PHYSIOLOGY RESEARCHES AND INNOVATION

PROCEEDING OF SURABAYA INTERNATIONAL PHYSIOLOGY SEMINAR

Foreword

Assalamu 'alaikum Wr. Wb

Greetings,

Alhamdulillahi robbil alamin. We finally finished article publication in proceeding of Surabaya International Physiology Seminar (SIPS). The proceeding was ISBN indexed entitled "**Physiology Researches and Innovation**". It consist of excluded articles that submitted to the Scitepress for Scopus indexing.
We highly apreciate to Indonesian Physiological Society (IAIFI) members for SIPS participation and article submission. Further, we hope that it will significantly contribute to the development of physiology researches and innovation in Indonesia. Please don't be hesitate for sugestion in order to make it better.

Wassalamu 'alaikum wr wb,

Warm regards,
Chairman of committee/ Head of Physiology Department

Dr. Bambang Purwanto, dr., M.Kes

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Correlation Between Plasma ß-Endorphin Levels and Plasma Testosterone Levels in Male Wistar Rat That Given Aerobic and Anaerobic Exercise

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Keywords ß-Endorphin, testosterone, aerobic exercise, anaerobic exercise

Abstract Background: Regularly done physical exercise could positively affect to increasing of endorphin and testosterone level. This study aim to know the correlation between plasma ß-Endorphin level in male Wistar rat that given aerobic and anaerobic exercise. Methods: this study using Post Test Control Group Design. Experimental animal are 24 male Wistar rat divided into control, aerobic, and anaerobic groups. Aerobic exercise performed 7 times a week at a speed 20m/minutes for 30 minutes, while anaerobic exercise performed 7 times a week at a speed 35m/minutes for 20 minutes at 1 minutes interval every 4 minutes, using a treadmill for 6 weeks. Results: There is increasing of plasma B- endorphin level in anaerobic group compared to aerobic and control groups (57.65±9,66 vs 54,27±10,23 vs 49.37 ±15.55 pg/mL). Plasma testosterone level measurement obtained increasing of aerobic and anaerobic groups compared to control group (6,24±3.06 vs 4.93±4,60 vs 3,38±1,74ng/mL). Correlation test in aerobic group obtained p=0,002 with r=0,905. Correlation test in anaerobic group obtained p=0,168 with r--0,539. Conclusion: There was a high correlation between the mean plasma ß-Endorphin levels with the mean plasma testosterone levels in 7 times a week aerobic group.

1. INTRODUCTION

Sexual activity is a human biological necessity to obtain offspring. Therefore, sexual problems often cause a rift in household which can end in a divorce. Sexual dysfunction is a serious problem for most of men. Several sexual dysfunctions experienced by men include low libido, erectile dysfunction, and premature ejaculation[3].

Libido is defined as an urge to commit sexual activities.[26] Libido or sexual desire disorder is defined as the absence or deficiency of sexual fantasy and a desire for sexual activity which can persist and cause severe stress and problems in interpersonal relationships. Sexual desire disorder can be caused by psychological factors such as anxiety and depression as well as physical factors such as low levels of testosterone[17]

One of the relaxation techniques which can improve sexual desire disorders is exercise. During exercise, the body will produce endorphins which will bind with receptors from the hypothalamus and limbic system. The increased levels of endorphin is correlated with decreased pain sensation, increase in memory, improved appetite, sexual performance, blood pressure, and respiration. Exercise can increase endorphin levels 4-5 fold in the blood. Therefore, increased exercise will result in higher level of endorphins produced[14].

Endorphin is a neuropeptide produced by the body during relaxation or calm state. Endorphin is produced in the brain and the spinal cord. ß-endorphin is the most potent endogenous opioid peptide. ß-Endorphin is found in the second order neuron and the peripheral nervous system.[18] In addition, ß-Endorphin is also detected in testis, specifically in semen, epithelium of epididymis, vas deferens, vesica seminalis, and

prostate[2.10.15.23.29]. In the peripheral nervous system, ß-Endorphin induce analgesia by binding with opioid receptor, especially the p type. The interaction will inhibit the release of tachykinins especially substance peptide which is a key protein for pain transmission[30]. Apart from producing endorphins, regular exercise can have positive impact on endocrine functions, such as increasing testosterone levels[20]

In contrast, Maffetone (2007) found that excessive exercise can cause endocrine dysfunction, such as increasing levels of cortisol and decreasing levies of testosterone. In high intensity exercise, there will be an increase in ACTH secretion and reduced plasma level of LH. In high intensity exercise, corticotropin releasing hormone (CRH) will induce ACTH and B-endorphin release. Increased ß-Endorphin can inhibit gonadotropin release (LH secretion)28. Decreased secretion of LH can cause reduced testosterone release which is produced by Leydig cells[5].

Study by McMurray, *et al* (1995) found significant increase in testosterone levels in group with aerobic and anaerobic physical activities. In contrast, study by Kraemer *et al* (2007) found significant decrease of testosterone levels in groups with exercise. This decrease in testosterone levels is a result of stimulation of hypothalamus-hypophysis or peripheral sites (disrupt testicular functions) by exercise which cause alteration in negative feedback loop that regulates hormones production. Fournier *et al* (1997) stated that ß-Endorphin levels would be increased significantly during exercise, but testosterone 'levels would be decreased during exercise. This phenomenon were caused by difference in hormonal response which could result in body during exercise.[9] Several studies showed from difference in neuro-psychoendocrine reactivity increased levels of plasma opioid neuropeptide during exercise in athletes[4,6,7,24]. Other study by Orlova, *et al* (1988) stated that the mechanism of increased production of endorphin is caused by increased synthesis from POMC which result from the exercise[25]

Currently, there are not many studies which investigate the relationship between ß-Endorphin.

2.1 Measurement of ß-Endorphin and Testosterone Levels

The ß-Endorphin and plasma testosterone were measured using ELISA method utilizing ELISA Kit for Rat from ELABSCIENCE.

2.2 Data Analysis

Data were analyzed using 23th version of SPSS for windows. Spearman Rank test was then performed to analyze the correlation between plasma ß-endorphin levels and plasma testosterone levels in male Wistar rat that given aerobic and anaerobic exercise.

levels and plasma testosterone during aerobic and anaerobic exercise. A lot of the studies which have been conducted only investigate the impact of exercise on ß-Endorphin levels which are secreted by the hypothalamus. The goal of this study is to analyze the correlation between plasma ß-Endorphin levels and plasma testosterone levels in male Wistar rat that given aerobic and anaerobic exercise.

2. METHODS

This study has obtained ethical approval by the Ethic Commission in Faculty of Medicine Sriwijaya with the University number. 56/ kepkrsmhfkunsri/ 2017 dated 13th of April 2017. This is an experimental laboratory study with Post Test Control Group Design. This study is conducted in BioScience Research Laboratory in Palembang from April until June 2017. The experimental animals used in this study are 24 Wistar rat, aged 6-8 weeks weighing between 60-80 gr, which were allocated randomly into 3 groups: Pl control group, without exercise; P2 group which were subjected to aerobic exercise every day for 6 weeks; P3 group which were subjected to anaerobic exercise every day for 6 weeks.

The anaerobic exercise was given by placing the experimental rat in animal treadmill and running treadmill 35n/minutes for 20 minutes at 1 minutes interval every 4 minutes, In contrast, aerobic exercise was performed by placing the rat in treadmill with the speed 20 m/minutes for 30 minutes continuously'. The rat were subjected to these physical activities for 6 weeks. In the last day of the study, the rat were decapitated after running

in the treadmill, and intracardiac blood samples were obtained.

3. RESULTS

The Mean Plasma ß-Endorphin and Testosterone Levels

The results from mean plasma ß-Endorphin levels measurement showed increased levels of plasma B-endorphin in experimental groups compared with control (49.37+15.55 pg/mL). ß-Endorphin levels in anaerobic group 7 times a week was higher (57.65+9.66 pg/mL) compared with aerobic group 7 times a week (54.27+ 10.23 pg/mL). The results from mean plasma testosterone levels measurement showed higher levels in 7 times a week aerobic group (6.2413.06 ng/mL) compared with 7 times a week aerobic group (6.24±3.06 ng/mL) compared with 7 times a

Table 1. Mean Plasma ß-Endorphin Level and Plasma Testosterone Level In Control, 7x A Week Aerobic, And 7x A Wick Anaerobic Group

Group	N	Plasma ß-Endorfin Level Mean±SD (ng/ml)	Plasma Testosterone Level Mean±SD (ng/ml)
Control Group	8	49.37±15.55	3.38±1.74
7x Aerobic Group	8	54.27±10.23	6.24±3.06
7x Anaerobic Group	8	57.65±9.66	4.93±4.60

Next, Spearman Rank test was performed to investigate the correlation between mean plasma B-endorphin levels with plasma testosterone levels in control, 7x a week aerobic, and 7x a week anaerobic group. Table 2 showed that there was significant correlation between mean plasma ß-Endorphin levels aerobic group with high correlation (r=0.905; p=0.002).

Table 2. Correlation Between Mean Plasma ß-Endorphin Levels and Mean Plasma Testosterone Levels in Control, 7x A Week Aerobic, and 7x A Wick Anaerobic Group.

Group	n	r	P*
Control Group	24	-0,143	0,736
7x Aerobic Group	24	0,905	0,002
7x Anaerobic Group	24	-0,539	0,168

P Spearman Rank Test p <0.05*

4. DISCUSSION

Based on the results of this study, there was an increase in mean plasma ß-Endorphin level in both aerobic and anaerobic groups, but the increase was higher in anaerobic compared with aerobic group. This increase is because high intensity anaerobic physical exercise can increase lactic acid production which also increase plasma ß-Endorphin levels. Long period of high intensity exercise more than 10 minutes result in increased lactic acid which caused ß-Endorphin release by catecholamine and cortisol. The result of this study support earlier findings by Goldfarb & Jamurtas (1997), which stated that the increase of ß-Endorphin levels were more significant in anaerobic exercise, which were affected by metabolic demands[11]. This was also similar to a study by Rahkila *et al* (1987) which showed significant increase in plasma ß-Endorphin levels in week anaerobic group (4.93±4.60 ng/mL) (Table 1). Anaerobic physical exercise group which therefore showed the relationship between the intensity of physical exercise and ß-Endorphin secretion[27]

The results of testosterone measurement in this study found an increase in mean plasma testosterone levies during aerobic physical exercise. Hackney, *et al* (1995) stated that the increase of testosterone levels during physical exercise is because physical exercise induced testosterone secretion which regulated the negative feedback in endocrine system[12]. Study conducted by Hawkins, *et al* (2008) involving men subjected to aerobic physical exercise found a significant increase of plasma testosterone levels (p=0.004)[13]. Similar findings were found in a study by Hudson, *et al* (1987) which found a significant increase of 27% of plasma testosterone levels in men after aerobic physical exercise[14]. Study conducted by Ari, *et al* (2009) also found that as VO2 max increase, the plasma testosterone levels will also increase'. Next, Johnson (1999) found that physical exercise can affect testosterone levels by affecting the

circulation to produce libido because the sexual desire will increase after routine physical activities[16].

The results of correlation test between plasma B- endorphin levels and plasma testosterone levels showed that there was a significant correlation in aerobic group (p=0.002, 1-=0.905), whereas there was no significant correlation in the anaerobic group. This is because physical exercise can increase B-endorphin levels which will affect hormonal system and sexual functions. Fournier, *et al* (1997) stated that ß-Endorphin levels would be increased significantly during physical exercise, but testosterone levels would be decreased during physical exercise because of the difference in hormonal response which could result from difference in neuro-psychoendocrine reactivity in body during exercise[9].

The results of this study is also in line with the study from Safanirejad, *et al* (2009) which showed that high intensity exercise could cause CRH to induce POMC to synthesize ß-Endorphin. The increased levels of ß-Endorphin can inhibit gonadotropin release (LH secretion)[28]. Next, Colon (2007) stated that the decreased secretion of LH could cause the reduction of testosterone produced by Leydig cells[5]. Study conducted by Kostic, *et al* (1997) also showed that LH release could inhibit testosterone synthesis directly in Leydig cells which decrease plasma testosterone[19]

5. CONCLUSION

There was a high correlation between the mean plasma ß-Endorphin levels with the mean plasma testosterone levels in 7 times a week aerobic group.

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