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Exercise training increase brain-derived neurotrophic factor and irisin level in healthy young adults in Basra city

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Abstract
Regular treadmill exercise is more efficient than voluntary in neuroprotection by changing brain metabolism, at the moment, regular treadmill exercise has been observed to improve many physiological impacts in humans and animals. The present study sought to verify the effect of regular treadmill exercise on brain-derived neurotrophic factor (BDNF) and irisin in healthy adult's men in Basra city.Thirty healthy subjects (age 22). Participated in this study and were divided into two groups; group one (G1) and group two (G2), subjects underwent to regular treadmill exercise in two programs for eight weeks. Respectively, to determine the comparison between groups, serum of BDNF and Irsisn level were investigated. BDNF and Irisin levels in G1 and G2 were significant post exercise sessions compared to prior exercise (P>0.001). No significant was observed in BDNF compared to Irisin in G1. Also No significant was observed in BDNF compared to Irisin in G2. Generally, the regular exercise program selected in this study affected to release of BDNF and Irisin in healthy non-athletic men.

Keywords: regular exercise, BDNF, Irisin, Young

Introduction

In general, it is known that exercise training improves the vital, physiological and psychological functions of life quality in people (Slimani et al., 2018) [35]. In particular, regular exercise training has a positive impact on the central nervous system (CNS) and peripheral nervous system (PNS) (Dishman et al., 2006).Additionally,exercise training interventions increase the secretion of neurodevelopmental factors, including the brain-derived neurotrophic factor (BDNF) in elite athletes (Seifert et al., 2010) but the mechanism of BDNF secretion in non-athletic still contradictory. In contrast, BDNF is originally found in the brain (Sädbom-Williams, 2021) [30]. but also found in the peripheral system (Schmidt & Duman, 2010) [32] More specifically, it is a functional protein in neurons of the CNS and PNS (Rodríguez-Iglesias, Sierra, & Valero, 2019) [29].

Moreover, it supports the survival of neurons, stimulates the growth and differentiation of new neurons and synapses through axonal and dendritic growth (Hromadkova et al., 2020) [15] and is consider as one of the most potent substances in stimulating neurogenesis (Almeida et al., 2019) [1]. Conflicting results showed the increase of BDNF during high-intensity exercise (Antunes, Rossi, Teixeira, & Lira, 2020 [2]; Jiménez-Maldonado, Rentería, García-Suárez, Moncada-Jiménez, & Freire-Royes, 2018) [20]. but not during moderate or light exercise (Enette et al., 2020; Schmolesky, Webb, & Hansen, 2013) [13]. Increasing BDNF improves the functions of the brain, particularly the hippocampus,which is the main center of cognitive and learning processes in the brain (Cunha, Brambilla, & Thomas, 2010) [8].

Irisin is a myokine that plays an important role in lipid metabolism and enhances the mitochondrial biogenesis in myocytes, and induces the browning of white adipose tissue (Arhire, Mihalache, & Covasa, 2019) [3]. Irisin is one of the most recently discovered and works directly on the cells that control the destruction and building of bone (L. Liu et al., 2021).Previous studies have shown that irisin possesses defensive properties opposite to obesity, insulin, and liver fat disease, appearing in some of these metabolic changes a correlation with inflammatory markers, which suggests that irisin may regulate the inflammatory response (Arias-Loste, Ranchal, Romero-Gómez, & Crespo, 2014 [4]; del Moral & Aguilera, 2018) [9].

In line with this, It has also been documented that irisin crosses the CNS through the blood-brain barrier and stimulates BDNF gene expression (Wrann, 2015),which increases cognitive and psychological levels in humans (Fagundo et al., 2016) and animals (Wrann, 2015). Further, Irisin is released from muscles response to exercise training and mediates some of the beneficial effects of exercise in humans (Ohtaki, 2016) such as weight loss thermoregulation, and obesity (Ohtaki, 2016).Studies conducted on animals have shown that exercise training increases irisin levels (Arhire et al., 2019) while the level of irisin decreases in neurological diseases (Kim & Song, 2018; Y. Liu, Zhu, Guo, Chen, & Meng, 2020), which causes some psychological or emotional defects in patients. Previous studies showed that the level of irisin decrease in an animal model of stroke compared to animals who were subjected to bouts of exercise training (Ding et al., 2005; Li, Li, Yuan, Qu, & Wang, 2017; Matsuda, Sakakima, & Yoshida, 2010).Warren explained the molecular basis of irisin, as they believe that exercise releases irisin and this secretion support the functioning of PGC-10/FNDC5/BDNF receptors which in turn protects and nourishes neurons during stress or diseases (Wrann, 2015).

Thus, since the adaptation and cooperation of physiological conditions in the human body among themselves is very important for the development of functional ability in general of elite athletes to reach a high achievement or for non-athletes to maintain a healthy physical structure, as well as for patients to complete the recovery stages, the study aims to investigate the effect of regular exercise training on BDNF along with irisin level in non-athletes adults in Basra city.

Material and Methods

Participantsa

A total of thirty adults young from Basra city were randomly assigned and divided into one of two groups (G1 and G2), each group contains 15 Participants.The participants were implicated in the study based on the following criteria: no medicine use , normal levels of fasting glucose and arterial blood pressure (<130/85 mmHg). Anthropometry and characteristic assessments shown in table 1 .

Firstly, participants were briefed about the goal of the programs and fully understand the procedure as well as they were familiarized with the instruments of study. The test and assessment were started between 8.00 am to 10.00 pm. Besides, the air-conditioned room temperature was set at 22ºC. Anthropometric parameters and body fat% were taken in the laboratory with adequate privacy.

Exercise Protocols

To evaluate the difference between groups and after the warm-up, two exercises programs were utilized, (i) participants at G1 started running on the treadmill apparatus at a speed of (10 km / h) and gradually increased to (14 km / h) for a period of (2 minutes), the speed increased to reaches (16 km / h) for 3 min.(ii) participants at G2 starts running on the treadmill at a speed of (8 km / h) for a period of (3 minutes) and the speed and gradually increased to (10 km / h) and then (12 km / h) for a period of (2 minutes) the final speed reaches to (14 km / h) for 3 minutes .The exercise sessions were completed two months.

Measurement

Height was estimated by a centimeter to nearest of 0.1 cm. Weight was measured by a digital weighing scale with 0.1 kg. Body fat% was measured by the BIA strategy . utilizing a low current of 50 kHz, 500 µA. Blood pressure was measured for checking the appearance of any test criteria by a Mercury sphygmomanometer. Test end measures were followed by ACSM's rules for exercise testing and prescription.

In prior and post-experimental, 2 ml of blood sample withdrawn from participants and immediately drawn into glass tubes and centrifuged at a speed of 3500 for five minutes according to manufacturer instructions of the kits. The concentration of BDNF (sensitivity; 0.063) and irisin (sensitivity; 0.72) were assessed by ELISA kit (GmbH, Germany).

Statistical analysis

The Kolmogorov-Smirnov test was conducted to find out that the sample distribution is identical in this study.SPSS 22.0 was used for all statistical analyses, the data are expressed as the mean ± standard error of the mean. Data were analyzed using Pearson correlation and student t-test. Significance was established at P values < 0.05.

Results

As shown in Table 2, a significance of BDNF and Irisin level in G1 and G2 post of exercise compared to prior of exercise intervention (P>0.001). While table 3 shows no statistical difference between BDNF and Irisin in the first experiment (P>0.06). Also, no significant difference between the BDNF and Irisin in the second experiment (Table 4).

Table 1: Physical characteristics of subject.

Characteristic	Value
Age (year)	22-25
High (cm)	175.3±6.88
Weight(kg)	75.8±11.00
Vo2maxml/kg/min Mean ±S.D.	43.25±7.25
Body Fat %Mean ±S.D.	23.65±5.55

Table 2: Comparison of BDNF and irsin in to stage of exercise programs (Prior to Post). values are presented as mean±standard deviation.

Variables	Prior (G1)	Post (G1)	Prior (G2)	Post (G2)
BDNF	5/26±0/67	5/93±0/95*	5/36±0/66	6/19±0/93*
Irisin	35/59±3/48	39/39±3/17*	35/85±1/96	42/93±4/80*

Table 3: Comparison between BDNF to irsin in first experimental, values are presented as mean±standard deviation.

Variables	T test	P>value
BDNF	-2/308	0/046*
Irisin	-2/361	0/043*

Table 4: Comparison between BDNF to irsin in second experimental, Values are presented as mean±standard deviation.

Variables	T test	P>value
BDNF	12/73	15/40
Irisin	10/69	19/75

Discussion

The main finding of the study suggests positive results of regular exercise training on BDNF and irisin in non-athletie healthy youth . Recently, BDNF and irisin are thought to play a role in regulating the metabolism of energy in various tissues, including the brain and muscles (Iizuka, Machida, & Hirafuji, 2014) [17]. Data of this study demonstrated that the regular exercise training capable to increase BDNF and irisin in 8 weeks . Our results support the fact that a during exercise training, BDNF is increased and this leads to numerous physiological processes involved in many aspects of human brain development and plasticity, including proliferation, differentiation, neuronal survival, neurogenesis, synaptic plasticity, dendrite growth, and long-term memory, cognitive function (Bathina & Das, 2015) [5]. In addition, decrease levels of BDNF are associated with disorders of both the nervous and metabolic systems, such as severe depression, Parkinson's (Scalzo, Kümmer, Bretas, Cardoso, & Teixeira, 2010) [31], obesity (Byerly et al., 2009) [7] and type 2 diabetes (Ono et al., 2000) [27].

Comparatively, this study conducted with recent findings that exercise increases BDNF expression and protein content, as well as increases systemic BDNF in humans (Jamali, Shahrbanian, & Tayebi, 2020) [18].

Thus, we suggest that a differences protocol of exercise training can increas the BDNF level.

Irisin was identified as a new muscle-derived messenger substance, which may be implicated in the mediation of health-related benefits from regular exercise. Results of this study showed an increase in the level of irisin secretion .Our study conducted with the study of Bostro (Boström et al., 2012) [6] when showed out a 10 weeks of exercise training was associated with an increase in irisin compared with the non-exercised. However, other results have noted that nor aerobic exercise or resistance exercise could increases the irisin level (Dianatinasab et al., 2020). In contrast, chronic exercise training determined a significant effect in decreasing circulating irisin (Qiu et al., 2015).Most probably that an acute exercise training may be associated with a decrease in circulating irisin. Previous studies determinate that the irisin level was decreased during exercise training in obese people because the irisin is attached to metabolism system (Tine Kartinah & Rosalyn Sianipar, 2018). Thus, we suggest that chronic exercise training and resistant exercise are associated to reduces body weight similar to the irisin process and also has been noted to be reduced after body weight surgery. Therefore, circulating irisin may be decreased as an output of chronic or resistance exercise affect the body weight. One study showed that irisin secretion up-regulates the mRNA of BDNF, and this relationship is a clear indication that irisin is involved in the cognitive processes and performance activity when a connection with BDNF (Huang, Yan, Luo, & Yang, 2019). Although the BDNF and irisin at rest time did not change due to the dependence of the level of oxygen. Jedrychowski and colleagues indicated that healthy humans have circulating irisin levels in the range amount 3 and 5 ng ml-1, and the values generally increasing during exercise training by improving energy expenditure (Jedrychowski et al., 2015) [6].

Conclusions

Our study aimed to investigate the level of BDNF and irisin in non-athletic healthy men after exercise training of 8 weeks. We concluded that regular exercise training for 8 weeks is capable to release the irisin and pass into the blood-brain barrier that targets the BDNF and consequently leads positive impact on performance activities.

Conflicts of Interest

The author declare that they do not have conflict of interest.

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