanthosoma sagittifolium*). Cocoyam is a local food ingredient rich in fiber, which is 1.5 g for 100 g of ingredients that has the potential to be made into flour and used in making noodles to overcome dyslipidemia (3).

MATERIALS AND METHODS

The ingredients used in making noodles in this study were wheat flour and cocoyam flour. The method used in this study was an experimental method with a Complete Randomized Design (CRD) using 4 treatments and 3 replications with the ratio of wheat flour and cocoyam flour F0 (100%:0%), F1 (90%:10%), F2 (70%:30%), F3 (50%:50%). Physicochemical tests (water, ash, protein, fat, carbohydrates and crude fiber) through Proximate tests and sensory tests (color, aroma, texture and taste) were done through the Hedonic Scale Scoring test with assessment criteria of like very much (score 4), like (score 3), dislike (score 2), and dislike very much (score 1); the study involved 25 semi-trained panelists aged 18-23 years; men and women. They have studied and conducted organoleptic tests. Ethical approval to conduct this research was obtained from the University Ethics Committee, Sari Mulia University (Number: 085/KEP-UNISM/III/2022).

RESULTS AND DISCUSSION

The physicochemical characteristics based on proximate tests on cocoyam dried noodles can be seen in Table I. The low gluten content can result in weaker water binding power, making the release of water molecules at the time of drying easier. Temperature and drying time have a noticeable influence on the ash content of the resulting cocoyam flour (4). The decrease in protein content in noodles is in line with an increase in the proportion of cocoyam flour and a decrease in the proportion of wheat flour (5). Uneven temperature during inventory will cause fat oxidation reaction. Carbohydrate and crude fiber levels in dried noodles increased with an increase in the proportion of cocoyam flour and decreased in the proportion of wheat flour.

The results of sensory properties based on the Hedonic Scale Scoring test and Friedman's statistical test on cocoyam dried noodles can be seen in Figure 1. The brightness level of the color of dry noodles based on modified flour tends to decrease with the increasing addition of modified cocoyam flour. Cocoyam has a beany aroma characteristic, so the use of a lot or little

Table I: Physicochemical properties of cocoyam dried noodles

Parameters	F0	F1	F2	F3	p value
Water (%)	13.28	7.69	6.46	5.71	0.016[b]
Ash (%)	2.12	1.92	1.64	2.84	0.015[b]
Protein (%)	12.85	12.07	11.97	10.14	0.015[b]
Fat (%)	1.50	1.54	1.70	1.35	0.000[a]
Carbohydrates (%)	70.23	76.78	78.22	79.95	0.016[b]
Crude fiber (%)	0.55	0.66	0.88	1.00	0.000[a]

[a]*One Way Anova,* [b]*Kruskall Wallis*
Note: Ratio wheat flour:cocoyam flour F0 (100%:0%), F1 (90%:10%), F2 (70%:30%), F3 (50%:50%)

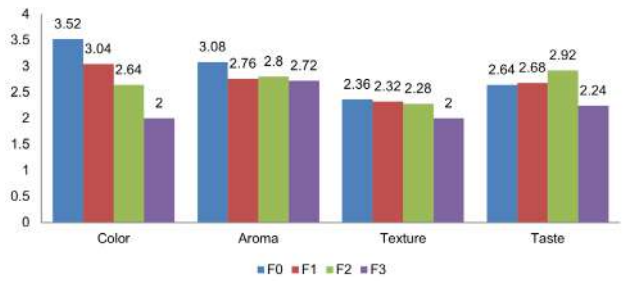

Fig.1: Sensory average value of cocoyam dried noodles

Fig.2: Cocoyam dry noodle products on all treatments
Note: F0 (code: 3012), F1 (code: 0109), F2 (code: 0903), F3 (code: 1702)

cocoyam flour can affect the aroma produced. The addition of cocoyam flour causes the texture to be a bit harder because it does not contain gluten. The higher the percentage of the addition of cocoyam flour, the more it will have the dominant taste typical of cocoyam.

CONCLUSION

The best physicochemical noodle was found at F2 (ratio wheat flour 70%: cocoyam flour 30%), but it was necessary to improve its sensory properties.

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EXTENDED ABSTRACT

Proximate Analysis and Antioxidant Activity Assay of Four Selected Indonesian Fruits: *Clausena excavata, Kadsura scandens, Pyrenaria serrata*, and *Phaleria macrocarpa*

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SUMMARY

Indonesia has a variety of fruits, but some of them are underutilized, such as *Clausena excavata, Kadsura scandens, Pyrenaria serrata*, and *Phaleria macrocarpa*. We measured their nutritive values through proximate analysis and antioxidant activities through 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity. We found that *C. excavata, K. scandens*, and *P. serrata* were edible but *P. macrocarpa* was poisonous. *P. macrocarpa* had the highest antioxidant (86.36%) and the most abundant total protein (7.76%). The highest content of carbohydrates and fat were harbored from *P. serrata* (85.94%) and *C. excavata* (6.79%), respectively. All fruits have good nutritive values and are potential antioxidant sources.

Keywords: Biodiversity, Edible fruit, Nutritive value, Radical scavenging activity, Underutilized fruit

INTRODUCTION

Many fruits from Indonesia are underutilized, such as *Clausena excavata* Burm.f. (*tikusan*), *Kadsura scandens* (Blume) Blume (*ki lebui*), *Pyrenaria serrata* Blume (*ki jeruk*), and *Phaleria macrocarpa* (Scheff.) Boerl. (*mahkota dewa*). The leave, stem bark, and root of *C. excavata* are known in folk medicine and proven to be antioxidant, anticancer, and antimicrobial agents (1), but little is known about the usefulness of its fruit. Rhizome and leave of *K. scandens* provide medicinal benefits (2). Its fruit is edible but unpopular. *K. scandens* are categorized as 29 rare medicinal plants stated in the Indonesia Biodiversity Strategy and Action Plants that should be prioritized to be conserved (2). *P. serrata* fruit contains alkaloids, flavonoids, tannins, glycosides, and saponins, but is underutilized (3). *P. macrocarpa* is popular herbal medicine. Its phytochemical, nutritive values, and biological activities are investigated (4). This research was conducted to measure four selected Indonesian fruits' nutritive values and antioxidant activities.

MATERIALS AND METHODS

The fruits of *C. excavata, P. serrata*, and *P. macrocarpa* were collected from Cibodas Botanic Gardens. The fruit of *K. scandens* was taken from Mount Gede-Pangrango National Park in March 2022. Fruits drying was carried out in an oven at 40°C for seven days. Antioxidant activity and nutritive value measurements were carried out at the Appropriate Technology Research Laboratories Subang, National Research and Innovation Agency. Radical scavenging activity measurements were carried out in triplicate for antioxidant activity determination. Proximate analysis of all fruits was based on the Association of Official Analytical Chemists (AOAC) 1990 (5). Statistical analysis was conducted by one-way ANOVA followed Post-Hoc Least Significant Difference (LSD) by RStudio. All data were stored in the Repositori Ilmiah Nasional (National Scientific Repository – RIN) (https://hdl.handle.net/20.500.12690/RIN/J7WMSH).

RESULTS AND DISCUSSION

The fruits of *P. serrata, K. scandens*, and *C. excavata* were edible but not popular for consumption. Our paper is the first study on their nutritive values. From Table I, all fruits showed a high percentage of radical scavenging activity that reflected high content of antioxidants. The antioxidant content of *C. excavata* was not measured due to the insufficient fruit sample. On the other hand, a study has found that essential oil from leaves of *C. excavata* had antioxidants activity of 2059.29 µg/mL (1). *P. serrata* had advantageous large fruits (about 3 – 5 cm in diameter) (Fig.1.a) and significantly the highest content of carbohydrates (85.94%) (Table II) if these fruits were utilized as food sources. The guava-like appearance was attractive, but the sour and fast-oxidized flesh required processing technology if they would be

Fig.1: Fruit of a) *P. serrata*, b) *K. scandens*, c) *C. excavata*, d) *P. macrocarpa*

mass harvested and consumed. Fruits of *K. scandens* had unique aggregated shapes, sour, and aromatic taste with attractive bright red color when ripe (Fig.1.b). Their fat content was the lowest (Table II). The ripe fruits of *C. excavata* were small, translucent pinkish, palatable, and juicy like grapes (Fig.1.c). Their fat content was significantly the highest (6.79%) (Table II). *P. macrocarpa* fruits were dark red (Fig.1.d) with fibrous flesh. The fresh fruits and seeds were poisonous (4), even though the dried fruits contained the strongest antioxidant (86.36%) and the most abundant protein (7.76%) (Table 2). Fruits of *P. macrocarpa* from Yogyakarta (Indonesia) had different profiles (4). Their total ash, fat, and carbohydrate were lower (5.24, 1.25, and 33.03%, respectively), but the protein was higher than other fruits (8.51%). From Table II, the moisture content of all dried fruit was acceptable to prevent microbial growth (below 10%), and all fruit provided essential minerals that were marked by their ash content.

CONCLUSION

P. macrocarpa contains the highest antioxidant (86.36%) and the most abundant protein (7.76%). The highest content of carbohydrates and fat are harbored from *P. serrata* (85.94%) and *C. excavate* (6.79%), respectively. The four selected underutilized Indonesian fruits have good nutritional values and are potential antioxidant sources.

Table I: Antioxidant activity of four selected Indonesian native fruits

Sample	Radical Scavenging Activity (%)
P. macrocarpa	$86.36\pm0.50_{a}$
K. scandens	$81.90\pm0.12_{b}$
P. serrata	$79.37\pm0.50_{c}$

Note: Numbers followed by the same letter in the same column were not significantly different (p>0.05). The antioxidant content of *C. excavata* was not measured due to the insufficient fruit sample.

Table II: Proximate analysis of four selected Indonesian native fruits

Fruit	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrates (%)
P. serrata	$5.43\pm0.17_{c}$	$4.55\pm0.05_{b}$	$0.81\pm0.03_{d}$	$3.26\pm0.10_{d}$	$85.94\pm0.09_{a}$
K. scandens	$9.80\pm0.20_{a}$	$4.24\pm0.14_{b}$	$1.30\pm0.01_{c}$	$6.32\pm0.58_{b}$	$78.34\pm0.91_{b}$
P. macrocarpa	$5.69\pm0.07_{c}$	$6.17\pm0.08_{a}$	$5.76\pm0.06_{b}$	$7.76\pm0.11_{a}$	$74.62\pm0.03_{c}$
C. excavata	$7.35\pm0.18_{b}$	$6.09\pm0.06_{a}$	$6.79\pm0.02_{a}$	$5.40\pm0.45_{c}$	$74.37\pm0.31_{c}$

Note: Numbers followed by the same letter in the same column were not significantly different (p>0.05)

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EXTENDED ABSTRACT

In vitro Iron and Zinc Bioaccessibility of RUTFs from Locally-Available Protein Sources

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SUMMARY

Alternative ready-to-use therapeutic food (RUTF) formulas were developed in Indonesia using locally-available protein sources which resulted in Milk-based, Legumes-based, Fish-based, and Soy and Fish-based RUTFs. Due to the standard and the incorporation of plant-based ingredients, iron and zinc contents were assessed in this study along with their in vitro bioaccessibility. Most of the RUTFs have comparable iron contents, but the zinc contents are slightly lower than the standard. More than 50% of ready-to-absorb minerals were provided by all RUTFs. Locally-available ingredients have the potentials to be used in the formulation of RUTFs with sufficient mineral contents while highlighting the need to increase the mineral bioaccessibility of the product through ingredient modification or fortification.

Keywords: Alternative RUTF, *In vitro* bioaccessibility, Iron, Locally protein sources, Zinc

INTRODUCTION

Several alternative RUTFs to treat severely acute malnourished (SAM) under five-aged children were developed in Indonesia using locally-available ingredients as their protein sources. Milk, legumes (soy and mung bean), catfish, and a combination of soy and fish were processed into wafer rolls filled with RUTF paste (1). Minerals such as Iron (Fe) and zinc (Zn) are also included in the specification standard of RUTF. The plant-based ingredients tend to have lower mineral absorption (2). Thus, mineral bioaccessibility analysis should be performed by using in vitro method, which requires lower cost and shorter duration, and also showed a high correlation with in vivo data (3). This study aimed to analyze Fe and Zn compositions and in vitro bioaccessibilities of four RUTF formulas.

MATERIALS AND METHODS

This study analysed 4 formulas (Table I) that were selected according to the acceptance sensory test from 8 formulas (1). The raw flours (rice, soybean, and mungbean) were drum-dried at 120°C, 36 rpm, then milled and sieved using 80 mesh. The cooked flours were mixed with other ingredients until the mixture achieved paste-like consistency. The paste RUTF was then pumped into the wafer roll with a ratio of paste:wafer roll of 11:3 g (1). Using Atomic Absorption Spectroscopy, the samples were then analysed for Fe and Zn contents. Mineral bioaccessibilities for Fe and Zn were analysed in vitro using simulated digestion fluids to resemble the oral, gastric, and intestinal phases of the human digestive system and compared the mineral contents in supernatant from the digested sample with the total mineral from the initial sample (3). Data analysis was performed by One-way ANOVA and followed by Tukey's Test for the significant result ($p<0.05$).

Table I: Ingredients composition of RUTF Formulas

Ingredients	RUTF			
	Milk	Fish	Legumes	Soy & Fish
Soy flour (%)	0.00	0.00	31.90	24.00
Mung bean flour (%)	0.00	0.00	5.00	0.00
Whole milk powder (%)	29.50	0.00	0.00	0.00
Skim milk powder (%)	15.00	0.00	0.00	0.00
Fish flour (%)	0.00	13.60	0.00	9.00
Other ingredients	54.50	86.40	63.10	67.00

RESULTS AND DISCUSSION

All of the RUTF formulas had comparable Fe content with the standard, except Milk-based RUTF, which had slightly lower Fe content. The slightly lower Zn contents were observed in all RUTF formulas compared to the standard, with the lowest amount found in Milk-based RUTF (Table II). The lower Fe and Zn content in Milk-based RUTF could be resulted from the less homogenous paste due to the dense texture of Milk-based RUTF before

Table II: Mineral compositions and bioaccessibility of RUTF Formulas

RUTF	Mineral content (mg/100g)		Mineral bioaksesibility (%)	
	Fe	Zn	Fe	Zn
Milk	9.48±0.11^{d}	9.73±0.19^{b}	60.08±0.59^{a}	72.93±0.62^{a}
Legumes	12.55±1.12^{a}	10.53±1.17^{a}	53.71±0.45^{c}	66.23±0.64^{c}
Fish	10.21±1.01^{c}	10.40±0.64^{a}	57.47±0.59^{b}	68.43±0.67^{bc}
Soy & Fish	11.63±0.85^{b}	10.70±1.18^{a}	58.55±0.62^{b}	68.43±0.36^{b}
Standard*	10.00-14.00	11.00-14.00	-	-

Note: Data were derived from 3 replicates and displayed as mean ± deviation standard
Values with different superscript letters within a column described significantly different (p-value≤0.05)
* Standard based on Joint FAO/WHO/UNICEF Food Standards Programme (2019)

mixing. Reducing rice flour and increasing coconut oil could improve the texture and homogeneity of this RUTF. By increasing the percentage, the modification of vitamin and mineral premix could improve mineral contents in all RUTF formulas to achieve the standard specifications.

A higher *in vitro* Fe and Zn bioaccessibilities were identified in Milk-based RUTF. The casein phosphopeptides (CCPs) produced from the digestion of casein in milk provide the binding site for divalent minerals like calcium, iron, and zinc, therefore increasing their bioaccessibilities (4). This study demonstrated relatively high in vitro minerals bioaccessibility with more than 50% of ready-to-absorb minerals, even though all the RUTF formulas used plant-based ingredients, such as rice flour and peanut. Incorporating vitamin and mineral premix could improve mineral bioaccessibility due to the high solubility of the decomposed form of minerals. Besides, vitamin C in premix could protect minerals from oxidation during digestion process (5). Because there is a tendency for further decrease of mineral contents during the absorption process, the bioaccessibility of RUTF should be improved by increasing the premix and conducting a pre-treatment process for plant-based ingredients.

CONCLUSION

The locally-available ingredients had the potential to be used in the formulation of RUTF that provides sufficient iron and zinc contents. More than 50% of these minerals are ready-to-absorb. The improvements are needed to increase the mineral bioaccessibility of the product by ingredients and premix modifications.

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EXTENDED ABSTRACT

Potentials of Modified *Beneng* Taro (*Xanthosoma undipes K.Koch*) Flour as an Alternative Functional Food Ingredient

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SUMMARY

Beneng taro is an Indonesian tuber with high starch and fiber, which has the potential to be turned into modified flour. This study aimed to analyze the physical characteristics and yield processing of modified *Beneng* taro flour. Tuber of 1.5 years old was used, and it was soaked and fermented to produce modified flour. The fermentation process helped to produce more refined and whiter flour, but the yield of modified *Beneng* taro flour fermentation with a starter was not different from the one with a starter. So, beneng taro is a potential material for alternative functional food ingredients.

Keywords: *Beneng* taro, Fermentation, Local tuber, Modified flour, Functional food ingredients

INTRODUCTION

High consumption of wheat flour and imports of wheat in Indonesia can have a negative impact on food and nutrition security. The development of food products is expected not only to satisfy appetite, but also meet nutritional needs and play a role in disease prevention. One of the Ingredients have nutritional value and health benefits is *Beneng* Taro. *Beneng* taro (*Xanthosoma undipes K.Koch*) is a local tuber in Indonesia that is reported to have the highest nutritional content compared to other types of taro, such as protein and fiber content (1). Based on previous studies, taro contains higher fiber and resistant starch than wheat and rice (2). This study aims to analyze the physical characteristics (whiter and crumbly texture) and yield processing of *beneng* taro flour modified through a fermentation process with and without the addition of a starter.

MATERIALS AND METHODS

Beneng taro of 1.5 year was used. Raw tuber was peeled, sliced at 1-2 mm, washed, and soaked with 10% NaCl for 120 min. After soaking, sliced tubers were rinsed before the fermentation process for 18h in anaerobic conditions (±25°C). One fermented sample was not given starting inoculum, and another was added with starting inoculum containing *L.plantarum* prepared in a solution of 4 g/L per kg of tubers. After fermentation, the tubers were dried for 6h at 60°C in a cabinet dryer. After being dried, the tuber was crushed with a pin-disc mill and sieved at an 80 mesh. An unfermented sample was used as a control. All experiments were conducted in triplicate, and data were presented as mean ± SD. One-way ANOVA was used to evaluate statistical significance, and Tukey was used to examine differences ($P<0.05$). Meanwhile, the analysis of color and fragile texture used descriptive tests.

RESULTS AND DISCUSSION

The analysis showed that the fermented beneng taro with and without starting inoculum showed better physical characteristics than an unfermented sample, with a more fragile texture (Fig.1) and whiter color of flour (Fig.2). Fragile texture due to the fermentation process starch degradation by microorganisms decreases the ability of the material to hold water. Thus, more bound water is released, resulting in the material's texture becoming soft, porous, and more fragile (3).

The color of beneng taro flour with fermentation treatment tends to be whiter than unfermented

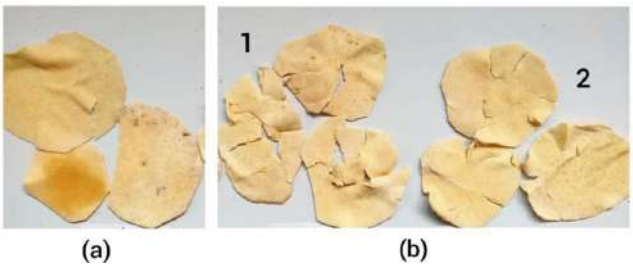

Fig.1: Beneng taro tuber (a) after soaking NaCl; (b) after fermentation (1) with starter; (2) without starter

Fig.2: Beneng taro flour (a) Unfermented ; (b) Fermented with starter; (c) Fermented without a starter.

treatment. The color change in this flour indicates that the fermentation process causes the pigments in the taro tubers, especially the carotenoid pigments of beneng taro, to be damaged so that they dissolve in water. This is due to the acidic conditions during the fermentation process causing oxidation and degradation of carotene so that the color of the food material changes. The stability of carotenoids is similar to that of vitamin A, which is sensitive to oxygen, light, and acidic conditions (4).

Based on table I, the yield of each stage of making beneng taro flour from drying to sifting was not significantly different. Yield measurement aims to determine the efficiency level of the beneng taro flour process. Fermented and unfermented treatments did not show any significant difference. However, the yield of beneng taro flour through the fermentation process had a higher value because the fermentation process makes the tuber texture more fragile, thus facilitating milling. During the fermentation process, microorganisms produce cellulase enzymes that can increase fibrillation, where dietary fiber, whose component is hemicellulose, can be degraded. This causes the texture of taro chips to become softer and fragile so that they can reach the desired degree of milling with a smaller percentage of material left behind and higher yields (5).

Table I: Yield from the process of making Taro Beneng flour

Yield (%)	Treatment		
	Unfermented	Fermented without starter	Fermented with starter
After Drying (%)	18.81±2.79[a]	19.99±0.78[a]	19.79±0.45[a]
After Milling (%)	93.54±1.36[a]	96.11±0.15[a]	93.11±1.84[a]
After Sieving (%)	95.22±1.83[a]	96.30±0.95[a]	97.18±1.43[a]

*Different letter shows significantly different ($p<0.05$)

CONCLUSION

This research shows that the fermentation process produces fragile texture tubers, the color of the flour tends to be whiter, and the yield is higher than the unfermented process (96.30-97.18%), respectively. This study shows that beneng taro can be a potential material for an alternative functional food ingredient.

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EXTENDED ABSTRACT

Antioxidant Activity and Mineral Content of Pohpohan (*Pilea trinervia*) Nori with Yam (*Dioscorea alata*) Starch and Carrageenan

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SUMMARY

Pohpohan leaf has the potential to be used as a raw material for nori. However, it has not been fully characterized. Adding yam starch and carrageenan improves the physicochemical and functional characteristics, including antioxidant activity and mineral content. The effect of pohpohan nori with yam starch and carrageenan for antioxidant activity was measured by DPPH, and mineral content was analyzed using SEM-EDX. The results showed that the pohpohan nori has an antioxidant activity between 101.66-146.19 ppm with moderate intensity, and the minerals consist of Na, Mg, S, Cl, K, Ca, and Cu as an active substances for health.

Keywords: Antioxidant, Carrageenan, Minerals, Pohpohan nori, Yam starch

INTRODUCTION

Nori has an umami taste and compact texture. It also contains various healthy nutrients (1). However, the raw material of nori, which is red seaweed Porphyra, is difficult to obtain in the tropics (2). The nori development from local material like pohpohan leaf can be a new solution with potential antioxidant activity, a variety of minerals, and high crude fibre similar to the functional characteristics of general nori (3). Besides, yam starch and carrageenan as hydrocolloid components can affect bioactive substances in nori products. Hydrocolloids components have many hydroxyl groups that form branched chains in a three-dimensional matrix to shield and defend the functionally active substances (4), such as antioxidant activity and mineral components. This study aimed to analyze the antioxidant activity and composition of minerals from pohpohan nori with yam starch and carrageenan.

MATERIALS AND METHODS

The experimental design of pohpohan nori used a factorial Completely Randomized Design (CRD) with a ratio of pohpohan leaves and yam starch (90:10, 80:20, 70:30) and different carrageenan concentrations (2% and 3%), so that six treatments with four replications into twenty-four treatment units were obtained. Pohpohan leaves were sorted, weighted, washed, blanched at 80°C for 3 minutes, and mashed. The pohpohan porridges were mixed with yam starch and carrageenan according to formulations and other ingredients were added for seasoning. The nori dough was formed on a fibre baking sheet and then dried in an oven at 80°C for 120 minutes. The functional properties of pohpohan nori for antioxidant activity were measured by 2,2-diphenyllpicrylhydrazyl (DPPH) method with Spectofotometer UV-Vis. The morphology profile was seen from Scanning Electron Microscope (SEM) images and the mineral contents were analyzed using Energy Dispersive X-ray (EDX) method.

RESULTS AND DISCUSSION

Pohpohan nori from all formulations has IC_{50} values between 101.66-146.19 ppm. This value is in the range of 100-150 ppm, showing that the antioxidant activity is at moderate intensity compared to the antioxidant activity of BHT which is higher because it has an IC_{50} value of less than 100 ppm. Pohpohan nori with lower substitution of yam starch and higher addition of carrageenan had the lowest IC_{50} value indicating the strongest antioxidant activity. Yam starch decreased along with the increase in the composition of pohpohan leaf that has high antioxidant activity, compared to yam starch with low antioxidant activity because the processing of yam separates most of the starch and few other nutrients so that the bioactive compound can only defend antioxidant activity. Carrageenan is an encapsulant that can coat the bioactive components and

Table I: The antioxidant activity with IC50 value

Treatment (Yam starch+Carrageenan)	IC50 value (ppm)
P(90:10)+K(2%)	107.76
P(90:10)+K(3%)	101.66
P(80:20)+K(2%)	132.88
P(80:20)+K(3%)	125.97
P(70:30)+K(2%)	146.19
P(70:30)+K(3%)	142.96

shield the antioxidant activity.

The SEM results on the nori pohpohan microstructure showed the distribution of scattered granules on the nori surface sheet. This is possible due to the addition of similar ingredients in all treatments such as starch and carrageenan. The EDX result indicated the mineral contents of pohpohan nori, which are Carbon (C) and Oxygen (O2) as macronutrients, also micro-minerals Magnesium (Mg), Sodium (Na), Potassium (K), Chloride (Cl), Calcium (Ca), and Cuprum (Cu). The minerals function as antioxidants and immunity boosters, such as Magnesium for energy production, oxidative phosphorylation, and glycolysis process; Sodium and Potassium to maintain nerve irritability and pH balance; Calcium can increase the amount of collagen and induce bone flexibility.

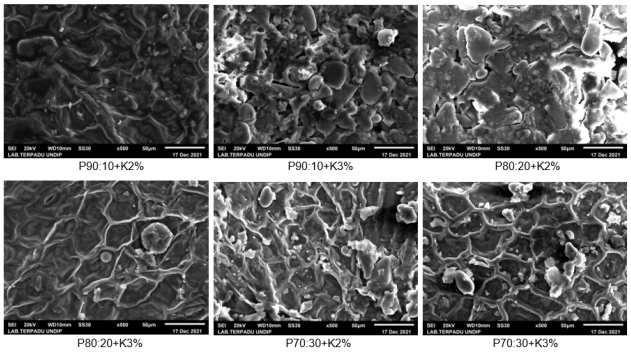

Fig. 1: The nori morphology with SEM images through 500x magnification

Table II: The mineral content with EDX method

Treatment (Yam starch+Carrageenan)	Mineral Content (%)								
	C	O	Na	Mg	S	Cl	K	Ca	Cu
P(90:10)+K(2%)	52.79	41.64	1.43	0.10	0.25	1.97	0.70	1.03	-
P(90:10)+K(3%)	51.59	41.45	0.91	0.06	0.19	1.78	0.57	1.47	0.31
P(80:20)+K(2%)	54.20	40.77	1.10	0.06	0.21	1.90	0.69	0.79	0.26
P(80:20)+K(3%)	50.53	40.42	1.98	0.10	0.32	3.53	1.40	1.03	0.54
P(70:30)+K(2%)	59.14	32.40	1.84	0.08	0.26	2.51	1.12	0.68	0.47
P(70:30)+K(3%)	56.60	33.91	2.00	0.11	0.24	3.17	1.30	0.87	0.45

CONCLUSION

In conclusion, the functional characteristics of pohpohan nori with yam starch and carrageenan are based on antioxidant activity and mineral content. The antioxidant activity has an IC_{50} value indicating antioxidant activity with moderate intensity, and the mineral composition contains Na, Mg, S, Cl, K, Ca, and Cu elements.

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EXTENDED ABSTRACT

Proximate Composition and Calcium Content of Adlai (*Coix lacryma-jobi* L.)- Pili (*Canarium ovatum* L.) Drink

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SUMMARY

The development of indigenous plant-based drink is one of the fastest emerging trends in functional food product development. The study aims to develop a drink from Adlai (*Coix lacryma-jobi* L.) and Pili (*Canarium ovatum* L.). The adlai grain and pili nut were processed into a blend. Their proximate composition as well as calcium content were analyzed following the AOAC (2000) and the dry ash extraction method, and inductively coupled plasma optical emission spectrometry, respectively. The adlai-pili blend showed lower proximate composition and calcium content than commercial plant-based drinks. Its potential to be a substitute sustainable drink warrants further investigation.

Keywords: Adlai, Pili, Plant-based drink alternatives, Processing

INTRODUCTION

Adlai, also known as Job's tears because of its tear-shaped grains, has been acknowledge as the new alternative food source while Pili nut is native in the Philippines with seventy-five know species. The development of a drink from indigenous raw materials like adlai and pili will maximize its utilization and induce the consumption of functional food in the country. Thus, the study aimed to develop a potential substitute drink that is sustainable from Adlai (*Coix lacryma-jobi* L.) and Pili (*Canarium ovatum* L.).

MATERIALS AND METHODS

The recipe drink was adopted from local cereal-based beverages with some modifications. The adlai grains were thoroughly rinsed and cooked in a 1:2 cup adlai to water ratio. Then, the cooked adlai was liquidized using a high-speed blender with a 1:3 cup cooked adlai to water ratio. The liquidized adlai was then strained twice through a steamed cheesecloth. Meanwhile, the pili nuts were rinsed and dried with a kitchen paper, and liquidized with a 1:3 cup pili nut to water ratio. The mixture was also strained twice. The freshly produced 50:50 adlai drink and pili nut drink with 10% sweetener was pasteurized using a pressure cooker at 72°C for 15 seconds and stored in sterilized bottles at 4°C prior to analysis. The proximate analysis was conducted based on AOAC official methods, 17th edition (2000). The calcium content was determined by dry ash extraction method and acid digestion ICP-OES.

RESULTS AND DISCUSSION

When compared to almond-soybean and red rice blends, the adlai-pili drink exhibited a higher moisture content compared to almond-soybean drink with a difference of 6.45%. Meanwhile, it was observed to have a lower moisture content by 13.28% with red rice drink (Table I).

The crude protein analysis showed an amount of 0.45% in adlai-pili drink which was significantly lower compared to almond-soybean drink but was relatively higher compared to red rice blend. The same pattern was observed with the total fat content of the adlai-pili drink. The ash content of adlai-pili drink (0.11%) when compared with the adlai drink and red rice blend showed a relatively higher content with 0.09% and 0.04% difference, respectively. The total carbohydrates of the adlai-pili drink were measured at 13.18%. The calcium content of the adlai-pili drink was measured at 8.65 mg/100g which was lower compared to almond-soybean blend and to the adlai grain and pili kernel. Given these results, it may be deduced that the processing of the adlai grain and the pili kernel relatively reduced its total fat, total carbohydrate, ash and calcium contents. It may have resulted from the shear stress undergone by the raw materials during processing as well as the denaturation of specific compounds mainly

Table I: Nutrient content of Adlai-Pili drink in comparison with other cow's milk alternatives and adlai grain and pili kernel.

Parameters	Adlai-Pili Drink	Adlai Drink[1]	Adlai Grain[4]	Pili Kernel[5]	Almond-Soybean Drink[2]	Red Rice Drink[3]
Moisture, g/100g	84.73	86.1	12.00	6.14	78.29	98.01
Protein (N x 6.25), g/100g	0.45	ND	12.80	3.94	2.44	0.13
Total Fat, g/100g	1.53	ND	1.00	12.77	7.10	0.71
Ash, g/100g	0.11	0.02	0.20	6.52	2.37	0.07
Total Carbohydrate, g/100g	13.18	13.9	73.90	65.91	9.81	1.07
Calcium, mg/100g	8.65	ND	25.00	230.00	12.73	ND

[1]Manning C.J., Navarro R.G.,& Cruz, C.O. (2017)
[2]Kundu P., Dhankhar J.,& Sharma A. (2018)
[3]Wijaya C., & Romulo A. (2021)
[4] Vilbar T.(2014)
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protein during the boiling step.

CONCLUSION

The developed adlai-pili drink blend with a ratio of 50:50 had lower proximate composition and calcium compared with unprocessed grains and kernels and also with commercial plant-based drinks.

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EXTENDED ABSTRACT

Nutrient Content, Carbohydrate Profile, And *In Vitro* Glycemic Index Of Giant Swamp Taro [*Cyrtosperma Merkusii (Hassk.) Schott*]

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SUMMARY

Giant swamp taro is an underutilized root crop in the Philippines. The nutrient content, carbohydrate profile, and in vitro digestibility of starch of cultivated and wild varieties of giant swamp taro were determined in this study. Boiled giant swamp taro of cultivated and wild varieties has energy contents of 377.29 and 385.67 kcal, respectively. The cultivated taro flour showed a significantly higher amounts of amylose, dietary fiber and resistant starch compared to the wild variety. The glycemic index of the flour from the two varieties were classified as intermediate.

Keywords: Carbohydrate profile, Giant swamp taro, Glycemic index, Underutilized root crop

INTRODUCTION

The remarkable increase in the spread of degenerative diseases and other nutrition- related disorders have driven consumers' interest in healthy food items. Giant swamp taro is an indigenous root crop in the Philippines that has a promising nutritional and health benefits. Starchy roots and tuber crops play a vital role in the human diet. The nutritional value of the crops lies in their ability to provide one of the cheapest sources of dietary energy in the form of carbohydrate and good sources of dietary fiber. In developing countries, they provide 9% of the total calorie intake (3). This study aimed to provide information on the nutritional and carbohydrate profile and other potential health values of the cultivated and wild varieties of giant swamp taro grown in Catanduanes. Furthermore, this is beneficial in establishing data on the important benefits of this underutilized root crop.

MATERIALS AND METHODS

The raw, boiled and floured forms of the two varieties of giant swamp taro corms were chemically analyzed. The nutrient contents were determined following the AOAC, 1980. Starch content and amylose were determined using the anthrone method and the amylose content using a colorimetric assay, respectively. The amylopectin was obtained by difference (% amylopectin = total starch % - amylose %). The quantification of the resistant starch and dietary fiber was done using the Resistant Starch Assay and Total Dietary Fiber Assay Procedure by Megazyme, respectively. A spectrophotometer was used to read the prepared samples. The total dietary fiber was determined using the enzymatic-gravimetric method with the total dietary fiber assay kit of Sigma-Aldrich, Inc. The kinetics of in vitro starch digestion was followed by a nonlinear model. ANOVA and LSD were used to analyze the data and statistical tests were performed at 5% level of significance.

RESULTS AND DISCUSSION

Boiled giant swamp taro of cultivated and wild varieties has energy contents of 377.29 and 385.67 kcal, respectively. The raw wild variety (54.75 µg/100g) had significantly higher beta – carotene content than the raw cultivated variety (35.37 µg/100g). The boiled cultivated variety (23.53 µg/100g) had lower beta – carotene content than the boiled wild variety (45.06 µg/100g). The floured form of the wild variety had 45.06 µg/100g while the cultivated variety had 33.09 µg/100g beta – carotene content. The heat treatments undergone by the giant swamp taro could have caused the observed reduction in the beta-carotene contents of both boiled and floured samples. The raw wild and cultivated varieties had

81.21% and 80.29% starch, respectively. Upon boiling, an increase in the starch content was observed in both varieties. The boiled cultivated variety (83.23%) had significantly higher starch content than the boiled wild variety (81.08%). The floured cultivated variety had 82.60% starch content and the floured wild variety had 81.08% (Table I). As in its raw form, higher and lower amounts of amylopectin and amylose were found in the wild compared to the cultivated variety. The boiled and floured cultivated variety measured significantly higher amounts of amylose than the processed products from a wild variety.

Boiling increased the dietary fiber of the cultivated variety from 4.14% to 4.82% but the fiber decreased in the wild variety. The flour from wild variety (4.71) had significantly higher dietary fiber content than the flour made from the cultivated variety (4.38%) (Table II). Boiling increased the resistant starch of the cultivated variety from 1.66% to 2.27% but decreased in the wild variety from 2.12% to 1.89%. The glycemic index of the flour from the two varieties was classified as intermediate (Table III).

CONCLUSION

The findings indicate that giant swamp taro can be a good source of nutrients with significantly higher amount of amylose, dietary fiber and resistant starch. Its glycemic index is classified as intermediate. This root crop is vital in attaining nutritionally balanced diet and a potential alternative staple in diabetes management.

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Table I: Starch, amylopectin and amylose content of raw, boiled and flour of giant swamp taro corm

Giant swamp taro	Starch (%)			Amylopection (%)			Amylose (%)		
	Raw	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**
Cultivated variety	80.29[a]	83.23[a]	82.60[a]	58.47[a]	59.37[a]	58.74[a]	21.95[a]	23.85[a]	23.74[a]
Wild variety	81.21[b]	81.08[b]	81.08[b]	59.02[b]	58.74[b]	58.86[a]	59.02[b]	22.34[b]	22.34[b]

*Having the same letter within the column are not significantly different at p(<0.05).

Table II: Total dietary fiber and resistant starch content of the cultivated and wild variety of giant swamp taro corm

Giant swamp taro	Total dietary fiber (%)			Resistant starch content (%)		
	Raw	**Boiled**	**Flour**	**Raw**	**Boiled**	**Flour**
Cultivated variety	4.14[a]	4.82[a]	4.38[b]	1.66[a]	2.27[a]	2.08[a]
Wild variety	4.63[b]	4.38[b]	4.71[a]	2.12[b]	1.89[b]	1.89[b]

*Having the same letter within the column are not significantly different at p(<0.05).

Table III: Glycemic index contents of the cultivated and wild variety of raw, boiled and flour of giant swamp taro corm

Giant swamp taro	Glycemic index (%)		
	Raw	**Boiled**	**Flour**
Cultivated variety	67.28[a]	64.72[b]	66.25[b]
Wild variety	74.70[b]	70.96[a]	70.98[a]

*Having the same letter within the row are not significantly different at p (<0.05).

EXTENDED ABSTRACT

Effect of Fermentation on Antioxidant Contents, Antioxidant Activity, and Mineral Contents of *Cleome gynandra* Leaves

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SUMMARY

C. gynandra provides medicinal benefits due to nutritional properties. This study aimed to determine the effect of fermentation on antioxidant properties and mineral contents of *C. gynandra*. The findings showed that fresh *C. gynandra* had the highest total phenolic content (60.44±3.14 mg GAE/g extract), followed by commercial fermented (49.48±1.88 mg GAE/g) and self-fermented (7.89±0.83 mg GAE/g). Fresh *C. gynandra* also showed the highest scavenging activity (66.01±1.14%) compared to both fermented samples. The fresh sample had the highest minerals content except sodium. Fermentation might reduce the antioxidants and minerals in *C. gynandra*.

Keywords: Antioxidant, *Cleome gynandra*, Fermentation, Mineral contents, Nutritional value

INTRODUCTION

C. gynandra is used for culinary and treating diseases (1). Besides antioxidant properties, *C. gynandra* also has anti-inflammatory and anticancer (1) properties. Every part of *C. gynandra* has different nutritional and medicinal benefits. The leaves of *C. gynandra* are found to help improve eyesight and treat diseases such as scurvy and marasmus and are also reported to treat headaches, earache, and arthritis (2). Food preservation is vital in slowing down food spoilage, especially for fresh products. Fermentation is one of the common preservation methods such as fermented *C. gynandra* is mostly consumed as food products. Simple brining, which will cause lactic acid fermentation, is usually used to ferment vegetables. However, fermentation may reduce the nutritional value of the foods. Thus, it is imperative to determine the effect of fermentation on the nutritional values of *C. gynandra*.

MATERIALS AND METHODS

Samples were collected from Kuala Pilah, Malaysia. Collectively, three samples were produced, which are fresh, self-fermented (addition of brine solution with no added vinegar), and commercial fermented (addition of vinegar) samples. The preparation of fermented samples was based on Muhialdin et al. (3). Microwave assisted extraction was carried out for the extraction method. To determine antioxidant content, total phenolic content (TPC) used Folin-Ciocalteu assay and total flavonoid content (TFC) used aluminium chloride colorimetric assay. Diphenylpicrylhydrazyl (DPPH) radical scavenging activity and β-carotene bleaching (BCB) assay were carried out for total antioxidant activity determination, and atomic absorption spectrophotometer was used for mineral content determination (4). All experiments were conducted in three independent repeats. One-way ANOVA followed by Tukey test was used for all experiments and all values with $p<0.05$ were considered significant.

RESULTS AND DISCUSSION

As shown in Table I, TPC of the *C. gynandra* samples in descending order was fresh, followed by commercial fermented and fermented. Fresh *C. gynandra* leaves had the highest TFC, followed by commercial fermented and self-fermented leaves. The TPC and TFC were markedly reduced in both fermented samples compared to fresh samples. In comparison between both fermented samples, the commercial fermented had higher antioxidant contents compared to self-fermented sample. In addition, fresh *C. gynandra* also showed the highest scavenging activity compared to both fermented samples. The BCB also showed the same trend compared between fresh and fermented samples. The decrease in TPC and TFC after fermentation was due to an increase in anaerobic bacteria that need phenolic compounds as their nutrient source for their growth (3). The reduction of TFC was due to flavonoids diffusion into the solution. They were easily diffused as they were water-soluble.

The reduction of DPPH scavenging and BCB activities in fermented samples might be due to the decrease in phenolic compounds and flavonoids. It was found that when there was higher TPC or TFC, there would be a higher antioxidant activity (4).

As shown in Table II, fresh *C. gynandra* leaves had the highest content of minerals. In contrast, the sodium content of *C. gynandra* leaves had an inverse sequence, in which fermented leaves had the highest sodium content, followed by commercial fermented leaves and fresh leaves. During fermentation, minerals such as calcium and iron in the vegetables will migrate into the fermentation liquid, and the migration becomes stable when a balance is reached (5). During fermentation, minerals such as calcium and iron in the vegetables will migrate into the fermentation liquid, and the migration becomes stable when a balance is reached.

Table I: Antioxidant content and activity of fresh, self-fermented and commercial fermented *C. gynandra* leaves

Variables	Fresh	Self-Fermented	Commercial fermented
TPC (mg GAE/g extract)	60.44±3.14^{ac}	7.89±0.83^{ab}	49.48±1.88^{bc}
TFC (mg CE/g extract)	31.34±0.44^{a}	4.41±0.44^{ab}	28.26±2.35^{b}
DPPH assay (%)	66.01±1.14^{ac}	8.66±1.04^{ab}	44.82±0.29^{bc}
BCB assay (%)	47.73±2.50^{ac}	15.98±0.37^{ab}	42.70±2.19^{bc}

Value expressed in mean±standard deviation (concentration of the samples: 1,000µg/mL). Values with different letters in the same row are significant at p<0.05

Table II: Mineral content of fresh, self-fermented and commercial fermented *C. gynandra* leaves

Variables	Fresh	Self-Fermented	Commercial fermented
Calcium (Ca) (mg/100g DW)	1719.04±12.02^{a,c}	318.19±34.58^{a,b}	1076.54±77.78^{b,c}
Iron (Fe) (mg/100g DW)	44.11±3.95^{a,c}	19.62±1.73^{a}	28.45±0.78^{c}
Magnesium (Mg) (mg/100g DW)	563.04±2.55^{a,c}	91.89±0.92^{a}	103.34±8.77^{c}
Potassium (K) (mg/100g DW)	3394.19±236.17^{a,c}	350.24±6.58^{a}	492.69±9.33^{c}
Sodium (Na) (mg/100g DW)	122.33±10.96^{a,c}	3737.68±8.49^{a,b}	2083.68±50.91^{b,c}

Value expressed in mean±standard deviation. Values with different letters in the same row are significant at p<0.05

CONCLUSION

Antioxidant capacities and mineral contents were higher in fresh samples. Fermentation would reduce the antioxidant and minerals except for sodium. Therefore, it is recommended to consume fresh *C. gynandra* leaves, but if fermented is preferred, addition of vinegar and reduction of salt content might be considered.

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EXTENDED ABSTRACT

Effect of Enzymatic Hydrolysis Time on Antioxidant Activity of Protein Hydrolysates from Sea Cucumber (*Holothuria scabra*)

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SUMMARY

In the present study, enzymatic hydrolysis was conducted to produce protein hydrolysate from sea cucumber (*Holothuria scabra*). Protein hydrolysates were successfully produced from sea cucumber body wall using alcalase at different hydrolysis time (30 to 300 min). The molecular weight distribution of sea cucumber protein hydrolysates (SCPHs) ranges from 1 to 14.2 kDa, as determined by the tricine SDS-PAGE profile. The highest value of radical-scavenging activity of 62.15% was obtained after 30 minutes of hydrolysis. The findings provide useful information concerning sea cucumber protein hydrolysates for wide range of applications, including food and pharmaceutical products.

Keywords: Alcalase, Antioxidant activity, Enzymatic hydrolysis, Sea cucumber, Sea cucumber protein hydrolysate

INTRODUCTION

Sea cucumbers are a promising source of proteins for protein hydrolysates production, which may have biological properties such as antioxidant activity (1). Various protein hydrolysates with improved biological activities have been produced from various protein sources through controlled enzymatic hydrolysis. Production of protein hydrolysates from several species of sea cucumber including *Stichopus Japonicus* (2) and *Stichopus vastus* (1) have been reported in several studies. However, limited information can be obtained on the antioxidant activity of protein hydrolysates produced from *Holothuria scabra* sea cucumber. Hence, the current work aims to examine the effect of hydrolysis time on antioxidant activity *Holothuria scabra* SCPHs.

MATERIALS AND METHODS

The *Holothuria scabra* sea cucumber was purchased from Kota Belud, Sabah, Malaysia and immediately processed in the laboratory to obtain the body wall. Mincing was performed using a high-speed grinder prior to refrigeration at -20°C until further use. Enzymatic hydrolysis of the minced product was performed with Alcalase enzyme® 2.4 L (Novo Industry, Denmark). Molecular weight distribution of the resulting SCPHs was determined using Tricine (SDS-PAGE) (3). The scavenging effects of SCPHs on 2,2-diphenyl-1-picryhydrazyl (DPPH) was determined according to Zhu et al. (4) method with slight modifications. The findings were presented as mean ± standard deviation of three independent analyses.

RESULTS AND DISCUSSION

Enzymatic hydrolysis of minced sea cucumber was performed with Alcalase at various hydrolysis times (30 - 300 min), and progress was monitored using the degree of hydrolysis (DH), as shown in Fig. 1. The initial stage of hydrolysis (30 minutes) yielded a DH value of 13.58%. As the hydrolysis time increased from 60 to 240 minutes, the hydrolysis rate gradually increased from 16.51% to 22.59%, indicating a 10% increase in hydrolysis rate per hour. The hydrolysis rate nearly reached a constant

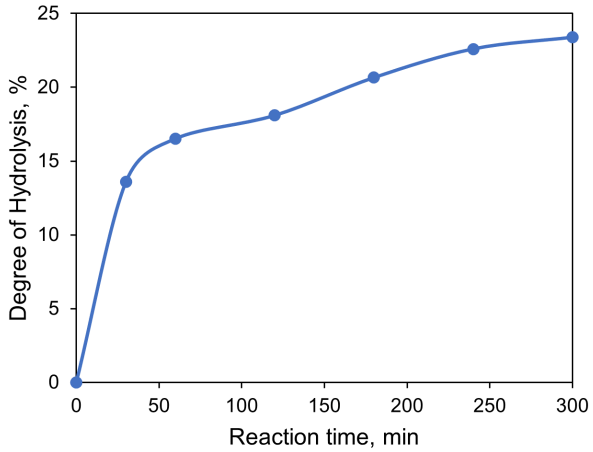

Fig. 1: Effect of hydrolysis time on the degree of hydrolysis of sea cucumber.

DH value when the enzymatic hydrolysis was carried out for 240 to 300 min.

Fig. 2 shows that the molecular weight distribution of the SCPHs is in the range of 1.06-14.20 kDa, in accordance with the finding described by Zhou et al. (2). This data indicates that enzymatic hydrolysis with Alcalase for 30 to 300 min successfully broke down the protein structure into small protein fragments that could be bioactive peptides.

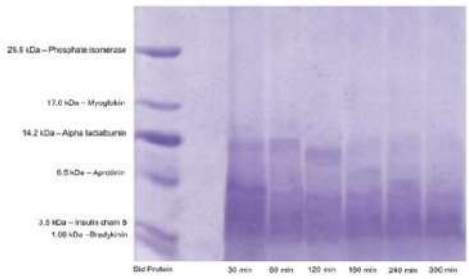

Fig. 2: SDS-PAGE of sea SCPHs at different hydrolysis time

SCPHs produced at different hydrolysis durations were examined for their antioxidant activity using the DPPH radical scavenging assay (Fig. 3). The highest activity (62.15%) was found in hydrolysates produced at 30 min. As the hydrolysis time increased from 60 to 300 minutes, the DPPH radical scavenging activity of

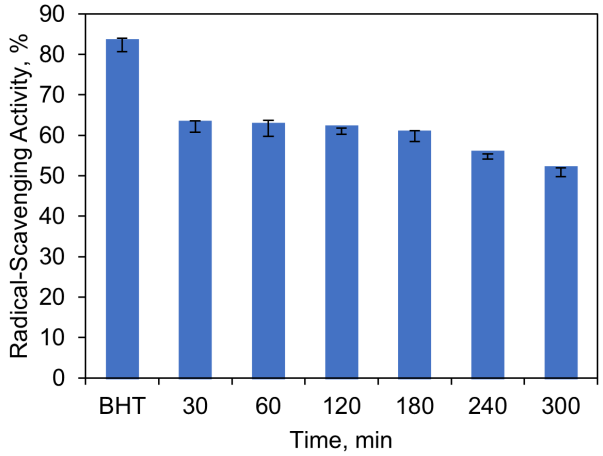

Fig. 3: Radical-scavenging activity of SCPHs produced at different hydrolysis time

SCPHs decreased from 61.60% to 50.86%. Antioxidant properties of peptides are largely determined by the amino acid composition, structure, and molecular weight distributions. This could be associated with the protease specificity on substrate, which alter the size, free amino acid composition, and amino acid sequences of peptides (2).

CONCLUSION

Protein hydrolysate can be prepared from sea cucumber (*Holothuria scabra*) through enzymatic hydrolysis with Alcalase. SCPHs with molecular sizes less than 14.2 kDa have a significant effect on antioxidant activity. The shorter hydrolysis time (30 min) produces peptides with high radical scavenging activity.

ACKNOWLEDGEMENT

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EXTENDED ABSTRACT

Cold-sterilized Coconut Water Improves the Rehydration and Recovery of Female Adolescent Futsal Athletes in Bogor, Indonesia

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SUMMARY

Cold sterilization using ultrafiltration and ultraviolet extends coconut water's shelf life while preserving nutritional and organoleptic properties. This research aims to discover the effects of cold-sterilized coconut water drinks on the rehydration of female adolescent futsal athletes (n=21, 14.7±2.1 years old). The experiment uses a cross-over design with four rehydration fluids, i.e., cold-sterilized coconut water, commercial isotonic drink, commercial coconut water, and bottled water (1-week washout period). The results show that cold-sterilized coconut water induces the best percent rehydration and rehydration index (p=0.024 and p=0.010, respectively) and better sensation. Cold-sterilized coconut water is recommendable as a rehydration fluid.

Keywords: Coconut water, Female adolescent futsal athlete, Isotonic drink, Recovery, Rehydration

INTRODUCTION

Athletes must rehydrate and replace body water and electrolyte to maintain their internal organ functions, regulate temperature, and prevent dehydration and poor competition outcomes (1). Coconut water is similar to an isotonic drink and helps rehydration and recovery as effectively as carbohydrate-electrolyte sports drinks and, therefore, is a recommended natural source for isotonic drinks (2). Ultrafiltration and ultraviolet can potentially increase its shelf life without degrading nutrient content and organoleptic quality (3). Futsal is a team sport that requires muscle strength, speed, agility, and high energy. A female adolescent futsal team based in a Public Junior High School in Bogor, Indonesia which has won many tournaments and prepared as a national team needs a rehydration protocol and is looking for a natural and effective carbohydrate-electrolyte drink. The study aimed to discover the effects of coconut water isotonic drinks from ultrafiltration and ultraviolet process on the rehydration of these athletes.

MATERIALS AND METHODS

The study used a Cross-Over, Randomized Single Blind design in administering coconut water isotonic drink obtained from ultrafiltration and ultraviolet process (IDUU), commercial isotonic drink (CID), commercial coconut water drink (CWD), and commercially bottled water (CBW), with 1-week washout periods (Fig. 1). Female adolescent futsal athletes based at Public Junior High School 3, Cibinong, Indonesia, participated (n= 21, 14.7±2.1 years old). Using portable digital tools, experts measured blood glucose (Accu-Chek Active), blood pressure and heart rate (Omron HEM 8712 Tensimeter). The rehydration percentage and index calculation used body weight and fluid volume (4). Rehydration percentage is the difference between body weight before and after exercise minus body weight two hours after rehydration, divided by the volume of fluid consumed. The rehydration index is the volume of fluid divided by the weight gain and the rehydration percentage. Data

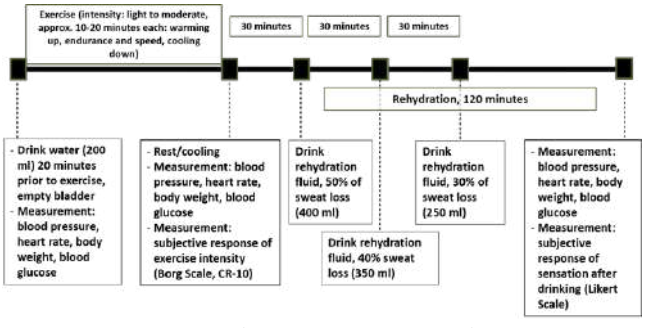

Fig. 1: Intervention and measurement procedure.

were analyzed using SPSS for Windows 17.0 for One Way Anova, followed by the Duncan Multiple Range Test (α=0.05).

RESULTS AND DISCUSSION

Subjects experienced weight loss of 300 to 1100 g (mean±SD 633±231 g), and the sweat loss rate ranged from 0.63 to 1.1 L/hour (0.62±0.24 L/hour). All rehydration fluids in the study successfully restored the subjects' body weight to the pre-exercise weight, but there was a significant difference in rehydration percentage (Table I). IDUU provided the highest rehydration percentage. A rehydration index of more than 1.00 indicates that the intervention product is less effective as a substitute for body fluids. IDUU gave the best rehydration index (closest to 1), and CBW was the least effective rehydration fluid.

There was no difference in the subjects' blood pressure and heart rate between treatments. However, IDUU resulted in high blood sugar levels and no significant difference between CID and CWD (Table II). CBW had the weakest effect. Subjects drinking IDUU and CID achieved or surpassed their pre-exercise blood sugar levels. The provision of CWD and CBW was unsuccessful in increasing the athletes' blood sugar levels after rehydration.

Although the volume of rehydration fluid was predetermined, the subjects were still asked to stop drinking if they felt they had drunk too much or felt discomfort, such as bloating or nausea, or disliked the drinks. On average, subjects consumed 997±12, 968±79, 928±144, and 743±222 ml IDUU, CID, CWD, and CBW, respectively. The palatability and acceptability of a rehydration fluid can affect the volume an athlete drinks and the level of rehydration (5). The subjects expressed no different sensation perception after drinking, i.e., relieving thirst and tiredness after exercise without feeling bloated and nauseous. However, it was easier for the subjects to drink more carbohydrate-electrolyte drinks (IDUU, CID, and CWD) than water (CBW). This finding is important if the subjects are in conditions where fluid consumption is done ad libitum (5).

Table I: Rehydration percentage and index of female adolescent futsal athletes

Parameters	Type of rehydration fluid				p
	IDUU	CID	CWD	CBW	
Rehydration percentage	84.65±13.57^{b}	81.17±16.71^{b}	81.40±19.87^{b}	64.07±23.69^{a}	0.024
Rehydration index	1.51±0.55^{a}	1.75±0.89^{a}	1.95±1.52^{a}	4.33±4.43^{b}	0.010

IDUU = cold-sterilized coconut water, CID = commercial isotonic drink, CWD= commercial coconut water drink, CBW = commercially bottled water. Different letters in the same row show significantly different at α=0.05.

Table II: The athlete's blood sugar levels before and after the rehydration period.

Blood sugar level (mg/dL)	Type of rehydration fluid				p
	IDUU	CID	CWD	CBW	
Before exercise	82±6	82±10	89±12	83±9	0.256
After exercise	89±8	86±7	88±10	88±6	0.725
After rehydration	93±8^{bc}	94±10^{c}	87±6^{ab}	83±6^{a}	0.001
Improvement after rehydration	4±13^{bc}	9±15^{c}	-1±11^{ab}	-5±6^{a}	0.012

IDUU = cold-sterilized coconut water, CID = commercial isotonic drink, CWD= commercial coconut water drink, CBW = commercially bottled water. Different letters in the same row show significantly different at α=0.05.

CONCLUSION

Cold-sterilized coconut water had similar effects on the rehydration and recovery of female adolescent futsal athletes compared to other carbohydrate-electrolyte drinks and was better than water. It received good acceptance, indicated by the volume drunk and the better sensation perception after drinking. Overall, it can be recommended as a rehydration fluid.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Nutrient Intake and Body Image Perception in Bodybuilding Athletes: A Narrative Review

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SUMMARY

Bodybuilders optimize body conditions to achieve low body fat. The aim of this study was to review the scientific literature on nutritional intake, perception of body image, and dietary supplements for bodybuilders during bulking and cutting phases. There is a decrease in nutrient consumption and the use of a hypercalorie diet as well as differences in supplements in the bulking and cutting phases. Bodybuilding athletes target to gain muscle mass and reduce body fat, and this may lead to muscle dysmorphia and eating disorders.

Keywords: Athlete, Body dissatisfaction, Bodybuilders, Nutrient intake

INTRODUCTION

Bodybuilders optimize body conditions to achieve low body fat. Often, the period of bodybuilding training is divided into bulking and cutting phases. The first phase is oriented towards increasing muscle mass and the last phase is emphasized in the weeks before the competition and is oriented towards reducing body fat. To achieve the target, bodybuilders use a combination of resistance training, extreme diet, nutritional supplements and drugs. Bodybuilders want a more muscular body shape which results in eating behavior and body dissatisfaction problems (1). The aim of this study was to review the scientific literature on nutritional intake, perception of body image, and dietary supplements for bodybuilders during bulking and cutting phases.

MATERIALS AND METHODS

This research method uses a literature narrative review from the Pubmed electronic database (last 10 years) from 2011 to the present. The keywords used to search the database were bodybuilding nutritional needs, dietary supplements, and body image perception. The type of literature review method used is descriptive. The studies included were those on nutritional intake which must be in the bulking and cutting phases in bodybuilding and body image perception in bodybuilding. Articles which discuss phases other than those mentioned and involves subjects in non-bodybuilding were excluded. Ten journals were screened and six were issued based on consideration of the research inclusion criteria.

RESULTS AND DISCUSSION

The results of research by Lenzi et al. (2) revealed a decrease in intake ($p=0.05$) from bulking to cutting including carbohydrates ($p<0.05$) while protein and almost all micronutrient intakes were well above the recommendation. The subjects in this study used protein supplements whey protein and albumin (81.2%), followed by branched-chain amino acids (BCAAs) and glutamine (68.8%), multivitamin/mineral supplements (56.3%), and omega-3 fatty acids (37.5%). These results were similar to the finding of Chappell et al. (2018), in which the total intake of carbohydrates, protein and fat decreased from the bulking phase to the cutting phase in the male ($p=0.001$) and female ($p=0.01$) groups with the use of caffeine supplements.

Devrim et al.'s (4) results of linear regression analysis predict significant eating disorders and eating disorders are relative risk factors for muscle dysmorphia and muscle-related body dissatisfaction. This result is consistent with the data reported by Santarnecchi and Dиttore (4). Bonferroni's post hoc results show that the scores associated with current and ideal body types have significant differences. There is an almost linear trend of increasing current and ideal body fat levels with decreasing levels of muscle mass.

The analysis showed that there was a decrease in nutrient intake in the bulking and cutting phases and there were differences in the types of supplements consumed by both male and female bodybuilding athletes. This is

Table I: Results of journal reviews related to bodybuilding nutrition intake in bulking phase and cutting phase

Author, date	Participants characteristics	Analysis Technique	Main Results
Lenzi et al. (2)	* 16 male competitive bodybuilding bulking (10-12 weeks before competition) and cutting (1 week before competition) * Ages 19 and 40 * Actively competes in the Men's Physique category bodybuilding championship.	Nutritional intake was assessed by three 24-hour food diaries conducted on 3 separate days (2 weekdays and 1 weekend day), facilitated by a visual aid photo album real food.	Dietary analysis revealed low carbohydrate intake during bulking, with a further decrease (at $p < 0.05$) during cutting.
Chappell et al. (3)	* 51 participants (35 male and 16 female) from The British Natural Bodybuilding Federation (BNBF)	Using a 34-item questionnaire that assessed diet at three time points.	The bodybuilder's nutritional intake is reflected in a high protein, high-carbohydrate and low fat. Total carbohydrate, protein and fat intake decreased over time in both male and female bodybuilding ($P < 0.05$).

Table II: The results of a journal review related to the relationship between body image perceptions in bodybuilders

Author, date	Participants characteristics	Analysis Technique	Main Results
Devrim et al. (4)	* 120 (competitive bodybuilding 62 people with mean age 31.0 ±10.60 years) and non-competitive 58 people (mean age 25.63±6.67 years)	* Personal information questionnaire (anthropometry and bodybuilding) * EAT-40 * MDDI * BIG (BIG O and BIG S)	The results show that eating disorder psychopathology is positively related to body dysmorphic disorder and body dissatisfaction in male bodybuilders.
Santarnecchi and Dиttore (5)	* Study 1 : 10 competitive male bodybuilders and 25 non-competitive men with at least 1 year of weightlifting experience * Study 2 : 10 male competing bodybuilders, 60 non-training subjects and 60 non-competing males	* MDDI * BIG-S * Past 15 year history questionnaire regarding muscle dysmorphia.	The severity of muscle dysmorphia was greater for competitive bodybuilders versus non-competitive bodybuilders and non-competitive controls that impact on body image dissatisfaction in competitive bodybuilding.

because bodybuilding athletes want to increase muscle mass and reduce fat (4;5). The consumption behavior of bodybuilding athletes is influenced by the presence of eating disorders (4) and muscle dysmorphia (5) which is positively related to body image perception.

CONCLUSION

There is a decrease in nutrient consumption and the use of a hypercalorie diet as well as differences in supplements in the bulking and cutting phases. Bodybuilding athletes want low fat and high muscle mass but eating disorders and muscle dysmorphia have an impact on body image perception.

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EXTENDED ABSTRACT

The Correlation of Adiposity, Energy, and Macronutrients Intake with Cardiorespiratory Fitness in Obese Male Adolescents in Bogor

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SUMMARY

Adolescence is a critical period for obesity. The purpose of this study was to analyze the correlation between body mass index (BMI), percent body fat (PBF), waist-to-hip ratio (WHR), energy and macronutrients intake and cardiorespiratory fitness (VO_2max) in obese male adolescents. This study used a cross sectional design. The subjects were 30 obese male adolescents. The results showed that there were a strong correlation between BMI and PBF with VO_2max ($p<0.05$). Obese male adolescents must pay attention from an early age to reduce BMI, PBF and WHR by doing physical activities and maintaining a balanced diet to improve cardiorespiratory fitness.

Keywords: Adolescent, BMI, Macronutrients intake, VO_2max, Waist-to-hip ratio

INTRODUCTION

Adolescence is a critical period of obesity. Obesity ranks in the top three causes of chronic health problems, becoming the biggest global public health challenge. The International Obesity Task Force (IOTF) reveals that the prevalence of overweight and obesity in adolescents is 23%. Adolescents are vulnerable to nutritional problems. The effect of obese adolescent is a strong predictor of higher mortality in later life (1). Decreased physical activity, body composition changes, and excessive food intake have an effect on the occurrence of worse obesity. Many factors can contribute to obesity including diet and physical activity (2). Male adolescents generally had higher WHR than girls. The abundance of adipocytes and poor cardiorespiratory fitness can lead to a higher risk of cardiovascular disease. Therefore, a study that analyzes the correlation between BMI, PBF, WHR and macronutrient intake with cardiorespiratory fitness in male adolescents is needed.

MATERIALS AND METHODS

This study used a cross sectional design with simple random sampling. The subjects were 30 obese male adolescents randomly selected to participate in this study. Inclusion criteria was male adolescent obese without chronic disease and exclusion criteria was respondents who do not want to sign the informed consent. Cardiorespiratory fitness (VO_2max) was measured using the 20 Meters Shuttle Run Test (MSRT) method. It is known that the 20 MSRT is a valid test for cardiorespiratory fitness in adolescents. BMI was assessed by anthropometric methods. PBF was measured by using Bioelectrical Impedance Analysis (BIA). WHR was measured by using measuring tape, and macronutrient intake using the 2x24 hour food recall method in consecutive days. The data were analyzed by Pearson correlation test after using the Shapiro-Wilk test indicating that data were normally distributed.

RESULTS AND DISCUSSION

Table I shows the characteristics of the obese male adolescents.The average of VO_2max value was very bad; the average of PBF was high. The average of WHR value≥0.90, showing the risk of obesity-related diseases and metabolic syndrome.

Table II shows a significant correlation between BMI, PBF, WHR with VO_2max ($p<0.05$). There is no correlation between macronutrient intake and VO_2max. The correlation between variables showed that the higher the BMI, PBF, WHR had lower the VO_2max. The study showed a significant negative correlation between BMI and VO_2max. Excess body fat puts an unfavorable burden on heart function and oxygen to working muscles. Cardiorespiratory fitness is very low in adolescents with increased body fat being a contributing factor to comorbidities in the elderly (3). The results of a

study on young adults in Odisha, India showed a weak negative correlation between BMI and VO_2max and a strong negative correlation between PBF and VO_2max (4). The correlation of WHR to cardiorespiratory fitness showed a negative correlation between WHR and VO_2max (5). There is no correlation between intake of macronutrients and cardiorespiratory fitness which might due to the use of food recall method only in 2 consecutive days.

Table I: Descriptive characteristics of subjects (n=30)

Variables	Average ± SD
Age (year)	18.33±0.47
VO_2max (ml/kg/min)	33.44±3.01
Height (cm)	168.30±5.89
Body Weight (kg)	81.64±8.61
BMI (kg/m^2)	28.80±2.55
PBF (%)	25.80±3.75
Waist circumference (cm)	95.46±6.64
Hip circumference (cm)	105.08±5.09
WHR	0.90±0.38
Energy (kkal)	2334.80±239.87
Protein (g)	60.47±13.64
Fat (g)	117.71±25.92
Carbohydrate (g)	261.57±45.80

Table II: The results of the Pearson correlation test on BMI, PBF, WHR, and macronutrient intake with VO_2max

Variables	VO_2max
BMI	p=0.000* r=-0.856
PBF	p=0.000* r=-0.644
WHR	p=0.008* r=-0.472
Energy	p=0.643 r=-0.880
Protein	p=0.165 r=-0.260
Fat	p=0.435 r=0.148
Carbohydrate	p=0.192 r=0.192

*significant at α<0.05
BMI=Body Mass Index; PBF= Percent Body Fat; WHR=Waist-to-Hip Ratio.

CONCLUSION

There is a significant correlation between BMI, PBF, WHR, and VO_2max. However, no correlation between energy and macronutrients intake with VO_2max. Obese male adolescents must reduce BMI, PBF and WHR by doing physical activities and maintaining a balanced diet to improve cardiorespiratory fitness.

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EXTENDED ABSTRACT

Body Composition and Body Satisfaction of the Bodybuilding and Physique Sports from Bangkok Sports

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SUMMARY

Nowadays, there are few studies on bodybuilding and physique sports in Thailand. We were inspired to explore athletes' exposures associated with eating behaviors and body satisfaction. This observational study recruited twenty-three male bodybuilders and evaluated their anthropometry, muscle mass, bone mass, resting metabolic rate (RMR), and eating attitudes using standard methods. The study shows that bodybuilding's beginning age and period of training and dieting affected eating problem behaviors. The high-body image dissatisfaction group had a high-fat percentage and a lower RMR. The study may explain mind and body status to improve awareness of health issues in Thai bodybuilders.

Keywords: Body build, Body image dissatisfaction, Calorimetry, DXA scan, Eating behavior

INTRODUCTION

The bodybuilding and physique sports study in the free-living condition is almost unavailable, and there is limited data in Thailand. The goal of bodybuilding is to get rid of body fat mass as much as possible to make a high-definition body skin of vascularly and striped huge muscles even if they are at risk of unhealthy body and mind (1). This research aimed to describe the data on a workout routine, anthropometry, resting metabolic rate that might be associated with eating behaviors, and body satisfaction which described the relationship between mind and body status to improve health issues awareness.

MATERIALS AND METHODS

Athletes would be recruited in the observational study if they were males aged 20-50, members of Bangkok's sports clubs, prepared to compete in 2022, and voluntarily signed the informed consent. The questionnaire collected sports-playing data. Anthropometry assessment used a digital scale, a portable stadiometer, a circumference measuring tape, and a dual-energy X-ray absorptiometric (DXA) scanner. Resting metabolic rate was assessed by using indirect calorimetry. At-risk eating problem behaviors was evaluated by the eating attitudes test-26 Thai version (12 scores cut-off) (2,3). The body dissatisfaction was calculated by the difference score between the actual and desired shape, compared with the seven drawing silhouettes of male bodybuilders (thinnest to the biggest body; 1 to 7 scores) (4). The results reported the mean with standard deviation, median with an interquartile range, and prevalence (95% confidence interval). The statistical analysis would use a t-test, Mann-Whitney U, and Chi-square (α=0.05, 2-sided).

RESULTS AND DISCUSSION

The 23 participants were 31.00 (29.17-38.50) years old and had a training time of 696.52±291.79 min/week in the pre-competition phase in 2022. They played bodybuilding when 18 (16-22) years old for 12.48±6.75 years and participated in the first competition when 26.17±6.98 years old for 4 (0-10) years. The 43.5% of participants had received the first to the fifth position ranks; contrastingly, 26.1% had never competed before. At-risk eating problem behaviors prevalence was 39.13% (17.55-60.71%). Excessive exercise for weight loss was 13.04% (-1.85-27.93%), significantly associated with at-risk eating problem behaviors (p=0.047). The participants were dissatisfied with 83.00% (66.00-99.00%) prevalence that the actual body was less massive than the desired body. The median body dissatisfaction score was 1 (1-3). At-risk

eating problems were not associated with high body dissatisfaction (p=0.680). At-risk eating problems group had both the beginning age of bodybuilding and the duration of the training and dieting significant differences from the no-risk group (Fig.1). The body

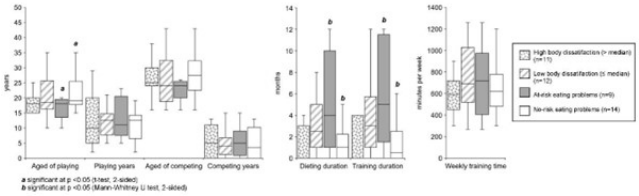

Fig. 1: The difference in playing history of bodybuilding and the 2022 competitions preparation data between the factors of body dissatisfaction and eating problem behaviors

height, weight, fat-free mass, and the circumferences of the shoulder, mid-right lower arm, and mid-right thigh significantly differ between at-risk and no-risk groups. The body fat percentages differ significantly between the high and low body dissatisfaction groups (Fig.2). The absolute resting oxygen consumption (VO2) and RMR differed significantly in the at-risk and no-risk groups. In contrast, the relative resting VO2 and RMR in the high and low dissatisfaction groups differed significantly (Fig.3). The prevalence of bone fracture history for any reason was 21.74% (3.50-39.98%). The bone mineral density Z-score of the whole body, lumbar spine, and

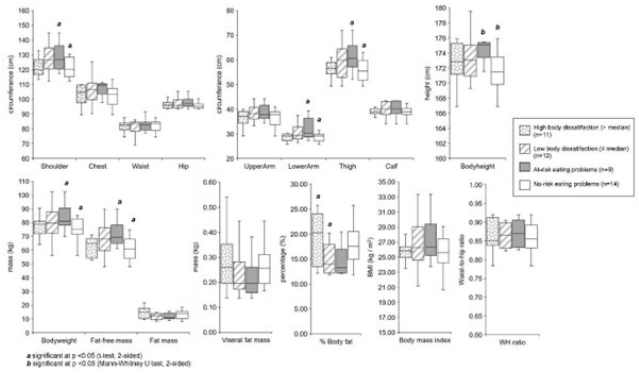

Fig. 2: The difference in anthropometric data between the factors of body dissatisfaction and eating problem behaviors

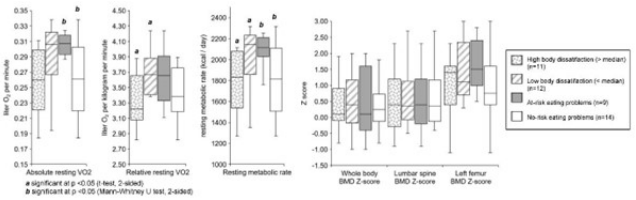

Fig. 3: The difference in resting oxygen consumption and bone mineral density Z-score between the factors of body dissatisfaction and eating problem behaviors

left proximal femur were 0.37±0.85, 0.59±0.96, and 1.22±0.94, respectively. Nevertheless, a participant had a moderate risk (-1.1 Z-score) of low bone mineral density in the femur bone.

CONCLUSION

Bodybuilding beginning age and the training and dieting duration affected eating problem behaviors with excessive exercise. The at-risk eating problems group had more massive muscles and RMR than the no-risk group, whereas the high body dissatisfaction group had higher % body fat and lower RMR than the low dissatisfaction group.

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