Cukurova Medical Journal

Araştırma Makalesi / Research Article

Effects of Exercise on β-Endorphin and Follicle Stimulating Hormone Levels among Female Army Officer

Kadın Ordu Çalışanlarında Egzersizin β-Endorfin ve Folikül Uyarıcı Hormon Düzeylerine Etkileri

Ruqaiyah Ruqaiyah[1],Retty Ratnawati[2], Edy Mustofa[3]

[1]Brawijaya University,Faculty of Medicine, Midwifery Master Study Programme,[2]Physiology Laboratory, [3]Obstetric and Ginaecology Laboratory, Saiful Anwar General Hospital, Malang, East Java, INDONESIA

CukurovaMedicalJournal 2014; 39 (3):496-500.

ABSTRACT

Purpose: This study aimed to investigate whether chronically high-intensity exercise can change β-endorphin and FSH level among female army officer.

Material and Methods: Fourty six healthy female army officer volunteered for the study. All of them gave written consent regarding their participation. The subjects were categorized in two groups: high-intensity exercise (HE, 23 subjects) and non exercise (NE, 23 subjects). The inclusion criteria were amenorrhea, no consumption of reproductive hormonal, age between 21-40 years, and not involved in diet programme, while the exclusion criteria were any factors that could interfere with normality. High intensity-exercise was performed chronically by running for between 1953-3200 meter, three times per day, 6 days per weeks, for 7 months. Serum β-endorphin was measured immunoenzymatically using an ELISA method. FSH serum was measured by chemiluminescence method.

Results: Age, body weight, height and onset of menarchee were not significantly different between group ($P > 0.05$). High-intensity exercise significantly increase the β-endorphin level compared to the control ($P < 0.01$). The level of FSH significantly decrease in the HE group than that the NE group ($P < 0.01$).

Conclusion: In conclusion, the high-intensitiy exercise on among female army officer can increase β-endorphin and decrease follicle stimulating hormone level.

Keywords: Performance; gonadotropin; corticotropin; chronic exercise; amenorrhea.

ÖZET

Amaç: Bu çalışmanın amacı yüksek yoğunlukta egzersizin kadın subaylarda β-endorfin ve FSH düzeylerinde değişikliğe yol açıp açmayacağını belirlemektir.

Materyal ve Metod: Kırk altı sağlıklı kadın subay bu çalışma için gönüllü oldu. Bunların hepsi çalışmaya katıldıklarına ilişkin yazılı onay verdi. Denekler 2 grupta kategorize edildi; yüksek yoğunluklu egzersiz grubu (HE, 23 denek) ve egzersiz olmayan grup (NE, 23 denek). Çalışmaya katılım kriterleri; amenore, reprodüktif hormonların tüketilmemesi, yaş aralığı 21-40 ve diyet programının dahil olmaması, bu belirtilen ile uyumsuz bulgular ise çalışma dışı bırakılma kriterleri olarak tanımlandı. Yüksek yoğunluklu egzersiz 7 ay boyunca haftada 6 gün ve günde 3 defa 1953-3200 metre koşu şeklinde uygulandı. Serum β-endorfin düzeyleri immünoenzimatik eliza yöntemiyle ölçüldü. Serum FSH seviyeleri kemiluminosens metoduyla ölçüldü.

Bulgular: Yaş, boy uzunluğu, vücut ağırlığı ve menarş başlangıcı bakımından gruplar arasında önemli bir farklılık ($p>0.05$) gözlemlenmedi. Kontrol grubuyla kıyaslandığında yüksek yoğunluklu egzersiz yapan grupta β-endorfin düzeyleri önemli ölçüde artmıştır ($p<0.01$). FSH değerleri NE grubuna göre HE grubunda önemli derecede azalmıştır ($p<0,01$).

Tartışma: Sonuç olarak yüksek yoğunluklu egzersiz kadın subaylarda β-endorfin düzeylerinin artmasına, FSH düzeylerinin de azalmasına neden olmaktadır.
Anahtar Kelimeler: performans; gonadotropin; kortikotropin; kronik egzersiz; amenore.

INTRODUCTION

The neuro-immune-endocrine system is a complex communication pathway involved in the adaptativeresponses to external and internal stressors for homeostasis regulation.Alteration of this axis may influence different functions, or systems, such as the reproductive function and metabolism[1].Many stressors could induce alterations on several neuro-immuno-endocrine parameters, through the activation of adrenalin and noradrenal, and a subsequent increase of luteinizing hormone (LH) and follicle stimulating hormone(FSH) levels[2].

Follicle stimulating hormone, is a heterodimeric glycoprotein produced within the adenohypophysis.This gonadotropin hormone involved in the regulation of several reproductive processes in the female. FSH acts primarily at the level of the ovarian follicle. FSH is essential for the growth of preantral follicles, antrum formation, estradiol secretion and their oocyte-acquiring competence to resume meiosis and to undergo fertilization and embryonic development[3].

It is accepted that physical exercise's main objective is the increase and improvement of physical performance, fitness maintenance, and for preventing systemic illnesses such as obesity and its complications. Moreover, it is also recommended for an improvement in quality of musculoskeletal and falls in the elderly[4]. Chronic aerobic, resistance and endurance exercises are resulted different physiological adaptationsat the cellular level and phenotypically[5,6]. Femalewho worked as military officer is person who received regularly chronic aerobic, resistance and endurance. Exercise represents a provocative stimulus to study such hormone dynamics[7,8].The change of physiological adaptation due to chronically exercise in this subjects may will change the hormonal level, especially β-endorphin and FSH level. This study aimed to investigate whether chronically high-intensity exercise can change β-endorphin and FSH level among female army officer.

MATERIAL and METHODS

Subjects

Fourty six healthy femalesarmy officer volunteered for the study. All of them gave written consent regarding their participation. A physician reviewed their medical histories. None of the volunteers had had previous infertility or hypothalamic–pituitary problems. The sample was allocated according to their own characteristics to one of the two groups: high-intensity exercise (HE, 23 subjects) and non exercise (control) (NE, 23 subjects). The inclusion criteria were amenorrhea (to homogenize the hormonal level), no consumption of reproductive hormonal, age between 21-40 years, and not involved in diet programme, while the exclusion criteria were any factors that could interfere with normality. Non exercise group (control) was femalesarmy officer who work in administrative unit.

Anthropometric parameters

The anthropometric variables measured in this study were age, height, body mass, and onset of menarchee. Height was determined using a mobile anthropometer (Kawe 44444, France) to the nearest millimeter, with the participant's head in the Frankfurt plane. Body mass was determined to the nearest 100 g using a digital scale (Tefal, sc 9210, France). All anthropometric measurements were performed by one observer to avoid inter-observer variation.

High intensity-exercise

High intensity-exercise was performed chronically by running for between 1953-3200 meter, three times per day, 6 days per weeks, for 7 months. High-exercise was achieved by measured pulse rate. If the pulse rates between 135-170

times per minute will categorized in high intensity-exercise.

Blood samples

Five milliliter blood was drawn from an antecubital vein into 5-ml EDTA tube. The EDTA tubes were then stored on ice and centrifuged in within minutes at 1600 rpm (5000 g) for 15 minutes at 4 °C. The separated serum were stored at -20°C until analyzed.

β-endorphin analysis

β-endorphin in serum was measured immunoenzymatically using an ELISA method using β-endorphin EIA Kit(human) High Sensitivity, Catalog number S-1134, Peninsula Laboratories, LLC, Member of Bachem, San Carlos, California, USA. All procedure was done according kit instruction.

FSH analysis

FSH levelin blood sample was measured in the laboratory through chemiluminescence method using human FSH Advia Centaur assay kit, catalog number 110756 (USA). The ADVIA Centaur FSH assay has an analytical sensitivity of 0.3 mIU/mL (IU/L). The reportable range of the ADVIA Centaur FSH assay is 0.3 mIU/mL (IU/L) to 400 mIU/mL (IU/L). All procedure was done according kit instruction. When serum samples with FSH levels greater than 200 mIU/mL (IU/L) we diluted and retested to obtain accurate results.

Ethics

This research has been approved by research ethics committee Faculty of Medicine University of Brawijaya, Malang, Indonesia

Statistical analysis

Data are presented as mean ± SD and differences between groups were analyzed using t-student test with SPSS 15.0 statistical package.

RESULTS

Table 1 shows the subject characteristics in the control group and high-intensity exercise group. The age and the level of body weight, height and onset of menarchee were not significantly different between group (P > 0.05).

Table 2 shows the levels of β-endorphin and FSH in the control group and high-intensity exercise group. High-intensity exercise significantly increase the β-endorphin level compared to the control (P< 0.01). The level of FSH significantly decrease in the HE group than that the NE group (P< 0.01).

Table 1. Basic characteristics of high-intensitiy exercise and non exercise female army

	Non exercise (*N* = 23)	High-intensitiy exercise (*N* = 23)
Age (years)	33.13 ± 2.83	33.52 ± 2.29
Weight (kg)	54.70 ± 4.16	53.52 ± 3.07
Height (cm)	159.70 ± 3.43	158.70 ± 2.96
Menarchee onset (years)	13.57 ± 1.12	13.39 ± 0.99

Values are expressed as mean ± SD. No differences were found for these variables which was an analyzed variable for assuming right subject allocation; kg: kilogram; cm: centimeter

Table 2.β-endorphin and FSH of high-intensitiy exercise and non exercise female army

	Non exercise (N = 23)	High-intensitiy exercise (N = 23)
β-endorphin (ng/ml)	0.09 ± 0.06	0.14 ± 0.06a
FSH (IU/ml)	7.36 ± 1.63	2.90 ± 1.32a

Values are expressed as mean ± SD. [a]P< 0.01; in comparison with non exercise group; FSH: follicle stimulating hormone; ng: nanogram; ml: mililiter; IU: international unit.

DISCUSSION

The results obtained from this study reveal that the high-intensity exercise on female army officer can increase β-endorphin and decrease FSH level. However, the main novelty of our study is the evidence that chronicallyhigh intensitiy exercise among subjects with basic regularly trained alter the endogenous synthesis of hormone levels.Exercise is form of stress, will produces a wide array of systemic and endocrine changes[9-12]. In this study, HE significantly increase the β-endorphin level compared to the NE group (P< 0.01). This finding indicate that intensity of exercise in this study able to increase the β-endorphin level. Excessive exercising elevates plasma β-endorphin level. Corticotropin releasing hormone (CRH), as the main stress mediator, is responsible for the central plasma β-endorphin level increase. CRH may directly inhibit gonadotropin releasing hormone GnRH secretion and stimulate plasma β-endorphin level production[13]. Previous studies showed that exercise at intensities more than 75% maximum oxygen uptake or 80% maximum heart rate induces significant increases plasma β-endorphin level[14-18]. In moderate and low intensity exercise, there is no significant different of plasma β-endorphin level[17,19]. Besides, due to relationship between β-endorphin level and exercise intensity and did not incresae significantly until exhaustion, pain and fatigue time[20], therefore β-endorphin level may be good predictor to determined performance of female Indonesian army.

The level of FSH significantly decrease in the HE group than that the NE control group (P< 0.01). This finding indicate that stimulation plasma β-endorphin level production maybe by CRH may directly inhibit gonadotropin releasing hormone GnRH secretion. The synthesis of estradiol is carried by the enzyme aromatase and regulated by negativefeedback by estradiol itself, which inhibits pituitary FSH secretion by regulating GnRH and its receptor levels at the hypothalamus-pituitary level[21-23].

In conclusion, the chronically high-intensitiy exercise on among female army officer can increase β-endorphin and decrease follicle stimulating hormone level. The β-endorphin level may be good alternative marker to predict performance of female Indonesian army.

Declaration of interest

The author(s) declare(s) that there is no conflict of interests regarding the publication of this article.

REFERENCES

1. Lopez JF, Akil H, Watson SJ. Neural circuits mediating stress. Biol Psychiatry. 1999;46:1461–71.
2. Chrousos GP, Torpy DJ, Gold PW. Interactions between the hypothalamic–pituitary–adrenal axis and the female reproductive system: clinical implications. Ann Intern Med. 1998;129:229–40.
3. Wu J, Tian Q. Role of follicle stimulating hormone and epidermal growth factor in the development of porcrinepreantral follicle in vitro. Zygote. 2007;15:233-40.
4. Pedersen BK, Saltin B. Evidence for prescribing exercise as therapy in chronic disease. Scand J Med Sci Sports 2006;16:3–63.
5. Florini JR, Ewton DZ, Coolican SA. Growth hormone and the insulin-like growth factor system in myogenesis. Endocr Rev. 1996;17:481–517.
6. Consitt LA, Bloomer RJ, Wideman L. The effect of exercise type on immunofunctional and traditional growth hormone. Eur J Appl Physiol. 2007;100:321-30.
7. Felsing NE, Brasel JO, Cooper DM. Effect of low and high-intensity exercise on circulating growth hormone in men. J ClinEndocrinolMetab. 1992;75:157–62.
8. Roemmich JN, Rogol AD. Exercise and growth hormone: does one affect the other? J Pediatr 1997;131:75–80.
9. Ronsen O, Haug E, Pedersen BK, Bahr R. Increased neuroendocrine response to a repeated bout of

endurance exercise. Med Sci Sports Exerc. 2001;33:568–75.

10. Loucks AB. Physical health of the female athlete: observations, effects, and causes of reproductive disorders. Can J Appl Physiol. 2001;26:176–185.

11. Loucks AB, Mortola JF, Girton L, Yen SS. Alterations in the hypothalamic–pituitary-–ovarian and the hypothalamic–pituitary–adrenal axes in athletic women. J ClinEndocrinolMetab. 1989;68:402–11.

12. Enea C, Boissuaes N, Fargeas-Gluck MA, Diaz V, Dugue. Circulating androgens in women: exercise-induced changes. Sports Med. 2011;41:1-15.

13. Meczekalski B, Podfigurna-Stopa A, Warenik-Szymankiewicz, Genazzani AR. Functional hypothalamic amenorrhea current view on neuroendocrine aberrations. GynecolEndocrinol. 2008;24:4-11.

14. Farrell PA, Gates WK, Morgan WP, Maksud MG. Increase in plasma B-endorphin/B-LPH immunoreactivty after treadmill running in humans. J Appl Physiol. 1982;52:1245-9.

15. Farrell PA, Kjaer M, Bach FW, Galbo H. B-endorphin and adrenocorticotropin response to supramaximal treadmill exercise in trained and untrained males. ActaPhysiol Scand. 1987;130:619-25.

16. Goldfarb AH, Hartfield BD, Armstrong D, Potts J. Plasma beta-endorphin concentration: response to intensity and duration of exercise. Med Sci Exerc. 1990;22:241-4.

17. Goldfarb AH, Hartfield BD, Potts J, Armstrong D. Beta-endorphin time course response to intensity of exercise: effect of training status. Int J Sports Med. 1991;3:264-8.

18. Oleshansky MA, Zoltick JM, Herman RH, Mougey EH, Meyrhoff JL. The influence of fitness on neuroendocrine responses to exhaustive treadmill exercise. Eur J Appl Physiol. 1990;59:405-10.

19. McMurray RG, Forsythe WA, Mar MH, Hardy CJ. Exercise intensity related responses of β-endorphin and catecholamines. Med SciExerc 1987;19:570-4.

20. Salomon P, Mazurek W: Levels of B-endorphin in patients with silent myocardial ischemia. Pol Arch Med Wewn. 1994;91:446-50.

21. Braden TD, Conn PM. GnRH and its mechanism of action. In: Leung PCK, Hsueh AJW, Friesen HG (eds) Molecular basis of reproductive endocrinology. Springer, New York, 1993;12–38.

22. Conn PM. The molecular mechanism of gonadotropin-releasing hormone action in the pituitary. In: Knobil E, Neill JD (eds) The physiology of reproduction. Raven Press, New York.1994;1815–26.

23. Marshall JC, Case GD, Valk TW, Corley KP, Sauder SE, Kelch RP. Selective inhibition of follicle-stimulating hormone secretion by estradiol. Mechanism for modulation of gonadotropin responses to low dose pulses of gonadotropin-releasing hormone. J Clin Invest. 1983;71:248–57.

YazışmaAdresi / Address for Correspondence:
Dr.RuqaiyahRuqaiyah
Faculty of Medicine, Brawijaya University,
Jl. Veteran, Malang, East Java, Indonesia
Email: Aikruqaiyah@yahoo.co.id

Geliş tarihi/Received on: 04.02.2014
Kabul tarihi/Accepted on:06.03.2014