The Difference of *B-Endorfin* Level in Brain Tissue and Testicular Tissue on Wistar Rats Given Once a Week Aerobic and Anaerobic Exercise

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Keywords: Brain, Endorphin, Physical Exercise, Testes.

Abstract: Physical exercise could increase the levels of *β-endorphin. β-endorphin* was not only secreted in brain but also in testicular. However, it was still unidentified whether physical once a week exercise affected the secretion of *β-endorphin* in the brain tissue and testicular. This study aimed to analyze the different levels of *β-endorphin* in brain tissue and testicular tissue of Wistar rats given once a week aerobic and anaerobic exercises. This study was an experimental laboratory research with Post Test Control Group Design, using 27 male Wistar rats divided into a control group, once a week aerobic and anaerobic. Aerobic exercise performed once a week at a speed of 20m/min for 30 minutes, while the anaerobic exercise performed once a week in 35m/min for 20 minutes at 1 minute interval every 5 minutes, using a *treadmill* for 6 weeks. The endorphin levels of brain and testicular tissue were measured using ELISA kits *for Rat Endorphin ELABSIENCE*. an increase in the average level of brain tissue's *β-endorphin* in the treatment group occured compared to the control group (35,01±8,19 pg/ml), aerobic (47,45±6,98 pg/ml) and anaerobic (51,85±5,01 pg /ml). On the other hand, the average level of testicular tissue's *β-endorphin* decreased compared to the control group (77,33 ± 20,64 pg/ml), aerobic (38,93±3,52 pg/ml) and anaerobic (53,35±8,80 pg/ml). In ANOVA test result, p = 0.000 was obtained. there was a significant difference average level of *β-endorphin* in brain and testicular tissue in Wistar rats aften being given once a week aerobic and anaerobic exercise.

1 INTRODUCTION

During physical exercise, body releases *β-endorphin* providing a great influence on the brain and body. Cunha *et al.,* (2008) said that physical exercise is a major stimulus for endorphins secretion depending on its intensity.[1] The more physical exercise, the higher the levels of *β-endorphin* will be produced. *β-endorphin* that comes out will be captured by receptors in the hypothalamus and limbic system serving to regulate emotions.[2]

When doing physical exercise, the brain will recognize physical exercise as a stressor.[3] Acidosis is a major stimulus release of β-endorphins during exercise, since stress and physical exercise can increase the levels of *β-endorphin* 3 to 10 times higher.[5] The results Van Essen (2007) showed that *β-endorphin,*a substance that can improve mood, which was produced by the hypothalamus and the pituitary gland that plays a role in explaining the effects of exercise for brain.[6] The results of Schwarz & Kindermann(1992) research showed that during physical exercise opioid function could be noticed on *β-endorphin*'s concentration changes depending on the intensity and duration of physical exercise performed.[7]

β-endorphin is also generated in testicular tissue. *β-endorphin* produced in the testes would stimulate the interstitial cells in testes and seminiferous, which will result in Leydig cells to affect Sertoli cells size and will change paracrine into a proliferative response in Sertoli cells which will predispose FSH.[8] *β-endorphin* in the testicular tissue works in Sertoli cells, and is suspected to hamper the function of Sertoli cells.[9] The levels of *β-endorphin* will rise significantly during physical exercise, but

Flora, R., Ferta Sari, L., Zulkarnain, M. and Sukirno, .
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In *Proceedings of Surabaya International Physiology Seminar (SIPS 2017)*, pages 256-260
ISBN: 978-989-758-340-7

testosterone levels will decrease.[10-11] This may occur due to differences in hormonal response that can be caused by the distinctive reactivity of *neuro psikoendokrine* in the body during physical exercise. According to a research conducted by Johnson (1999), the desire for sexual intercourse was increased when we physical exercise regularly. Physical exercise will affect testosterone levels, by affecting the circulation to cause libido.[12]

Several researches on physical exercise and endophine secretion and the impact of physical exercise to sexual intercourse ability have been conducted. However, researches discussing the release of endorphine during acute physical exercises and its relation to endophine in testicular tissue are still limited. This research intended to analyze the *β-endorphin* level differences in brain and testicular tissues on Wistar rats given aerobic and anaerobic once a week.

2 METHODS

This study was an experimental laboratory research with Post Test Control Group Design, using 27 male Wistar rats divided into a control group, aerobic and anaerobic. Aerobic exercise performed once a week at a speed of 20m/min for 30 minutes, while the anaerobic exercise performed once a week in 35m / min for 20 minutes at 1 minute interval every 5 minutes, using a *treadmill* for 6 weeks. The rats were acquired from Bio Sains Riset (bioscience research) Palembang animal house. The research were conducted on April to June 2016. This research obtained ethical approval from *komisi etik* (ethical commission) of Medical Faculty Universitas Sriwijaya No.56/kepkrsmhfkunsri/2017, 13 April 2017.

2.1 Brain and Testicular Homogenates Production

Brain and testicular homogenates production was adopted from Flora et al (2016) research.[13]

2.2 Endorphin Level Parameter Measurement

Brain and testicular endorphin levels were measured with ELISA kit *for Rat Endorphin* from *ELABSIENCE*.

2.3 Data Analysis

Data were analyzed using 16th version of SPSS for windows with significant level ($p<0,05$). In order to find the distinction in average level of endorphin between control group and treatment group, unpaired t-tes was performed. Furthermore, to find out the difference endorphin level among control group, aerobic group, and anaerobic group, *one way* ANOVA test was conducted observing the average difference among them.

3 RESULTS

3.1 Brain Tissue β- endorphin Level

To discove the comparison of Wistar rats' brain tissues' *β-endorfin* average level between aerobic and anaerobic exercise group, unpaired T-test was conducted. There was significant difference ($p<0,05$) in their *β-endorfin* average level.

Table 1: The comparison of wistar rats' brain tissues' *β-endorfin* average level between once a week aerobic and anaerobic exercise group.

Group	N	Mean± SD (pg/ml)	p*
Aerobic	9	47,45±6,98	
Group			0,00
Anaerobic	9	51,85±5,01	
Group			

p t-test p<0,05*

To discover whether there was a difference of endorphin level among control group, aerobic group, and anaerobic group, ANOVA test was conducted. The result showed that there was an increase of brain *β-endorfin* average level in treatment group. The average level of beta-endorphin was higher in anaerobic exercise group than was it in aerobic exercise and control group.

Table 2: The comparison of wistar rats' brain tissues' *β-endorfin* average level among control group, aerobic exercise group and anaerobic exercise group.

Group	n	Mean± SD (pg/ml)	p*
Control Group	9	35,01±8,19	
One-time Aerobic Group	9	47,45±6,98	0,00
One-time Anaerobic Group	9	53,35±8,80	

p* Anovatest p< 0,05

3.2 β- endorfin in Testicular Tissue

To determine the average levels of *β-endorphin* in Wistar rats' testicular tissue between control group and anaerobic exercise group, the unpaired t-test was conducted. There was a significant difference (p <0.05) in the average levels of *β-endorphin* in Wistar rats' testicular tissue between the aerobic and anaerobic exercise group.

Table 3: The comparison of wistar rats' testicular tissues' *β-endorfin* average level between once a week aerobic and anaerobic exercise group.

Group	n	Mean±SD(pg/ml)	p*
Aerobic	9	38,93±3,52	
Group			0,00
Anaerobic	9	53,35±8,80	
Group			

p t-test p< 0,05*

To determine whether there was a significant distinction of *β-endorphin* average levels on Wistar rats in testicular tissue among the control group, aerobic exercise group and anaerobic exercise group, ANOVA test was conducted. It was found that there was a decline in the average levels of *β-endorphin* in the testicular of the treatment group. There was a significant difference (p <0.05) on the average levels of *β-endorphin* in testicular tissue among the control group, aerobic exercise group and anaerobic exercise group.

Table 4: The comparison of wistar rats' testicular tissues' *β-endorfin* average level among control group, aerobic exercise group and anaerobic exercise group.

Group	n	Mean±SD (pg/ml)	p*
Control Group	9	74,70±20,85	
One-time Aerobic Group	9	38,93±3,52	0,00
One-time Anaerobic Group	9	53,35±8,80	

p* Anova test p< 0,05

4 DISCUSSION

According to this reasearch, increase in the average levels of *β-endorphin* in the brain tissue was found. This happened because physical exercise was one important factor in enhancing *β-endorphin* and the impact of physical exercise for the body was not only as a stressor, but also as stimulator; a secreted endorphins simulator.

During physical exercise, the brain would recognize physical exercise as a stressor. Physical exercise then stimulated hypoxia due to the low oxygen content in brain so that the brain sensed that we were in the process to deal with or avoid the stressor.[3] Given a stimulus such as a stressor would activate the HPA axis which would boost the hypothalamus and *Locus Coerulus* (LC). The hypothalamus would decrease the secretion of *Corticotropin Re-leasing hormone* (CRH) *Adrenocorticotropic Hormone* so that ACTH decreased and *Pro-opimelanocortin* (POMC) thrilled, which also reduced the production of ACTH and provoked the production of endorphins resulting pleasant feeling, fresh mind, and better emotion.[14]

This study was in line with research conducted by Viru and Tendzegolskis (1995) discussing the relationship between the level of training and *β-endorphin* concentrations observed in 12 trained individuals and untrained 11 individuals. Moderate-intensity physical exercise did not cause an increase in *β-endorphin* in the untrained group, while the high-intensity exercise increased levels of *β-endorphin* in the trained group.[15] Anaerobic exercise had a greater impact on the release of *β-endorphin* compared to aerobic exercise because the release of endorphins was stimulated by relatively high physical exercise.[16]

The results showed a significant relationship (p <0,05) on the increased levels of *β-endorphin* in the anaerobic group compared to the aerobic group and controls. This happened because the anaerobic exercise increased levels of *β-endorphin* related to lactate serum concentration, whereas aerobic exercise only had a smaller effect on the level of *β-endorphin.* Age and gender also influenced the lower levels of *β-endorphin.*[16] This result were cohesive with the Goldfarb & Jamurtas (1997) which demonstrated that aerobic and anaerobic exercise could increase levels of *β-endorphin.* However, The increase was more significant in anaerobic exercise depending on the level of metabolic demand.[17]

The results also showed a decline in the average levels of *β-endorphin* in testicular tissue. This decrease was due to the reproductive system which was very sensitive to the effects of stressors associated with physical exercise, resulting in hormonal disorders, which were influenced by the type, intensity, duration and frequency of exercise performed. Endorphins could cause an impaired function of the reproductive system and lower the secretion of LH and FSH.[18] During physical exercise, endorphins were known to have a strong

inhibitor properties on the secretion of GnRH. GnRH would directly inhibit the release of LH and prevent the synthesis testosterone to Leydig cells, inducing lower testosterone in plasma.

The results were parallel to a research conducted by Kostic et al (1997) which revealed that CRH and *β-endorphins* affected the hypothalamic-pituitary-gonad (HPG) by inhibiting the release of GnRH from the hypothalamus. CRH acted directly as an anti-reproductive peptide and *β-endorphin* served indirectly as an anti-reproduction peptide in the testes, where the two peptides to function as negative regulators of gonadotropin. GnRH would inhibit the release of LH and interupted the synthesis of testosterone directly to Leydig cells which therefore lowered testosterone in the plasma.[19] According Safanirejad, et.*all* (2009) when doing physical exercise, ACTH and secretion would intesify and LH LH levels decreased.[21] After doing physical exercises, corticotropin releasing hormone (CHR) induced the release of ACTH and *β-endorphin.* The increase of *β-endorphin* could impede the release of gonadotropin (LH secretion). The reduction of LH secretion might lead to an abatement in testosterone produced by the Leydig cells (Colon, 2007).[22]

The results also indicated that the drop in the average levels of *β-endorphin* in aerobic and anaerobic exercise group. There was a significant relationship (p <0,05) on the reduction of *β-endorphin* in aerobic and anaerobic exercise group. This took place since physical exercise

could effect hormones in the reproduction system that might be increased or decreased after an acute or chronic physical exercise.[10] In addition, *β-endorphin* had regulator effect on reproductive fuction at the level of the hypothalamus-pituitary axis.[8] From the results of this study it was concluded that aerobic and anaerobic exercise could result in changes to the levels of *β-endorphin* in the brain and the testes. There were significant differences in the brain (p <0.005) and testes (p <0.005) in terms of average levels of endorphin among wistar rats in aerobic exercise group and anaerobic exercise group.

5 CONCLUSION

There was significant distinction on the average level of β-endorphin on wistar rats' brain and testicular tissues after given aerobic and anaerobic treatments once a week for 6 weeks long.

ACKNOWLEDGEMENT

Researches would like to express their highest gratitude for the endowment of this study to Hibah Pascasarjana Kemenristekdikti 2017.

REFERENCES

Colon, Eugenia, et al., 2007. Insulin-like-growth factor-I is an important antiapoptotic factor for rat leydis cells during postnatal development. Endocrinology 148.1 .128-139.

Cunha GS. Ribero JL, 2008. Oliveira AR. Levels of *β-endorphin* in response to exercise and overtraning. Arq Bras Endocrinol Metabol .52:589-98

Fabbri, Andrea, and Maria L. Dufau., 1988. *Hormonal regulation of β-endorphin in the testis. Journal of steroid biochemistry* 30.1-6. 347-352.

Flora R, Theodorus, T., Zulkarnain, M., Juliansyah, R. A & Syokumawena, S., 2016. Effect Of Aerobic And Anaerobic Exercise Toward Serotonin In Rat Brain Tissue. The Journal Of Neurobehavioral Sciences, 3 (1), 2-6.

Founier, P-E., et al, 1997. Effect Of A 110 Kilometer Ultra-Marathon Race On Plasma Hormone Levels.International Journal Of Sports Medicine 18.04 .252-256

Founier, P-E., Et Al, 1997. Effect Of A 110 Kilometer Ultra-Marathon Race On Plasma Hormone Levels.International Journal Of Sports Medicine 18.04 252-256

Goldfard AH, Jamurtas AZ, Kamimori GH, Hegde S, Otterstetter R, Brown DA Gender, 1988. Effect On Beta-Endorphin Response To Exercise. Med Sci Sport Exerc .30:1672-1676

Harry. Mekanisme endorphin dalam tubuh. 2007. Available at endorphin dalam tubuh. Dibuka tanggal 10 februari 2017

Johnson, A., Wadsworth,J., Et Al, 1999. Sexsual Attitudes And Lifestyle Survey, UK 1990-1991. In: Health Service Circular HSC 1999/148 Treatment For Impotence. Departement Of Health, London.

Kadas E, Geher P, 2007. The effect of physical therapy on beta-endorphin levels. Eur J Appl Physiol 100(4):371–382

Kostic T, et al., 1997.The effect of opioid antagonists in local regulation of testicular response to acute stress in adult rats. Steroids. 62: 703-708.

Rahkila P, Hakala E, Alen M, Salminen K, Laatikainen T , 1988. Betaendorphin and corticotropin release is dependent on a threshold intensity of running exercise in male endurance athletes. Life Sci 43:551–558

Rubinstein M, Mogil JS, Japón M, Chan EC, Allen RG, Low MJ, 1996. Absence of opioid stress-induced analgesia in mice lacking beta-endorphin by site-directed mutagenesis. Proc Natl Acad Sci USA 93: 3995–4000.

Safarinejad.M.R, K. Azma, A.A. Kolahi,2009. The effects of inten-sive, long-term treadmill running on reproductive hormones,hypothalamus-pituitary-testis axis, and semen quality: a ran-domized controlled study. J. Endocrinol.200, 259–271

Schwarz L, Kindermann W,1992. Beta-endorphin, catecholamines,and cortisol during exhausttive endurance exercise. Int J SportsMed 10:324–328

Sharp, B., Pekary, A.E., Meyer, N.V. and Hershman, J.M., 1984. B-endorphin in male rat reproductive organs. Biochem. Biophys. Res. Commun. %:618-623.

Singer R, Bruchis S, Sagiv M, Allalouf D, Levinsky H, Kaufman H., 1989.Beta-endorphin and calcitonin in human semen. Arch Androl. 23: 77_81

Taylor DV, Boyajian JG, James N, Woods D, Chicz-Demet A, Wilson AF et al, 1994. Acidosis stimulates β-endorphin release during exercise. J Appl Physiol 77:1913-8.

Tendzegolkis Z, A Viru, E.Orlova, 1991. Exercise-Induced Changes Of Beta Endorphin Contents In Hypothalamus, Hypophysis, Adrenal And Blood Plasma Journal Sport Med 12 485-497

Tremblay Marks S, J.L. Copeland, W. Van Helder,, 2005. Influence ofexercise duration on post-exercise steroid hormone responses intrained males. Eur. J. Appl. Physiol.94, 505–513

Valentino, RJ 2008, *Convergen regulation of locus coeruleus activity as an adaptive response to stress, European Journal of Pharmacology,* Vol. 583, Hal. 194-203

Van Essen, David. 2007.Adult Neurogenesis. Society fo Neuroscience.www.sfn.org