The Difference of Effect Between Programmed Physical Aerobic Exercise With

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WORD COUNT 2465
TIME SUBMITTED 07-DEC-2020 09:11PM
PAPER ID 66532113

The Difference of Effect Between Programmed Physical Aerobic Exercise With Programmed Physical Anaerobic Exercise to B-Endorphin Level of Male Laboratory Rats Brain Tissue

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Keyword *Physical exercise, programmed aerobic, programmed anaerobic,* ß-Endorphin*, brain tissue*

Abstract **Background** Physical exercise can increase ß-Endorphin level of brain tissue. However, it is unknown whether the difference in the kind of physical exercise which is programmed affects the level of brain tissue's ß-Endorphin. The purpose of this research is to analyze the difference of ß-Endorphin level in male laboratory rats treated with programmed aerobic and anaerobic physical exercise. **Method** This research used *posttest control group* design with 30 male laboratory rats as the subject in the animal-testing, which is divided into control group, programmed aerobic group, and programmed anaerobic group. Physical exercise was given 3x a week in for six weeks by using treadmill with the speed set at 20m/ minute or 30 minutes for aerobic physical exercise and the speed set at 35m/ minute for 20 minutes with I minute interval for every 5 minutes anaerobic physical exercise. Endorphin level measurement is done by using ELISA *Kit for Rat* by *ELABSCIENCE*. **Results** There is a decrease in the level of brain tissue's ß-Endorphin in the programmed aerobic groups opposed to the control group (39.83 ± 9,19 pg/mL vs 40,6 ± 9,46 pg/mL). On the other hand, there is an increase in the level of brain tissue's ß-Endorphin in the programmed anaerobic group compared to programmed aerobic group (52.11 ± 5,92 pg/mL vs 40.6 ± 9,46 pg/mL). The result of *independent sample t-test* is p=0,002. **Conclusion** Programmed aerobic and anaerobic physical exercise affect the level of brain tissue's ß-Endorphin. There is a significant difference in the mean of brain tissue's ß-Endorphin level between programmed aerobic and anaerobic group after the treatment for 6 weeks.

1. INTRODUCTION

Physical exercise is a form of planned, regular, and continuous activity in a set intensity with the purpose of increasing health standard. Physical exercise done three times a week (programmed) can increase not only physical health but also endorphin's level.[1]

Animal-testing by Stein (1991) shows that endorphin is responsible in reducing pain and stress level of the subject animal. Endorphin helps reducing pain through suppressing stress. level as well as giving tranquilizing effect. Moreover, endorphin is also capable of causing addictiveness toward physical exercise.

Endorphin functions to regulate stress, suppress pain, increase immunity, halt aging process, control appetite, reduce blood pressure, and give system reward (happiness) to brain and mood. The main function of endorphin, however, is to halt pain transmission; as well as create euphoria effect similar to the effect from other opioids. [3-4]

Endorphin causes a psychological state known as "runner's high". Several studies show

that there is a significant increase of ß-Endorphin during or after great physical exercise. However, studies focusing on the correlation between great physical exercise and blood plasma endorphin level shows opposite results. [3]

Ferlazzo *et al.* (2012) states that the release of ß-Endorphin is also regulated by *adeno-hypophysis* which relies on adrenergic stimulation.[5] An animal-testing research towards as racehorse shows that endorphin can be used parameter to monitor the stress of physical exercise and healthiness. Another similar research shows that there is an increase of ß-Endorphin level depending on the intensity and duration of exercise. [6]

Various researches show an increase in the level of plasma ß-Endorphin during physical exercise. On the other hand, researches related to the release of ß-Endorphin in brain tissue in programmed aerobic and anaerobic physical exercise are still uncommon. This research aimed to analyze difference in the level of brain tissue's ß -Endorphin in programmed aerobic and anaerobic physical exercise.

2. METHOD

This research is a laboratory experimental research with *Post Test Control Group Design* which was done on April 2017 to June 2017.

The subject animal in this research is healthy male laboratory rats (Wistar rats) with the age

ranging between 6-8 weeks and weighed 60-80 grams. The subjects are divided randomly into 3 groups: control group which is not given any group (P2), and 3-time-a-week anaerobic exercise treatment (P1), 3-time-a-week aerobic exercise group (P3).Each group consisted of 1O rats, which bring the total 'sample needed in this research for 3 groups are 30 rats.

Anaerobic physical exercise treatment was given by placing a subject rat to the anima! treadmill with the speed 35n/minute for 20 minutes. Interval was given every minutes with the speed 20m/minute for 1 minute. On the other hand, aerobic physical exercise treatment was given by placing a subject rat to the animal treadmill with the speed 20m/ minute for 30 minutes continually.[8]

Treatment was given for 6 weeks. On the last day of treatment, decapitation was executed right after the subject finished the physical exercise. This research was given the ethical agreement by Sriwijaya University Medical Faculty Commission of Ethics.

2.1 Protocol Homogenate of Brain Tissue

1. Put the extracted rat's brain from the surgery on object glass with ice gel put under it to preserve the brain.
2. Execute the brain separation.
3. Measure the brain tissue.
4. Put the tissue in 1.5 ml microtube.
5. Add 100 micro liter PBS solution with 0,01 concentration and pH 7,4 by using micropipette into the microtube containing brain tissue's.
6. Next is dissolving the tissue using homogenizer for ± 1 minute with 8000rpm speed
7. After the tissue dissolved, centrifugation was done with 5000 rpm speed for 5 minutes (According to ELISA's manual book).
8. After centrifugation, supernatant was extracted and put into a new microtube.

2.2 Measurement of B Endorphin's Level

ß Endorphin's level of brain tissue's was measured in ELISA's method using ELISA's *Kit for Rat ß-Endorphin* **ELABSCIENCE.** The data of ß-Endorphin's level was gained by creating standardized curve chart which uses different levels of B Endorphin with the concentrations of 500 pg/mL, 250 pg/mL, 125 pg/mL, 62.5 pg/mL, 31,25 pg/mL, 15,63 pg/mL, 7,8 pg/mL and O pg/mL. The result shows a linear correlation between absorbency in 450 nm wavelength with different levels of ß Endorphin.

3. DATA ANALYSIS

Data acquired were analyzed using computerized system program SPSS 19th version for windows with significance level < 0,05. To compare the mean of ß-Endorphin level between control group, programmed aerobic group, and programmed anaerobic group, *one-way* ANOVA testing was used. As for the comparing of the mean of programmed aerobic and anaerobic group independent sample t-test was used.

4. RESULT

Brain Tissue's ß-Endorphin Level.

The result of mean measurement of brain tissue's ß-Endorphin level showed that there is an increase in the ß-Endorphin level in the brain tissue of anaerobic group. Meanwhile. Programmed aerobic group mean was decreased compared to control group. The mean of brain tissue's ß-Endorphin level for the programmed anaerobic group was higher than programmed aerobic group. The ANOVA testing showed that there is a significant difference between the mean of brain tissue's ß-Endorphin level in control group to the programmed aerobic and anaerobic group (p=0,00) (Table 1),

To know whether there is a significant difference in the mean of brain tissue's ß-Endorphin level in the programmed aerobic group to the programmed anaerobic group, independent sample t-test was used. The statistic result showed that there is a significant difference (p 0,05) in the mean of brain tissue's ß-Endorphin level of programmed aerobic group and programmed anaerobic group (Table 2).

Table 1. Comparison of Brain Tissue's ß-Endorphin Level of Laboratory Rats in Control Group to the Acute and Chronic Physical Exercise Groups.

	Group	N	Mean ± SD (pg/ml)	p*
ß-Endorphin level	Control	10	40,59±9,46	
	Programmed Aerobic	10	39,82±9,19	0,0005
	Programmed Anaerobic	10	52,11±5,92	

**p one-way p<0.005*

Table 1 showed that there is an increase of mean of brain tissue's ß-Endorphin level in programmed

anaerobic group's laboratory rats. Meanwhile, compared to the control group, there is a decrease of

mean of brain tissue's ß-Endorphin level in programmed aerobic group. There is a significant difference (p=0,0005) between the brain tissue's ß-Endorphin level of the laboratory rates of the control group to the programmed aerobic and anaerobic physical exercise group.

Table 2. Comparison of Brain Tissues ß-Endorphin Level's Mean Aerobic and Anaerobic Group

Group	N	Mean ± SD (pg/ml)	p*
Programmed Aerobic	10	39,82±9,19	0,002
Programmed Anaerobic	10	52,11±5,92	

**Independent Sample T-Test<0.005*

Table 2 showed that there is a significant difference (p<0,05) in the brain tissue's ß-Endorphin

level's mean of male laboratory rats in the programmed aerobic and anaerobic group.

5. DISCUSSION

The calculation result of mean of ß-Endorphin level in this research showed that there is a decrease in the mean of ß-Endorphin level in the programmed aerobic physical exercise group, while there is an increase in the mean of ß-Endorphin level in the programmed anaerobic physical exercise group. This increase and decrease of ß-Endorphin level in the experimental groups is assumed to be caused by the programmed aerobic physical exercise which does not incite great physical stress

compared to the programmed anaerobic physical exercise.

According to Shi *et al*, (2010) stress in programmed aerobic and anaerobic physical exercise affects the synthesis of ß-Endorphin in brain tissue.[9] In stress state due to physical exercise; *hypothalamus-pituitary-adrenocortical (HPA)* system is activated. HPA system is crucial in the immunology system and the plasticity of the tissue which affect cell's survival. [10] Chronic physical exercise causes the body to get stressed for a period of time. Physical exercise is one of the factors important in increasing the ß-Endorphin of brain tissue and the effect of physical exercise to the body which can be a stimulator to secrete the ß-Endorphin hormone in the brain tissue. [11]

This research produces result similar to the research by Niinisto *et al* (2010) which states that increase in ß-Endorphin level in programmed physical exercise is due to physical stress which cause the release of *corticotrophin-releasing hormone* (CRH) which activates the HPA axis, triggering decrease of ACTH and stimulate *Pro-opiomelanocortin* (POMC) that stimulates production of ß-Endorphin in brain tissue. [12] Thanks to this, happy and tranquiling effects appeared after doing physical exercise. [13]

ANOVA testing result shows that there is a significant difference ($p<0,05$) in the mean of B-Endorphin level in the laboratory rats brain tissue of both the programmed aerobic and anaerobic physical exercise groups. This happened because physical exercise affects the increase of ß-Endorphin concentration especially in the pain and mood change of perception. Mehl *et al*. (1999) states that increase in ß-Endorphin level in brain tissue depends on the intensity as well as kind of physical exercise. [7] Physical exercise causes the ß-Endorphin in laboratory rats' brain tissue increased in terms of the regulation through HPA axis. Anaerobic physical exercise produces the piling of lactic acid. during anaerobic physical exercise, lactic acid in blood will increase which make the sterile acid goes to the brain and entail GPR81 receptor or Hydroxy carboxylate (HCARI) in blood vessel, brain cell and regulates cAMP level. [15] Excessiveness of camp will results in pain decrease and mood increase. Previous researches show that lactic acid in blood increases ß-Endorphin level of laboratory rats' brain tissue. [14]

The research result of Ferlazzo *et al*, (2012) shows that, in programmed physical exercise, there is an increase of ß-Endorphin level in brain tissue. Changes in the ß-Endorphin level of brain tissue show dependency characteristic in the intensity and duration of sport. During anaerobic physical exercise, lactic acid increases which become the deciding factor of ß-Endorphin release. ß-Endorphin affects acidosis tolerance, despite the physiological connection between ß-Endorphin and lactic acid is still unclear.

6. CONCLUSION

There is a significant difference ($p<0,05$) in the mean of brain tissue's ß-Endorphin level between

programmed aerobic physical exercise to programmed anaerobic physical exercise.

7. ACKNOWLEDGEMENT

The researchers give their utmost gratitude to the funding given by *Hibah Pascasarjana Kemenristekdikti 2017.*

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