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Submitted Manuscripts

STATUS	ID	TITLE	CREATED	SUBMITTED
ADM: Luis Alves, Marcos	CTA-2021-0557.R2	THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER View Submission	11-Dec-2021	19-Dec-2021
<ul style="list-style-type: none"> Awaiting Reviewer Scores Awaiting EIC Decision 				

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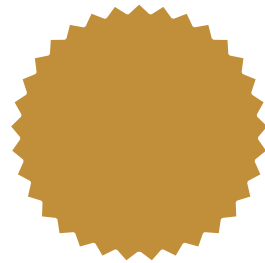
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Manuscript Title

The Addition of Gambir Catechin Extract in the Production of Functional Robusta Coffee Powder

Author(s)

Budi Santoso, Syerina Raihatul Jannah, Agus Wijaya, Aldila Din Pangawikan

Date Issued

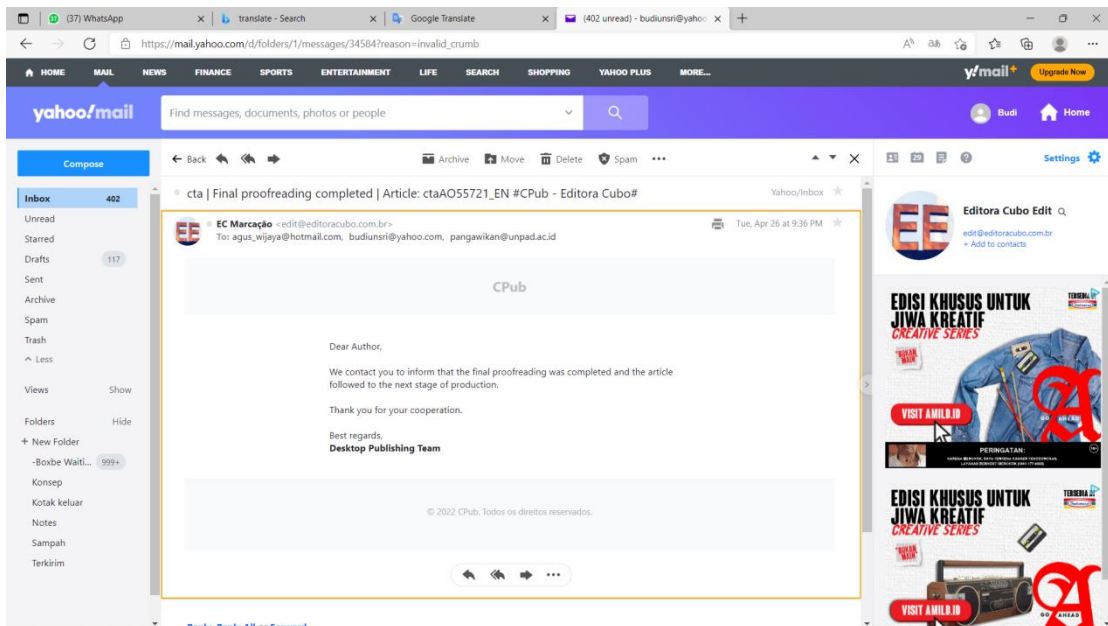
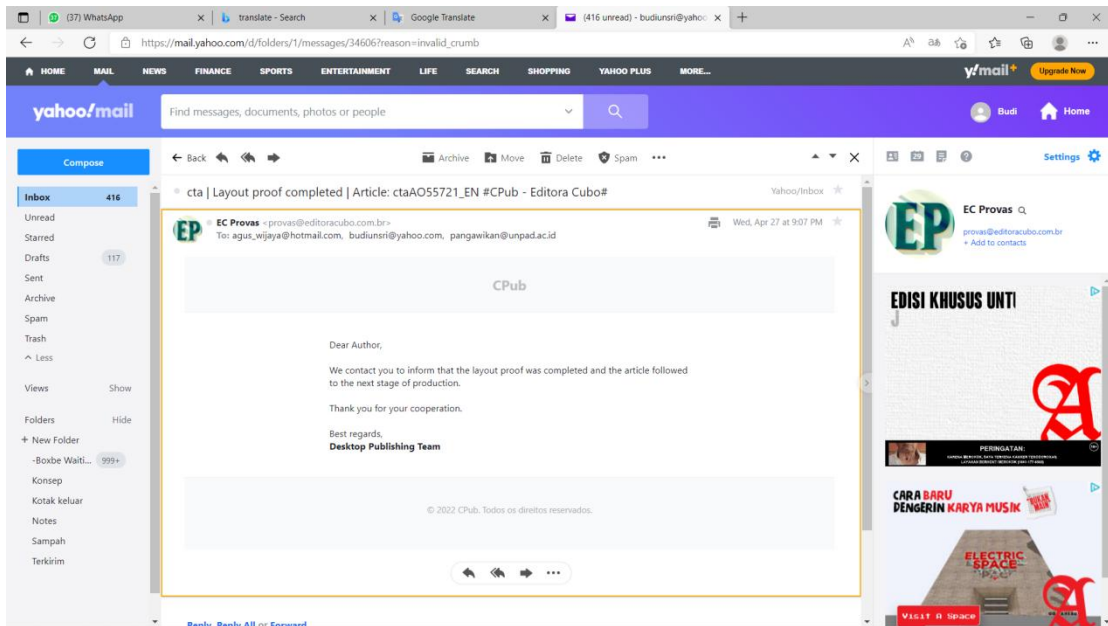
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Thu, Apr 21 at 12:07 AM

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07-Mar-2022

Dear Dr. Marcos Revista

Attached is manuscript ID CTA-2021-0557 R3

Manuscript ID: CTA-2021-0557 R3

Manuscript Type: Original Article

Manuscript Title: THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER

Corresponding Author: Dr. Budi Santoso

Submitting Author Contact Information: Dr. Santoso, Budi Palembang Palembang 30062

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07-Mar-2022

Dear Dr. Marcos Revista:

Attached is manuscript ID CTA-2021-0557.R3.

Manuscript ID: CTA-2021-0557.R3

Manuscript Type: Original Article

Manuscript Title: THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER

Corresponding Author: Dr. Budi Santoso

Submitting Author Contact Information: Dr. Santoso, Budi Palembang Palembang 30962

Submitted Date: 06-Mar-2022

Revised Date (if applicable): 23-Oct-2021, 19-Dec-2021, 06-Mar-2022

Accepted Date: 07-Mar-2022

All Author(s): Santoso, Budi; Wijaya, Agus; Pangawikan, Aldi

All Author(s) E-mail: budisunri@yahoo.com, agus_wijaya@hotmail.com, pangawikan@unsoed.ac.id

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Food Science and Technology

Decision Letter (CTA-2021-0557)

From: food@глоbo.com
To: budisunri@yahoo.com
CC:
Subject: Food Science and Technology - Decision on Manuscript ID CTA-2021-0557
Body: 05-Sep-2021

Dear Dr. Santoso:

Manuscript ID CTA-2021-0557 entitled "THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER" which you submitted to the Food Science and Technology, has been reviewed. The comments of the reviewer(s) are included at the bottom of this letter.

The reviewer(s) have recommended publication, but also suggest some revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s) comments and revise your manuscript.

To revise your manuscript, log into <https://mc04.manuscriptcentral.com/cta-scielo> and enter your Author Center, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision.

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Once again, thank you for submitting your manuscript to the Food Science and Technology and I look forward to receiving your revision.

Sincerely,
 Dr. Adriano Cruz
 Editor-in-Chief, Food Science and Technology
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Associate Editor
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Associate Editor
Comments to the Author:
REVIEWER #1:
- This manuscript reports the addition of gambir catechin extract in Robusta coffee powder to increase the functional properties based on total phenolic content, and antioxidant activity. Overall the paper is generally well written and structured. The results are clear and compelling that gambir catechin extract able to increase the total phenolic content and antioxidant activity of the coffee, without an adverse effect on the sensory properties.
- However, the study is not intensive, very basic. Results could be expected from those previous studies/ literature. The result could be predicted since catechin known as a compound which is rich in polyphenols and has as strong antioxidant properties.
- In this research catechins was produced from dry gambir extract by using ethanol as a solvent. The dry extract was mixed with ground coffee with the ratio 5% up to 20% catechin. A typical cup of brewed coffee is made using 7-10 g of coffee. This means theoretically that one serving of functional coffee contains 500 mg up to 2000 g catechin. Has the determination of ratio taken in account the safety associated with the safe doses for consumption of catechins? It is suggested to test the catechins content in gambir catechins extract.
- However the paper need to be improved. Specific comment as follows :

Introduction :
Have to improve the write up for introduction especially in the area of problem statement, state of the art and novelty of the study.
It is suggested to add more information regarding catechin from gambir extract.
It is suggested to add more information regarding to coffee mixed with other materials in order to increase the functional properties.
Materials & methods. The materials and methods not clear, not replicable, and repeatable.
The source and grade of materials used was not clear.
The test methods for phenolic content (Orac, 2006) should described clearly including the modification applied (there is no gallic acids in the materials). The test result also shall be expressed as equivalent with standard calibration used.
The test methods for antioxidants activity should be written clearly, since (Masaroh et al., 2018) is written in local languages. Moreover in the paper, they compare 3 antioxidant activity assay (DPPH, FRAP and FIC), which methods did used.
Test methods for pH should be written clearly, since Indonesia National Standards is written in local languages (bahasa).
Please add the number and the qualification or categories of the panelist which was used in sensory test.
The range of hedonic score/scale was used to narrow. Normally hedonic scale consist of 9 level.
Line 101-105, the weight of functional coffee which was used for test shall be written clearly (how many grams of functional coffee which was stirred with 250 ml of water). The information regarding the weight of coffee important to know the concentration of sample.
Result and Discussion.
On line 111 it says "the highest F1 treatment and the lowest treatment F5". This statement differ with the Figure 1, the solubility of F5 is the highest.
Line 141-143 stated "... Comply with Indonesian National standards, use international standards, use international standards.
On line 151 to 152, The total phenolic content should be expressed as equivalent with standard calibration used mg/ml, such as gallic acid equivalent (mg/ml GAE) in case the gallic acid was used as standard calibration.
On line 239 to 241 Figure 5, the legend still in bahasa please make it in English.
I suggest to cite more relevant and recent literature instead of relying on single source.
The statement at the conclusion stating that the best treatment was 80% Robusta coffee powder with 20% gambir catechin extract is not right and correct, because it is only based on the amount of total phenol and antioxidant activity, without considering other factors such as result of statistical analysis, the properties of catechin and its toxic dose.
Have to improve the references with the latest and relevant journal (most of references are in Bahasa Indonesia published more than 5 years).

REVIEWER #2:
The study aims to improve the functional properties of Robusta coffee with the addition of catechin gambir extract.
In abstract line 19: use the same reference unit, (or is one of them incorrect ?) IC50 value of 40.10 g/ml, to 583.06 µg/ml (or no increase)
Line 23 : "antioxidant activity (IC50=40.10 µg/mg), which unit is correct? According to line 184 micrograms/ml.
* Important to check all units of this text.
Line 36 coffee is a very popular drink all over the world, including Indonesia.
Why highlight only in Indonesia?
About gambir extract:
gambir catechin extract, in addition to the example in line 63 in sweet marshmallows...
is it already used in other foods? Is it ok for this word?
in which countries? explore this subject further... to understand the feasibility
Line 89: The Production of Gambir Catechin Extract.
Why does the extract have to be made with 70% ethane...? wouldn't the watery one be more suitable to be incorporated into the food? It was tested? Or incorporated the bread directly into hot water...?

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food@globo.com

REVIEWER #2:
The study aims to improve the functional properties of Robusta coffee with the addition of catechin gambir extract.
In abstract line 19: use the same reference unit, (or is one of them incorrect ?) IC50 value of 40.10 g/ml, to 583.06 µg/ml (or no increase)
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gambir catechin extract, in addition to the example in line 63 in sweet marshmallows...
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Line 89: The Production of Gambir Catechin Extract.
Why does the extract have to be made with 70% ethane...? wouldn't the watery one be more suitable to be incorporated into the food? It was tested? Or incorporated the bread directly into hot water...?
As confirmed by previous studies, line 140: "Yeni (2017) states that catechin compounds from gambir powder dissolve well in hot water"
Anyway, in general, it is interesting but needs to be revised, mainly in the units, in the world relevance of coffee consumption, and in the application of gambir in other foods.

REVIEWER #3:
The article in question does not present all the data for a full evaluation, apart from a discussion and superficial conclusion.
- It was necessary to add the type of coffee roasting used.
- The extraction method was not consistent with that mentioned, and it was not clear what the authors did after shaking for 15 seconds with a magnetic bar. Filtered?
- I didn't understand if this coffee produced was instantaneous or conventional powder for him to measure its solubility. Are you not referring to the extracted soluble solids? Without the methodology, it is difficult to assess.
- It does not mention the type of antioxidant test and makes comparisons with different methods taking into account only the IC50 result.
- Generally the hedonic scale contains an odd number of points: 1 neutral, 2 superior and 2 inferior.
- The explanation of the choice of 80:20 coffee is unfounded and was based more on sensory testing, which had no significant difference. Assessing the total phenolics and antioxidant capacity, the best content would be 90:10, despite the lower phenolic content, there was no statistical difference in the antioxidant or sensory test, in addition to using less extract, which reduces the value of the product and would provide a better value for money to the consumer.

REVIEWER #4:
The manuscript was not enough to average score, and it could be suggested to improve by major revision. There are some consideration note about the manuscript, statute at below paragraph.

General:
Functional robusta coffee powder by addition of catechin gambir is new and significant information to justify publication, but it had not yet clearly describe in this manuscript although the functional word had been stated in keywords. The manuscript introduction need to be supported by adequate state of art of functional coffee concept as well as significance of gambir catechin addition to improve it as practical application.

Method:
The method has not yet describe comprehensively. Manuscript procedure for production of gambir catechin extraction could not inform exactly the amount of catechin. It better to be classified as 'crude gambir extract'. Otherwise, if it is possible please to inform the catechin content of gambir extract by manuscript procedure. Procedure for production of functional coffee was also need to clarify the total amount (gram) of mixed coffee powder and gambir extract, compare to 250 mL of hot water, before stirred. Is it homogeneous mixed to be a unity commodity, carried out from the glass as one unique commodity (functional coffee) and then given the hot water and stirred. Otherwise, it carried from two separate glass as free individual commodity to mix in the same glass, simplified similar to sugar addition on a cup of coffee (250 mL), with the fact actually the sugar and coffee taken from separate glass. It need to clear the functional coffee is single commodity or simplified mean the procedure as a method of serving a cup of coffee by addition crude gambir extract and stirred with 250mL hot water for 15 seconds. In case of the sample preparation need to explain suitable size number/amount of sample for non-factorial completely randomized design which was used in this study with three replication, five independent variable and at least of five parameters (dependent variable). Since it was completely randomized design it's better to inform the amount or number of sample prepared to guarantee the design was properly conducted.

Method of Sensorial Test
The sensorial test method especially for hedonic test (taste, flavor, color) of functional coffee need to add information and clarification about the category of semi-trained panelist. There are not enough panelist at amount of 25 number semi-trained panelist that was classified as general consumer or not well trained panelist. Therefore please inform and clarify the term of 'semi-trained' panelist, for example: the standart and minimum qualification of panelist, type of trained had been enrolled, experience on drinking coffee or coffee tester, and other. This qualification of panelist is very important because of their guarantee for valid scoring. The hedonic score in this manuscript was primary reason to conclude the product was reject or not.

Result/Data interpretation/Discussion
The Interpretations and conclusions has not been justified enough by the results. It's need to inform the relationship or correlation of parameters measured by researcher. The relationship of pH with antioxidant activity (IC50) and total phenol need to be supported by regression equation and information of correlation coefficient value (r value). The measurement parameter and it relationship need to support by some additional relevan reference to build the concept of functional coffee by addition of gambir catechin, as well as the formulation of shape and size of coffee mixed gambir catechin.

Others / Miscellaneous
There are some word term is still written in Indonesia Lanauage such as 'warna, rasa, aroma' (manuscript line 259-261), and the term 'aroma' at many manuscript line. May be better to change the term 'aroma' with 'flavor' for representing the

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Entire Scoresheet:
Reviewer: 1
Recommendation: Major Revision

Comments:
Overall the paper is generally well written and structured. The results are clear and compelling that gambier catechin extract able to increase the total phenolic content and antioxidant activity of the coffee, without an adverse effect on the sensory properties. However the manuscript will be considered after mayor revision but reject in the present form. Please find the reviewer comment in attachment.

Additional Questions:
Does the manuscript contain new and significant information to justify publication?: Yes
Does the Abstract (Summary) clearly and accurately describe the content of the article?: Yes
Is the problem significant and concisely stated?: Yes
Are the methods described comprehensively?: No
Are the interpretations and conclusions justified by the results?: No
Is adequate reference made to other work in the field?: Yes
Length of article is: Adequate
Number of tables is: Adequate
Number of figures is: Adequate
Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable).: I have no conflict of interest

Rating:
Interest: 3. Average
Quality: 3. Average
Originality: 2. Good
Overall: 3. Average

Reviewer: 2
Recommendation: Minor Revision

Comments:
The study aims to improve the functional properties of Robusta coffee with the addition of catechin gambier extract.
In abstract line 15: use the same reference unit, (or is one of them incorrect ?) IC50 value of 40.10 g/ml to 883.06 µg/ml (or no increase)
Line 23 : "antioxidant activity (IC50=40.10 µg/mg), which unit is correct? According to line 184 micrograms/ml."
* Important to check all units of this text
Line 36 coffee is a very popular drink all over the world, including Indonesia.
Why highlight only in Indonesia?
About gambier extract:
gambier catechin extract, in addition to the example in line 63 in sweet marshmallows...
is it already used in other foods? Is it ok for this word?
in which countries? explore this subject further... to understand the feasibility
Line 89: The Production of Gambir Catechin Extract.
Line 89: The Production of Gambir Catechin Extract.

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Quality: 3. Average
Originality: 2. Good
Overall: 3. Average

Reviewer: 2
Recommendation: Minor Revision

Comments:
The study aims to improve the functional properties of Robusta coffee with the addition of catechin gambier extract.
In abstract line 15: use the same reference unit, (or is one of them incorrect ?) IC50 value of 40.10 g/ml to 883.06 µg/ml (or no increase)
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in which countries? explore this subject further... to understand the feasibility
Line 89: The Production of Gambir Catechin Extract.
Why does the extract have to be made with 70% ethanol... ? wouldn't the watery one be more suitable to be incorporated into the food? It was tested? Or incorporated the bread directly into hot water...?
As confirmed by previous studies, line 140: "Yeni (2017) states that catechin compounds from gambir powder dissolve well in hot water"
Anyway, in general, it is interesting but needs to be revised, mainly in the units, in the world relevance of coffee consumption, and in the application of gambir in other foods.

Additional Questions:
Does the manuscript contain new and significant information to justify publication?: Yes
Does the Abstract (Summary) clearly and accurately describe the content of the article?: Yes
Is the problem significant and concisely stated?: Yes
Are the methods described comprehensively?: Yes
Are the interpretations and conclusions justified by the results?: Yes
Is adequate reference made to other work in the field?: Yes
Length of article is: Adequate
Number of tables is: Adequate
Number of figures is: Adequate
Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable).: none

Rating:
Interest: 2. Good
Quality: 2. Good
Originality: 3. Average

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Reviewer: 3

Recommendation: Reject

Comments:
(There are no comments.)

Additional Questions:
Does the manuscript contain new and significant information to justify publication?: Yes
Does the Abstract (Summary) clearly and accurately describe the content of the article?: Yes
Is the problem significant and concisely stated?: No
Are the methods described comprehensively?: No
Are the interpretations and conclusions justified by the results?: No
Is adequate reference made to other work in the field?: Yes
Length of article is: Too short
Number of tables is: Adequate
Number of figures is: Adequate
Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable): none
Rating:
Interest: 4, Below Average
Quality: 5, Poor
Originality: 3, Average
Overall: 4, Below Average

Reviewer: 4

Recommendation: Major Revision

Comments:
General:
Functional robusta coffee powder by addition of catechin gambir is new and significant information to justify publication, but it had not yet clearly describe in this manuscript although the functional word had been stated in keywords. It is better supported the manuscript introduction by adequate state of art of functional coffee concept as well as its significance of gambir catechin addition to improve it as practical application.

Method:
The method has not yet describe comprehensively. Manuscript procedure for production of gambir catechin extraction could not inform exactly the amount of catechin. It's better to be classified as 'crude gambir extract'. Otherwise, if it is possible please to inform the catechin content of gambir extract by manuscript procedure. Procedure for production of functional coffee was also need to clarify the total amount (gram) of mixed coffee powder and gambir extract, compare to 250 mL of hot water, before stirred. It's need to clear, it was homogenize mixed to be a unity commodity, carried out from the glass as one unique commodity (functional coffee) and then given the hot water and stirred. Otherwise, it carried from two separate glass as free individual commodity to mix in the same glass, simplified similar to sugar addition on a cup of coffee (250 mL), with the fact actually the sugar and coffee taken from separate glass. It's better to explain the functional coffee is single commodity, or it's simplified the procedure as a method of serving a cup of coffee by addition crude gambir extract and stirred with 250mL hot water for 15 seconds. In case of the sample preparation need to explain suitable size number/amount of sample for non-factorial completely randomized design which was used in this study with three replication, five independent variable and at least five parameters (dependent variable). Since it was completely randomized design it's better to inform the amount or number of sample prepared to guarantee the design was properly conducted.

Method of Sensorial Test
The sensorial test method especially for hedonic test (taste, flavor, color) of functional coffee need to add information and clarification about the category of semi-trained panelist. There are not enough panelist at amount of 25 number semi-trained panelist. It was classified as general consumer or not well trained panelist. Therefore please inform and clarify the term of semi-trained panelist, for example: the standart and minimum qualification of panelist, type of trained that has been enrolled.

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Result/Data Interpretation/Discussion
The interpretations and conclusions has not been justified enough by the results. It's need to inform the relationship or correlation of parameters measured by researcher. The relationship of pH with antioxidant activity (IC50) and total phenol need to be supported by regression equation and information of correlation coefficient value (r value). The measurement parameter and it relationship need to support by some additional relevan reference to build the concept of functional coffee by addition of gambir catechin, as well as the formulation of shape and size of coffee mixed gambir catechin.

Others / Miscellaneous
There are some word term is still written in Indonesia Language such as 'warna, rasa, aroma' (manuscript line 259-261), and the term 'aroma' at many manuscript line. May be better to change the term 'aroma' with 'flavor' for representing the consumer preference hedonic on smelling respons.

Additional Questions:
Does the manuscript contain new and significant information to justify publication?: Yes
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Number of figures is: Adequate
Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable): None
Rating:
Interest: 3, Average
Quality: 5, Poor
Originality: 2, Good
Overall: 3, Average

Date Sent: 05-Sep-2021

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Decision Letter (CTA-2021-0557.R1)

From: adriano.cruz@ifrrj.edu.br
To: budlunsi@yahoo.com
CC:
Subject: Food Science and Technology - Decision on Manuscript ID CTA-2021-0557.R1
Body: 25-Oct-2021

Dear Dr. Santoso:

Manuscript ID CTA-2021-0557.R1 entitled "THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER" which you submitted to the Food Science and Technology, has been reviewed. The comments of the reviewer(s) are included at the bottom of this letter.

The reviewer(s) have recommended publication, but also suggest some revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s) comments and revise your manuscript.

To revise your manuscript, log into <https://mc04.manuscriptcentral.com/cta-scielo> and enter your Author Center, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision.

You may also click the below link to start the revision process (or continue the process if you have already started your revision) for your manuscript. If you use the below link you will not be required to login to ScholarOne Manuscripts.

*** PLEASE NOTE: This is a two-step process. After clicking on the link, you will be directed to a webpage to confirm. ***

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You will be unable to make your revisions on the originally submitted version of the manuscript. Instead, revise your manuscript using a word processing program and save it on your computer. Please also highlight the changes to your manuscript within the document by using the track changes mode in MS Word or by using bold or colored text.

Once the revised manuscript is prepared, you can upload it and submit it through your Author Center.

When submitting your revised manuscript, you will be able to respond to the comments made by the reviewer(s) in the space provided. You can use this space to document any changes you make to the original manuscript. In order to expedite the processing of the revised manuscript, please be as specific as possible in your response to the reviewer(s).

IMPORTANT: Your original files are available to you when you upload your revised manuscript. Please delete any redundant files before completing the submission.

Because we are trying to facilitate timely publication of manuscripts submitted to the Food Science and Technology, your revised manuscript should be submitted by 25-Dec-2021. If it is not possible for you to submit your revision by this date, we may have to consider your paper as a new submission.

Once again, thank you for submitting your manuscript to the Food Science and Technology and I look forward to receiving your revision.

Sincerely,
Dr. Adriano Cruz
Editor-in-Chief, Food Science and Technology
adriano.cruz@ifrrj.edu.br

Associate Editor
Comments to the Author:
Dear authors,

Please, provide point-by-point replies for each reviewer's comments. Without the proper reply, the reviewers are not able to check if their suggestions/corrections were considered/accepted.

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Food Science and Technology

Decision Letter (CTA-2021-0557.R2)

From: adriano.cruz@ifrrj.edu.br
To: budlunsi@yahoo.com
CC:
Subject: Food Science and Technology - Decision on Manuscript ID CTA-2021-0557.R2
Body: 15-Feb-2022

Dear Dr. Santoso:

Manuscript ID CTA-2021-0557.R2 entitled "THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER" which you submitted to the Food Science and Technology, has been reviewed. The comments of the reviewer(s) are included at the bottom of this letter.

The reviewer(s) have recommended publication, but also suggest some minor revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s) comments and revise your manuscript.

To revise your manuscript, log into <https://mc04.manuscriptcentral.com/cta-scielo> and enter your Author Center, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision.

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*** PLEASE NOTE: This is a two-step process. After clicking on the link, you will be directed to a webpage to confirm. ***

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You will be unable to make your revisions on the originally submitted version of the manuscript. Instead, revise your manuscript using a word processing program and save it on your computer. Please also highlight the changes to your manuscript within the document by using the track changes mode in MS Word or by using bold or colored text.

Once the revised manuscript is prepared, you can upload it and submit it through your Author Center.

When submitting your revised manuscript, you will be able to respond to the comments made by the reviewer(s) in the space provided. You can use this space to document any changes you make to the original manuscript. In order to expedite the processing of the revised manuscript, please be as specific as possible in your response to the reviewer(s).

IMPORTANT: Your original files are available to you when you upload your revised manuscript. Please delete any redundant files before completing the submission.

Because we are trying to facilitate timely publication of manuscripts submitted to the Food Science and Technology, your revised manuscript should be submitted by 18-Mar-2022. If it is not possible for you to submit your revision by this date, we may have to consider your paper as a new submission.

Once again, thank you for submitting your manuscript to the Food Science and Technology and I look forward to receiving your revision.

Sincerely,
Dr. Adriano Cruz
Editor-in-Chief, Food Science and Technology
adriano.cruz@ifrrj.edu.br

Associate Editor
Comments to the Author:

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adriano.cruz@frj.edu.br

Associate Editor
Comments to the Author:
REVIEWER #1: (Major Revision)
In general, the author has corrected the contents of the writing in accordance with the input given. However, these improvements have not answered critical questions related to the selection/determination of catechins concentrations in the manufacture of functional coffee and catechins content/composition of gambier catechins extract. Instead of trying to explain the reason underlying the catechins ratio, the author changed the word of "catechins" in to "crude gambier extract". This is tends to obscure the ingredient used. It is suggested to test the composition of crude gambier extract to ensure what bioactive compounds are contained.
In this paper, the author proposes to make functional coffee drinks that have antioxidant properties by adding active substances that have antioxidant properties (catechins). Adding catechins to ground coffee has been shown to increase the antioxidant activity of the coffee. This is easy to predict, because the ethanolic extract from gambier (catechins) is known to contain high phenolic compounds and antioxidant activity. The paper has not discussed the interaction between coffee and catechins on the antioxidant activity.
Moreover, in this study the concentration (ratio) of the ethanolic extract of gambier used was very high, ranging from 5% to 20%. With this ratio, a cup of coffee will contain 500mg-2000 mg of catechins (A cup of coffee is usually made from 7 to 10 grams of coffee). The dose is high enough for a daily drink. This paper has not considered the possible hazard and safety effects associated with the use of ethanolic extract from gambier as an intake in beverages.
In addition the author has changed the sensory test result data without being followed by a re-analysis the effect of treatment on the sensory properties.
Another question is Why do people have to drink coffee that is added with catechins (more expensive) , when there are other products that are known to contain catechins at a more affordable price, such as tea (Camellia sinensis (L.) Kuntze), green tea, oolong tea etc.

REVIEWER #2: (Accept)
The article has been revised. The suggestions were incorporated and became much clearer and more coherent.

REVIEWER #3: (Accept)
Shorten the part of the standard curve in the analysis of total phenolics.

REVIEWER #4: (Minor revision)
General:
It was good idea to change "catechin" gambier extract to "crude" gambier extract title. The manuscript had been improved significantly on title, introduction / state of art and method. It has been described comprehensively. Supporting reference has been added adequately and appeared on reference's list. The manuscript lead to be good quality. Minor revision was needed as stated below.

Abstract
To declare the increasing of antioxidant activity (line-18) it is suggested to state: "the antioxidant activity with an IC50 value of 583.06 to 40.10 µg/mL". The last sentence of abstract (line 21-22) is not fully justified by result of experiment. The result show that new product taste was much lower hedonic score although the color and flavor was slightly higher. It's suggested not to declare that "the antioxidant properties of functional robusta coffee also indicate an improvement based on a sensory preference of the panelists". In fact, the taste of new product was not improved by crude gambier extract.

Keywords
It is suggested to omit the word "catechin" from keyword list, or change to crude gambier extract. The word "catechin" should not be appeared on "keywords" by consideration the new title of "crude gambier extract".

Practical application
It is suggested to make clear the state of product performance as mixed powder or coffee-drink. In case on practical application (line 24-26) it is better to add the explanation the state of commodity as mixed powder contained coffee powder and crude gambier extract, or it as separately powder of coffee powder at one package and crude gambier extract on the other package and it will be mixed a minute before serve coffee drink

Discussion
The result was justified enough to compare parameter value/functional substance of the product with or without crude gambier extract. The conclusion was stated that there are significant effect of the treatment on phenol, antioxidant activity, pH and solubility. If it's possible, it would be better to add more discussion about relationship among parameters had been measured.

Others / Miscellaneous
There are more than five terms of aroma (Indonesian language) has not yet translate to standard term for hedonic sensory test. It is suggested and better to use term "flavor" or other representative standard term

Entre Scoresheet:
Reviewer: 1
Recommendation: Accept

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Entre Scoresheet:
Reviewer: 1
Recommendation: Accept

Comments:
The article has been revised. The suggestions were incorporated and became much clearer and more coherent.

Additional Questions:
Does the manuscript contain new and significant information to justify publication?: Yes
Does the Abstract (Summary) clearly and accurately describe the content of the article?: Yes
Is the problem significant and concisely stated?: Yes
Are the methods described comprehensively?: Yes
Are the interpretations and conclusions justified by the results?: Yes
Is adequate reference made to other work in the field?: Yes
Length of article is: Adequate
Number of tables is: Adequate
Number of figures is: Adequate
Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable): none

Rating:
Interest: 2, Good
Quality: 2, Good
Originality: 2, Good
Overall: 2, Good

Reviewer: 2
Recommendation: Minor Revision

Comments:
General:
It was good idea to change "catechin" gambier extract to "crude" gambier extract title. The manuscript had been improved significantly on title, introduction / state of art and method. It has been described comprehensively. Supporting reference has been added adequately and appeared on reference's list. The manuscript lead to be good quality. Minor revision was needed as stated below.

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Originality: 2. Good
Overall: 2. Good
Reviewer: 2
Recommendation: Minor Revision

Comments:
General:
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Discussion:
The result was justified enough to compare parameter value/functional substance of the product with or without crude gambier extract. The conclusion was stated that there are significant effect of the treatment on phenol, antioxidant activity, pH and solubility. If it's possible, it would be better to add more discussion about relationship among parameters had been measured.

Others / Miscellaneous:
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Is adequate reference made to other work in the field?: Yes
Length of article is: Adequate
Number of tables is: Too few
Number of figures is: Adequate
Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable): none
Rating:
Interest: 2. Good
Quality: 2. Good

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Overall: 2. Good
Reviewer: 3
Recommendation: Accept

Comments:
Deserve the methodology of solubility analysis:
Shorten the part of the standard curve in the analysis of total phenolics.

Additional Questions:
Does the manuscript contain new and significant information to justify publication?: Yes
Does the Abstract (Summary) clearly and accurately describe the content of the article?: Yes
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Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable): none
Rating:
Interest: 3. Average
Quality: 2. Good
Originality: 2. Good
Overall: 2. Good

Reviewer: 4
Recommendation: Major Revision

Comments:
In general, the author has corrected the contents of the writing in accordance with the input given. However, these improvements have not answered critical questions related to the selection/determination of catechins concentrations in the manufacture of functional coffee and catechins content/composition of gambier catechins extract. Instead of trying to explain the reason underlying the catechins ratio, the author changed the word of "catechins" in to "crude gambier extract". This is tends to obscure the ingredient used. It is suggested to test the composition of crude gambier extract to ensure what bioactive compounds are contained.
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Moreover, in this study the concentration (ratio) of the ethanol extract of gambier used was very high, ranging from 5% to 20%. With this ratio, a cup of coffee will contain 500mg-2000 mg of catechins (A cup of coffee is usually made from 7 to 10 grams of coffee). The dose is high enough for a daily drink. This paper has not considered the possible hazard and safety effects associated with the use of ethanol extract from gambier as an intake in beverages.
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Quality: 2. Good
 Originality: 2. Good
 Overall: 2. Good

Reviewer: 4
 Recommendation: Major Revision

Comments:
 In general, the author has corrected the contents of the writing in accordance with the input given. However, these improvements have not answered critical questions related to the selection/determination of catechins concentrations in the manufacture of functional coffee and catechins content/the composition of gambier catechins extract. Instead of trying to explain the reason underlying the catechins ratio, the author changed the word of "catechins" in to "crude gambier extract". This is tends to obscure the ingredient used. It is suggested to test the composition of crude gambier extract to ensure what bioactive compounds are contained.
 In this paper, the author proposes to make functional coffee drinks that have antioxidant properties by adding active substances that have antioxidant properties (catechins). Adding catechins to ground coffee has been shown to increase the antioxidant activity of the coffee. This is easy to predict, because the ethanol extract from gambier (catechins) is known to contain high phenolic compounds and antioxidant activity. The paper has not discussed the interaction between coffee and catechins on the antioxidant activity.
 Moreover, in this study the concentration (ratio) of the ethanol extract of gambier used was very high, ranging from 5% to 20%. With this ratio, a cup of coffee will contain 500mg-2000 mg of catechins (A cup of coffee is usually made from 7 to 10 grams of coffee). The dose is high enough for a daily drink. This paper has not considered the possible hazard and safety effects associated with the use of ethanol extract from gambier as an intake in beverages.
 In addition the author has changed the sensory test result data without being followed by a re-analysis the effect of treatment on the sensory properties.
 Another question is why do people have to drink coffee that is added with catechins (more expensive) , when there are other products that are known to contain catechins at a more affordable price, such as tea (Camellia sinensis (L.) Kuntze), green tea, oolong tea etc.

Additional Questions:
 Does the manuscript contain new and significant information to justify publication?: Yes
 Does the Abstract (Summary) clearly and accurately describe the content of the article?: Yes
 Is the problem significant and concisely stated?: Yes
 Are the methods described comprehensively?: Yes
 Are the interpretations and conclusions justified by the results?: No
 Is adequate reference made to other work in the field?: Yes
 Length of article is: Adequate
 Number of tables is: Adequate
 Number of figures is: Adequate
 Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable): none
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Food Science and Technology

Decision Letter (CTA-2021-0557.R3)

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CC:
Subject: Food Science and Technology - Decision on Manuscript ID CTA-2021-0557.R3
Body: 07-Mar-2022

Dear Dr. Santoso:

It is a pleasure to accept your manuscript entitled "THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER" in its current form for publication in the Food Science and Technology. The comments of the reviewer(s) who reviewed your manuscript are included at the foot of this letter.

Thank you for your fine contribution. On behalf of the Editors of the Food Science and Technology, we look forward to your continued contributions to the Journal.

Sincerely,
 Dr. Adriano Cruz
 Editor-in-Chief, Food Science and Technology
 adriano.cruz@ifrrj.edu.br

Associate Editor
 Comments to the Author:
 (There are no comments.)

Entire Scoresheet:

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Adriano Cruz <on behalf of manuscriptcentral.com>
To: budiusri@yahoo.com
Tue, Feb 15 at 5:50 PM

15-Feb-2022

Dear Dr. Santoso:

Manuscript ID CTA-2021-0557.R2 entitled "THE ADDITION OF GAMBIR CATECHIN EXTRACT IN THE PRODUCTION OF FUNCTIONAL ROBUSTA COFFEE POWDER" which you submitted to the Food Science and Technology, has been reviewed. The comments of the reviewer(s) are included at the bottom of this letter.

The reviewer(s) have recommended publication, but also suggest some minor revisions to your manuscript. Therefore, I invite you to respond to the reviewer(s) comments and revise your manuscript.

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Editor-in-Chief, Food Science and Technology
adriano.cruz@fjn.edu.br

Associate Editor
Comments to the Author:

REVIEWER #1 (Major Revision)
In general, the author has corrected the contents of the writing in accordance with the input given. However, these improvements have not answered critical questions related to the selection/determination of catechins concentrations in the manufacture of functional coffee and catechins content/the composition of gambier catechins extract. Instead of trying to explain the reason underlying the catechins ratio, the author changed the word of "catechins" in to "crude gambier extract". This is tends to obscure the ingredient used. It is suggested to test the composition of crude gambier extract to ensure what bioactive compounds are contained.

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Moreover, in this study the concentration (ratio) of the ethanol extract of gambier used was very high, ranging from 5% to 20%. With this ratio, a cup of coffee will contain 500mg-2000 mg of catechins (A cup of coffee is usually made from 7 to 10 grams of coffee). The dose is high enough for a daily drink. This paper has not considered the possible hazard and safety effects associated with the use of ethanol extract from gambier as an intake in beverages. In addition the author has changed the sensory test result data without being followed by a re-analysis the effect of treatment on the sensory properties. Another question is Why do people have to drink coffee that is added with catechins (more expensive), when there are other products that are known to contain catechins at a more affordable price, such as tea (Camellia sinensis (L.) Kuntze), green tea, oolong tea etc.

REVIEWER #2 (Accept)
The article has been revised. The suggestions were incorporated and became much clearer and more coherent.

REVIEWER #3 (Accept)
Shorten the part of the standard curve in the analysis of total phenolics.

REVIEWER #4 (Minor revision)
General:
It was good idea to change "catechin" gambier extract to "crude" gambier extract title. The manuscript had been improved significantly on title, introduction / state of art and method. It has been described comprehensively. Supporting reference has been added adequately and appeared on reference's list. The manuscript lead to be good quality. Minor revision was needed as stated below.

Abstract
To determine the in-process of antioxidant activity, line 4814 is suggested to state: "the antioxidant activity with an IC50 value of 69.96 to 40.40 µg/ml". The

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Shorten the part of the standard curve in the analysis of total phenolics

REVIEWER #4. (Minor revision)

General:
It was good idea to change "catechin" gambier extract to "crude" gambier extract title. The manuscript had been improved significantly on title, introduction / state of art and method. It has been described comprehensively. Supporting reference has been added adequately and appeared on reference's list. The manuscript lead to be good quality. Minor revision was needed as stated below.

Abstract
To declare the increasing of antioxidant activity (line-18) it is suggested to state "the antioxidant activity with an IC50 value of 583.06 to 40.10 µg/mL". The last sentence of abstract (line 21-22) is not fully justified by result of experiment. The result show that new product taste was much lower hedonic score although the color and flavor was slightly higher. It's suggested not to declare that "the antioxidant properties of functional robusta coffee also indicate an improvement based on a sensory preference of the panelists". In fact, the taste of new product was not improved by crude gambier extract.

Keywords
It is suggested to omit the word "catechin" from keyword list, or change to crude gambier extract. The word "catechin" should not be appeared on "keywords" by consideration the new title of "crude gambier extract".

Practical application
It is suggested to make clear the state of product performance as mixed powder or coffee-drink in case on practical application (line 24-26) it is better to add the explanation the state of commodity as mixed powder contained coffee powder and crude gambier extract, or it as separately powder of coffee powder at one package and crude gambier extract on the other package and it will be mixed a minute before serve coffee drink.

Discussion
The result was justified enough to compare parameter value/functional substance of the product with or without crude gambier extract. The conclusion was stated that there are significant effect of the treatment on pheno, antioxidant activity, pH and solubility. If it's possible, it would be better to add more discussion about relationship among parameters had been measured.

Others / Miscellaneous
There are more than five terms of aroma (Indonesian language) has not yet translate to standard term for hedonic sensory test. It is suggested and better to use term: "flavor" or other representative standard term.

Entire Scoresheet:
Reviewer: 1
Recommendation: Accept

Comments:
The article has been revised. The corrections were incorporated and became much clearer and more coherent.

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10.1590/fst.55721

The addition of crude gambir extract in robusta coffee powder

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The addition of crude gambir extract in the production of functional robusta coffee powder

Budi SANTOSO*¹ <https://orcid.org/0000-0002-5037-0048>, Agus WIJAYA¹, Aldila DIN PANGAWIKAN²

Abstract

This study aims to improve the functional properties of robusta coffee by adding crude gambir extract. A completely randomized non-factorial design with 5 treatments is used and each treatment was repeated three times. The treatments consist of: robusta coffee powder (%): crude gambir extract (%) F1 = 100:0, F2 = 95:5, F3 = 90:10, F4 = 85:15, and F5 = 80:20. The results showed that the addition of crude gambir extract has a significant effect on increasing the total phenol value from 10.65 to 101.20 mg/mL GAE and the antioxidant activity with an IC₅₀ value of 583.06 to 40.10 µg/mL, acidity level (5.43-5.51), and the solubility percentage of 27.55-31.15%. Furthermore, the addition of crude gambir extract have no significant effect on the taste, color, and aroma of the functional coffee produced.

Keywords: antioxidant; crude gambir extract; functional; gambir; robusta coffee.

Practical Application: Mixed powder as separately powder of coffee powder at one package and crude gambir extract on the other package and it will be mixed a minute before serve coffee drink.

Received 12 July, 2021

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1 Introduction

Functional and sensory properties are the two most important factors that influence consumer attractiveness to coffee drinks. The functional properties of coffee are influenced by chlorogenic acid, while the sensory properties are influenced

by caffeine levels. Chlorogenic acid and caffeine are the most dominant components in coffee and both affect the health of the human body. However, high caffeine level has a negative impact on human health. Chlorogenic acid and caffeine in robusta coffee are higher than in Arabica coffee (Chu, 2012). Jeszka-Skowron et al. (2020) added that chlorogenic acid is the main bioactive compound with antioxidant properties. According to Wolska et al. (2017), the antioxidant compounds in robusta coffee are higher than arabica, namely 43.63% and 36.18%, respectively. Herawati et al. (2019) and Bobková et al. (2020) stated that roasting coffee has a significant impact on reducing antioxidant properties. The study conducted by Kuncoro et al. (2018) showed that coffee roasted at temperatures of 100, 110, and 120 °C decreases the caffeine content by 13, 18, 25% and chlorogenic acid by 37, 50, 59%, respectively.

Many studies have been carried out in recent years to maintain the antioxidant properties of coffee. Isac-Torrente et al. (2020) explained that processing coffee using the capsule method reduces antioxidant activity and overall phenol content. According to Jeszka-Skowron et al. (2021), in addition to the roasting process to preserve the chlorogenic acid and total phenol in coffee, other special treatment processes that can be carried out are steaming, decaffeination, or natural fermentation (luwak coffee). Haile & Kang (2020) carried out a spontaneous fermentation using *Wickerhamomyces anomalous* (KNU18Y3) strain on green coffee beans. Similarly, Cheng et al. (2019) showed that coffee processing using the vacuum drying method with the aid of a microwave can maintain the phenolic compounds in green coffee. Furthermore, Microwave-roasted coffee beans have a lower reducing power in IC₅₀ and total phenol compared to unprocessed coffee beans (Salamatullah et al., 2021). Samsonowicz et al. (2019) explained that the addition of bioactive compounds from cereal herbs increases the antioxidant and total phenols in coffee drinks and Bajaj & Ballal, (2021) reported that instant coffee incorporated with *Ganoderma lucidum* extract powder has a large number of anti-tumor and anti-oxidative properties because it contains triterpenoids as the main bioactive compounds. Rashidinejad et al. (2021) explained that the addition of milk to coffee can reduce its functional properties due to the interaction of milk components with the phenolic compounds in coffee.

A previous study showed that coffee contains bioactive compounds, which interact with each other to produce several beneficial effects when combined with other bioactive compounds. One of the bioactive compounds potentially used is catechin derived from the gambir plant. This plant has high antioxidants, namely (+)-catechins (Yeni et al., 2014). Santoso et al. (2018, 2019) added that the inclusion of gambir catechin extract in canna-based edible films increases antioxidant and antibacterial properties, respectively. Pambayun et al. (2019) stated the addition of gambir catechin extract in the formulation of marshmallow candy inhibits the growth of the bacterium *Streptococcus mutans*, which causes human dental plaque. Kamsina & Firdausni (2018) reported that the addition of gambir catechin extract to yam cake can increase the shelf life by inhibiting the growth of *Escherichia coli* and *Salmonella* bacteria with an inhibitory value of 11 mm and 15 mm, respectively. The incorporation of gambir catechin extract of about 600 ppm in margarine can reduce free fatty acids in these products (Aini et al., 2020).

2 Material and methods

2.1 Tools and materials

The tools used consist of a blender (Philips, Holland), hot plate, Whatman No 1 filter paper, analytical balance (Kenko, Japan), drying oven, pH meter (Eutech, Malaysia), rotary vacuum evaporator, 80 mesh filter, and a spectrophotometer (A and E Lab, USA). The various materials used are robusta coffee powder with medium to dark roast type from JagadRaye Coffee Pagar Alam, South Sumatra; gambir powder from Babat Toman Village, Musi Banyuasin, South Sumatra; tannic acid; 2,2-diphenyl- 1-picrylhydrazyl (DPPH); ethanol, methanol, gallic acid, pH 4 buffer, pH 7 buffer, and Folin-Ciocalteu from the chemical laboratory of agricultural products, Sriwijaya University.

2.2 Study design

A non-factorial completely randomized design was used in this study. A total of five treatments are carried out using the percentage ratio of robusta coffee powder with crude gambir extract (F1 = 100:0, F2 = 95:5, F3 = 90:10, F4 = 85:15, and F5 = 80:20) with 3 repetitions. In addition, 15 samples were used for each parameter in such a way that the total samples used for the 5 parameters were 75. Furthermore, the data were analyzed using an analysis of variance with the SAS Windows 9 program. The parameters observed consist of total phenol, antioxidant activity, acidity level (pH), solubility percentage (Gontard et al., 1993), and the sensory test was conducted using the hedonic method of taste, color, and aroma on a scale (1 = dislike very much, 2 = dislike, 3=like, and 4 = very much like) (Pratama, 2018).

a. Total Phenol

The total phenol level was determined based on Marjoni et al. (2015) which have been modified are as follows: 50 g of coffee powder were weighed, 500 mL of distilled water were added and stirred until homogeneous. 100 mg of the extract are then dissolved to 10 mL with distilled water to obtain a concentration of 10 mg/mL. The concentration of 10 mg/mL was pipetted into 1 mL and diluted to 10 mL with distilled water and the concentration of the extract was 1 mg/mL. Pipette 0.2 mL of extract, add 15.8 mL of distilled water and 1 mL of Folin-Ciocalteu reagent, shaken and allowed to stand for 8 minutes. Add 3 mL of 10% Na₂CO₃ to the mixture, leave the solution for 2 hours at room temperature. The

absorption was measured using a UV-Vis spectrophotometer with an absorption wavelength of 765 nm. The phenol content was obtained as mg gallic acid equivalent/g sample and created a calibration curve with the regression equation $y = ax + b$, where X is the concentration and Y is the absorbance.

Preparation of gallic acid calibration curve with Folin-Ciocalteu. Phenol reagent: 50 mg of gallic acid was weighed, 1 mL of 96% ethanol was added, distilled water was added until the final volume was 50 mL in such a way that a concentration of 1 mg/mL was obtained as the mother liquor. The mother liquor was pipetted to 1 mL, 1.25 mL, 1.5 mL, 1.75 mL, and 2 mL, respectively and then diluted with distilled water to a final volume of 10 mL at concentrations of 100, 125, 150, 175, 200 ppm gallic acid. Furthermore, a 0.2 mL pipette of each concentration of the gallic acid solution was added, then 15.8 mL distilled water and 1 mL Folin-Ciocalteu reagent are added and the mixture was stirred until homogeneous and allowed to stand for 8 minutes. 3 mL of 10% Na_2CO_3 solution was added, shaken homogeneously, and then allowed to stand for 2 hours at room temperature, and the absorption was measured at an absorption wavelength of 765 nm.

b. Antioxidant Activity (IC_{50})

The antioxidant activity test was carried out by calculating the IC_{50} value using the DPPH method (1,1-diphenyl-2-picrylhydrazyl) according to Association of Official Analytical Chemists (2005), which has been modified: The combined ground coffee sample weighed ± 0.1 g and then dissolved with 100 mL of methanol (1000 ppm). The sample solution was formulated into 5 concentration series, namely 100 ppm, 80 ppm, 60 ppm, 40 ppm, and 20 ppm. A series of 100 ppm dilution was created from 0.5 mL of sample added to 4.5 mL of methanol in a test tube and homogenized. The 80 ppm dilution series was composed from 0.4 mL of the sample, 4.6 mL of methanol was added, placed in a test tube, and homogenized. A series of 60 ppm dilutions were produced from 0.3 mL of sample added to 4.7 mL of methanol in a test tube and homogenized. A 40 ppm dilution series was prepared from 0.2 mL of sample added to 4.8 mL of methanol in a test tube and homogenized. A series of 20 ppm dilutions were prepared from 0.1 mL of sample added to 4.9 mL of methanol in a test tube and homogenized. In addition, 0.2 mL of each concentration was taken and 2 mL of DPPH solution (0.0038 g DPPH plus 50 mL methanol) was added and homogenized with a vortex. The DPPH solution was placed into a cuvette and the absorbance value was measured using a spectrophotometer (wavelength 517 nm) and was recorded as absorbance blank (A_{blank}). The solution that has been vortexed was left in a dark room for 30 minutes and then placed into a cuvette and the absorbance value was measured using a spectrophotometer (wavelength 517 nm) and recorded as sample absorbance (A_{sample}). Antioxidant capacity (% inhibition) can be calculated using the following formula: Percent Inhibition (%) = $(A_{\text{blank}} - A_{\text{sample}}) / A_{\text{blank}} \times 100\%$. The value of antioxidant capacity (% inhibition) of each concentration was used to find a linear equation. The linear regression equation ($y = ax + b$) was obtained to determine the IC_{50} value. The value of $y = 50$ in such a way that the value of x can be obtained as the value of the antioxidant activity.

c. Acidity Level (pH)

According to Kumesan et al. (2017), the pH value was determined using a modified pH meter as follows: The pH meter must first be calibrated to the sensitivity of the pointer with a pH 7 buffer solution. The sample of about 10 g was weighed and homogenized with 20 mL of distilled water for 1 minute, and pour into a 10 mL beaker. The electrode was immersed in the sample and waited for a while until the pH is stable. The pH value can be directly read on the pH meter scale, after which the electrodes were removed and rinsed with distilled water.

d. Sensory Test

A sensory test was carried out on functional coffee using the hedonic method with semi-trained panelists. A panel of 25 students of the Agricultural Products Technology Study Program, Sriwijaya University who had previously been trained in testing the properties of ground coffee and had studied plantation plant processing technology courses, especially coffee processing were used in this study. The functioning of the hedonic test is based on (Pratama, 2018), where panelists are asked to provide responses regarding the level of likes or dislikes of the sample presented. Samples are presented one at a time, then the panelists assess the sample based on the level of preference for color, aroma, and taste. Based on available value standards. Score scale: strongly dislike = 1, dislike = 2, like = 3, and like very much = 4).

2.3 Procedure

This study was carried out in 2 different stages, namely the production of crude gambir extract and functional robusta coffee.

a. The Production of Crude Gambir Extract

The crude gambir extract was produced using a modified maceration method (Damanik et al., 2014) as the 80% crude extract of gambier produced: dry gambir powder was pulverized in a blender and sieved through an 80 mesh sieve. A total of 100 g of dry gambir powder was added to the Erlenmeyer flask, and then 300 mL of 70% ethanol was poured into it and the maceration process was performed for 24 hours. The macerated powder was filtered using Whatman No.1 filter paper to obtain gambir filtrate. The filtrate was evaporated using a rotary vacuum evaporator at a temperature of 85 °C

until the ethanol evaporates. Furthermore, the process continued with the drying using a drying oven at a temperature of 85 °C until the crude gambir extract was obtained. The extract was mashed with a blender and filtered using an 80 mesh sieve and was placed in an airtight and light-tight bottle.

b. The Production of Functional Coffee

Functional coffee was produced based on a predetermined formulation of robusta coffee powder and crude gambir extract. Furthermore, functional coffee of 30 g with a powder size of 80 mesh was placed in a beaker, and 250 mL of coffee was added at 80 °C and stirred for 15 seconds using a magnetic stirrer. Functional coffee drinks are filtered using a bleached paper filter and can be analyzed according to predetermined parameters.

3 Results and discussion

3.1 Solubility percentage

The measurement of the solubility percentage was carried out on the conventional coffee powder. Functional robusta coffee powder has a solubility percentage of 27.55-31.15% with the lowest F1 treatment and the highest F5 treatment. The average solubility percentage is shown in [Figure 1](#).

The percentage comparison of the coffee powder with crude gambir extract has a significant influence on the percentage solubility of the functional coffee produced. The solubility percentage increases with the higher concentration of crude gambir extract ([Figure 1](#)). This is influenced by the polarity nature of the catechin compounds in crude gambir extract. [Pambayun et al. \(2007b\)](#) stated that gambir powder extracted using the maceration method with a mixture of water and ethanol as a solvent with a polarity index of 7.7 produced the highest catechin extract. Based on these results, it can be concluded that the catechin extract is polar. Furthermore, polar compounds only dissolve polar solvents such as ethanol, methanol, butanol, and water, while non-polar compounds only dissolve in non-polar solvents, such as ether, chloroform, and n-hexane ([Leksono et al., 2018](#)). [Yeni et al. \(2017\)](#) states that catechin compounds from gambir powder dissolve well in hot water.

These results are similar to a study performed by [Budiyanto et al. \(2021\)](#), which states that the solubility of kirmanan and juremian clones at different degrees of roasting ranged from 21.67-45.00%. [Azizah et al. \(2019\)](#) and [Siregar et al. \(2020\)](#) explained that arabica coffee processed by the fermentation method using *Saccharomyces cerevisiae* and lactic acid bacteria results in a solubility value of 30.35-30.74% and 4.26-4.56%, respectively.

3.2 Total phenol

The total phenol functional coffee ranges from 10.65-101.20 mg/mL GAE. The highest total phenol is found at the F5 treatment at 101.20 mg/mL GAE and the lowest with the F1 treatment at 10.65 mg/mL GAE. The average total functional phenol of coffee is shown in [Figure 2](#).

The honest significance difference test ([Figure 2](#)) shows that the total functional coffee phenol produced increases significantly with the increase in the concentration of crude gambir extract. In addition, it can be explained that the extract contains antioxidants. [Pambayun et al. \(2007b\)](#) and [Rauf et al. \(2010\)](#) explained that gambir powder contains catechin with a total phenol of 50.96% and 62.13%, respectively. [Kamsina et al. \(2020\)](#) report that adding gambir catechin extract increases total phenol in wet noodles by 84%.

The total phenol produced from coffee was similar to that of [Nichmah et al. \(2019\)](#), which shows that cinnamon coffee bags contain a total phenol of 34.46 mg/mL GAE. This functional coffee has a higher total phenol content than oven-roasted coffee, namely 16.66 mg/mL GAE ([Alkaltham et al., 2020](#)). The well-known branded coffee that is circulating in Indonesia is 46.27 mg/mL GAE ([Lelyana & Cahyono, 2015](#)) and roasted arabica coffee is 49.90 mg/mL GAE ([Odžaković et al. 2016](#)). Compared to the study by [Gornas et al. \(2016\)](#), unroasted green robusta coffee contains 208.89 mg/mL GAE of total phenol and 119.22 mg/mL GAE in roasted coffee.

3.4 Antioxidant activity

The antioxidant activity of this functional coffee uses IC₅₀. The resulting IC₅₀ values range from 40.10-583.06 µg/mL with the highest value in F1 treatment and lowest in F5. The average IC₅₀ value of the functional coffee produced is shown in [Figure 3](#).

The IC₅₀ value decreases along with the concentration of the crude gambir extract ([Figure 3](#)). This means that the antioxidant activity of functional coffee increases with the higher concentration of crude gambir extract, and this increase is due to its antioxidants. Gambir (*Uncaria gambir* Roxb) is a plant that contains derivatives of polyphenolic compounds, namely: catechins, tannins, epicatechin, quercetin epigallocatechin, and others. Most of the catechin are found in gambir, hence the plant is known as antioxidants and antibacterials ([Aditya & Ariyanti, 2016](#)). [Kurniatri et al. \(2019\)](#) explained that gambir extract contains 92.45% of catechin compounds.

Compared to the study by [Haile & Kang \(2020\)](#), green coffee beans fermented with *Wickerhamomyces anomalous* (Strain KNU18Y3) have an IC₅₀ of 25.51 ppm. [Desai et al. \(2019\)](#) cover the antioxidant compounds of green coffee using the

12.78 µg/mL microencapsulation method, the results are lower than that in this study. This was higher than that of Bobková et al. (2020), which stated that low-quality roasted green coffee powders are about 69.08-78.55 µg/mL and Isnindar et al. (2017). Masek et al. (2020) reported that robusta coffee and robusta green coffee contain antioxidants with an IC₅₀ of 2210 µg/mL and 81.6 µg/mL, respectively.

3.5 Acidity level (pH)

The functional coffee has a pH ranging from 5.43-5.51 with the lowest reported in the F5 treatment and the highest in F1. The average pH is shown in Figure 4. The average pH is shown in the figure below.

The acidity level (pH) of functional coffee decreases along with the increase in the concentration of crude gambir extract (Figure 4). This is because the extract is a weak acid and stable under acidic conditions. These results agree with Pambayun et al. (2007a) according to which the catechin in the gambir extract has many hydroxyl groups (characteristic of Arrhenius base compounds) because it binds directly to the phenolic ring and forms acidic compounds. Yeni et al. (2017) respectively stated that the antioxidant activity of gambir catechin extract increased and catechin is a weak acid that can be easily oxidized at a neutral pH value (pH 6.9) and stable at a low pH value (pH 2.8 and 4.9). The pH value of functional coffee hardly differs from robusta coffee, which is around 5.47 (Suwarmini et al., 2017), fermented robusta coffee 5.25-5.37 (Budi et al., 2020), brewed robusta coffee 5,16-5,69 (Aditya & Ariyanti, 2016), and instant powder beverage with mangosteen-peeled coffee ranged from 5,26-5,63 (Apriani et al., 2016).

The relationship between the parameters of solubility percentage, total phenol, antioxidant activity (IC₅₀), and pH is closely related to the content of catechin compounds in crude gambir extract. It is known that catechin compounds are polar, classified as phenolic compounds, antioxidants, and stable at acidic pH conditions, so that the higher the crude gambir extract content, the higher the solubility level and total phenol, the lower the IC₅₀ and pH values.

3.6 Sensory test

The method used to sensory test the taste of functional coffee taste, flavor, and the color is hedonic using 25 semi-trained panelists. The test results are presented in Figure 5.

The average hedonic scales for the taste, color, and flavor of functional coffee are 2.64-3.38; 2.8-3.16; and 2.8-3.4, respectively (Figure 5). The results of the Friedman-Conover test show that the combined treatment of robusta coffee powder with crude gambir extract has no significant influence on the taste, color, and flavor of the functional coffee produced. Furthermore, it is interpreted that the addition of crude gambir extract in a concentration of 20% (w/w) does not change the parameters mentioned. Furthermore, The sensory test also showed that the score for taste, color, and flavor of functional coffee is above 3, which means that this coffee is preferred by the members of the panel.

4 Conclusion

The addition of crude gambir extract in robusta coffee powder improves the antioxidant properties of functional robusta coffee with a sensory preference of the panelists. Robusta coffee which is incorporated with crude gambir extract has total phenol of 10.65-101.20 mg/mL GAE, antioxidant activity (IC₅₀ = 583.06-40.10 µg/mL), acidity level (5.43-5.51), and the solubility percentage of 27.55-31.15%.

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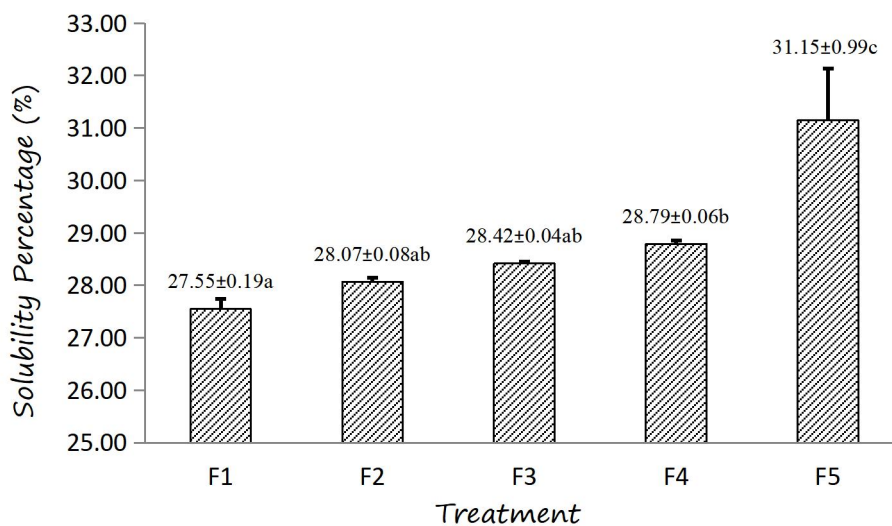
Figure 1 [[Q1: Q1]]. The average solubility percentage of functional robusta coffee powder.
 Description: F1 = 100% robusta coffee powder: 0% crude gambir extract. F2 = 95% robusta coffee powder: 5% crude gambir extract. F3 = 90% robusta coffee powder: 10% crude gambir extract. F4 = 85% robusta coffee powder: 15% crude gambir extract. F5 = 80% robusta coffee powder: 20% crude gambir extract.

Figure 2. The average total phenol of functional robusta coffee powder.

Figure 3. The average IC₅₀ value (µg/mL) of functional coffee.

Figure 4. The average acidity level (pH) of functional robusta coffee.

Figure 5. Sensory test on taste, color, and flavor of functional robusta coffee.



Description: F1= 100% robusta coffee powder : 0% crude gambir extract
 F2= 95% robusta coffee powder : 5% crude gambir extract
 F3= 90% robusta coffee powder : 10% crude gambir extract
 F4= 85% robusta coffee powder : 15% crude gambir extract
 F5= 80% robusta coffee powder : 20% crude gambir extract

Figure 1. The average solubility percentage of functional robusta coffee powder

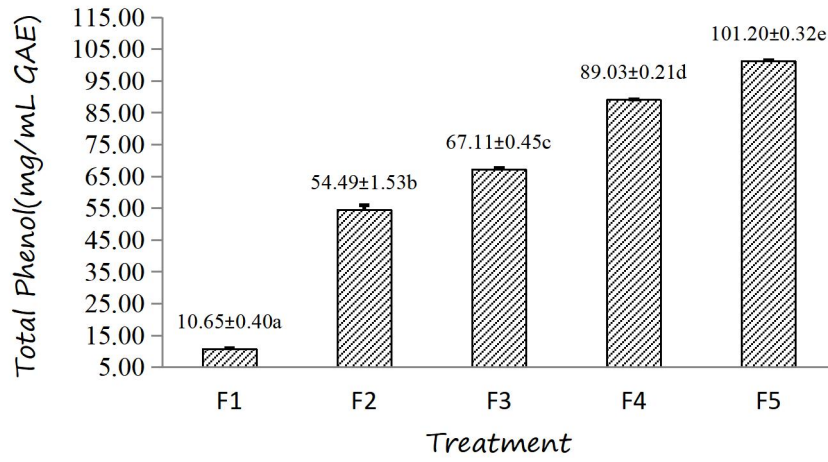


Figure 2. The average total phenol of functional robusta coffee powder

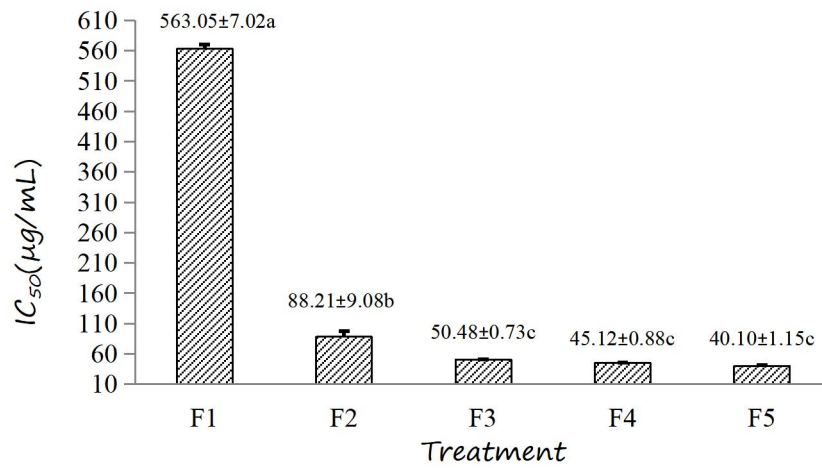


Figure 3. The average IC₅₀ value (µg/mL) of functional coffee

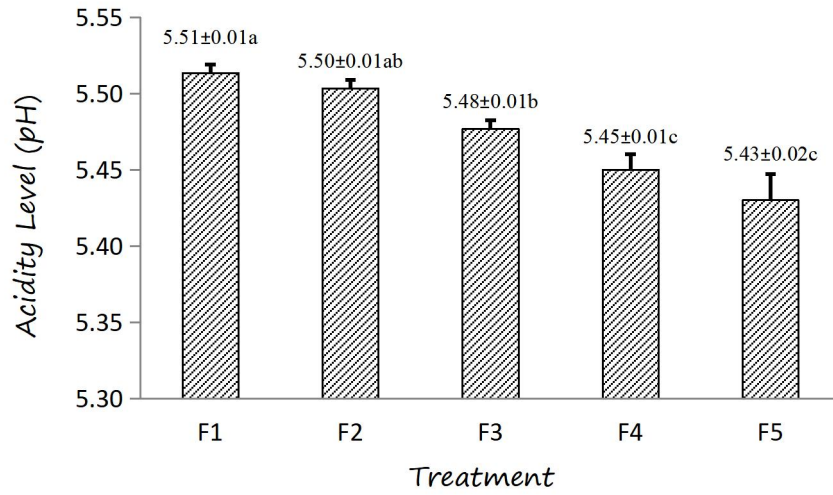


Figure 4. The average acidity level (pH) of functional robusta coffee

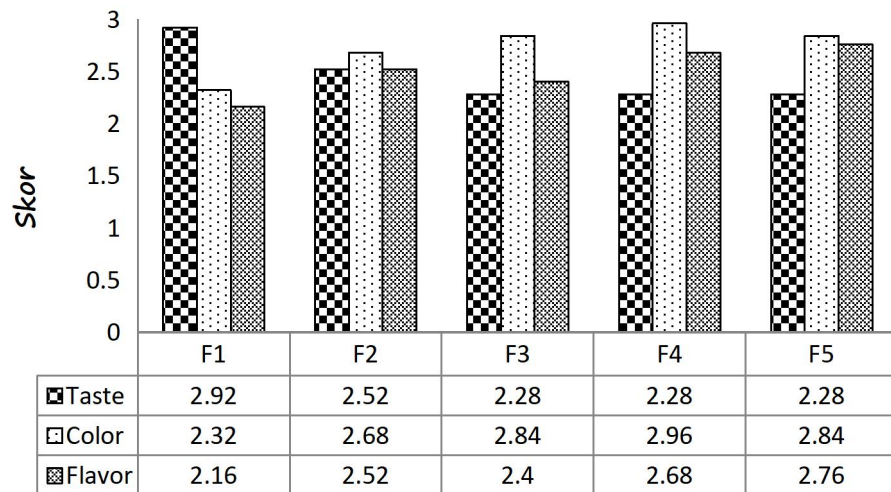


Figure 5. Sensory test on taste, color, and flavor of functional robusta coffee



Validasi:

Tanggal/ Date : _____

Formulir Kiriman Uang Remittance Application

Penerima/ Beneficiary Penduduk / Bukan Penduduk

Nama/ Name : Resident Non Resident

Alamat/ Address : **SOCIEDADE BRASILEIRA DE CIENCIA E ALIMENTOS**

Telepon/ Phone : **AV BRAZIL 2880 CAMPINAS SP**

Kota/ City : **BRAZIL** Country : **MALAYSIA**

Bank Penerima/ Beneficiary Bank : **BANK BRAZIL**

Kota/ City : Negara/ Country : **BANK BRAZIL**

No. Rek./ Acc. No. : **BR8600000000031410000076830C1**

Pengirim/ Remitter Bukan Penduduk / Penduduk

Nama/ Name : **BU DING ANIK SO** Non Resident

Nama Alias/ Alias Name : **109415888**

No. ID : **PALEMBANG**

KTP/SIM/ Passport/ KITAS : **PALEMBANG**

Alamat/ Address : **PALEMBANG**

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Berita (Message) : _____

Biaya dari bank koresponden dibebankan ke rekening/ Correspondent bank charges are for account of : Penerima/ Beneficiary Pengirim/ Remitter Sharing

Jenis Pengiriman/ : L/C / Clearing Draft RTGS SWIFT

Type of Transfer : Debit Rek. / Debit Acc. No.

Sumber Dana/ Source of fund : Tunai/ Cash Cek/ BC No.

Mata Uang/ Currency : IDR USD

Jumlah Dana yang dikirim/ Amount Transfer : **699** Jumlah / Amount **14545** Kurs/ Rate **8727000** Nilai/ Total Amount

Biaya/ Charge	Nilai/ Amount in Foreign	Rupiah Amount	Nilai/ Total Amount
Komisi/ Commission	14545	363625	
Pengiriman/ Handling			
Bank Koresponden / Correspondent Bank			
Jumlah Biaya / Amount Charge :			
Total yang dibayarkan/ Total Amount			

Jumlah yang dibayarkan/ Total Amount : **Rp9.125.625**

Terbilang / Amount in Words : **Sembilan juta Seratus Dua Puluh Lima Ribu Enam Ratus Dua Puluh Lima Rupiah.**

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