

Research Paper

The Effect of One Circuit Training Session on the Serum Levels of Brain-Derived Neurotrophic Factor and Insulin-Like Growth Factor-1 in the Elderly

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ABSTRACT

Objectives Physical activity is effective in improving cognitive function in older adults. Such function may be mediated by the upregulation of neurotrophic growth factors like Brain-Derived Neurotrophic Factor (BDNF) and Insulin-like Growth Factor-1 (IGF-1). The present study aimed to assess and compare the effect of 1 session of circuit training on the serum levels of BDNF and IGF-1 in elderly males and females.

Methods & Materials This quasi-experimental study was carried out in Khorramabad City, Iran in 2017. Five men (Mean±SD age=64.40±6.69 years, Mean±SD weight=74.8±5.63 kg, Mean±SD height=174.4±4.16 cm), and 5 women (Mean±SD age=64.5±6.05 years, Mean±SD weight=65±5.43 kg, Mean±SD height=167±5. Micipated voluntarily in this study. Three days before performing the training protocol, all subjects became familiarized with the methods of performing exercises at their homes. On the training day, at first, their blood samples were obtained; then, the subjects performed circuit training for approximately 1 hour. Second blood samples were obtained 3 minutes after the training session. The Paired sample t test and analysis of covariance were used to identify any significant differences. The statistical significance level was set at P<0.05.

Results This study was carried out on 10 elderly males and females. Results suggested that the serum concentration of BDNF (P<0.05) significantly increased and IGF-1 (P<0.05) significantly decreased. However, the differences between males and females in BDNF (P>0.05) and IGF-1 (P>0.05) were not significant. However, the percent changes of BDNF (22.78 vs. 27.91) and IGF-1 (-10.55 vs. -12.37) were lower in males than females.

Conclusion Circuit training for approximately 1 hour increases the serum concentration of BDNF and decreases IGF-1 in elderly males and females. Therefore, it is recommended that a body weight circuit training be performed in elderly males and females to improve their cognitive status.

Keywords:

Sex, Elderly, Cognition, BDNF, IGF-1

Extended Abstract**1. Objectives****T**

he natural process of aging is associated with changes in the structure and function of the brain and related cogni-

tive changes. Decreased recognition associated with increased age has been already reported. Some of these changes may be related to neurodegenerative diseases like Alzheimer disease and other types of dementia [1, 2]. Physical inactivity is an important risk factor for cognitive decline [3-5] and Alzheimer disease [5, 6] in the elderly. On the contrary, moderate but regular exercise,

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can have a protective effect even if initiated after midlife [2, 3, 5]. Physical activity can affect brain functions, including recognition, learning and memory [7]. Thus, this study examined the effect of 1 circuit training session on the serum levels of Brain-Derived Neurotrophic Factor (BDNF) and Insulin-like Growth Factor-1 (IGF-1) in elderly men and women.

2. Methods and Materials

This quasi-experimental study was conducted in 2016. The study population consisted of elderly people living in the south of Khorramabad City, Iran. Five men (Mean±SD age=64.40±6.69 years, Mean±SD weight=74.8±5.63 kg, Mean±SD height=174.4±4.16 cm), and 5 women (Mean±SD age=64.5±6.55 years, Mean±SD weight=65±5.43 kg, Mean±SD height=167±5.48 cm) participated voluntarily in this study. Inclusion criteria were aged ≥60 years, complete physical and mental health and willingness to participate in the research.

The exclusion criteria were unwillingness to continue training and fatigue during the exercise. Almost one week before the training session, all the exercises were performed by the subjects at home with the presence of a coach. All subjects were acknowledged about the potential benefits and risks of the exercise. The research method was approved by the Ethics Committee of Lorestan University of Medical Sciences. For intervention, one session of circuit training was employed. In this regard, subjects performed body weight resistance exercises (resistance training) and fast walking (aerobic training). The training protocol is described in Table 1.

There was a 3-min rest between each movement. Five minutes before and 3 minutes after the training session, blood samples (3 mL) were obtained from the subjects. Blood samples were centrifuged for 5 minutes at 3500 rpm, then the serum was prepared. Serum levels of

BDNF and IGF-1 were measured by ELISA method and related kits (BDNF kits, sensitivity=0.063 ng/mL, detection range=0.20-325 ng/mL; IGF-1 kits, sensitivity=1.95 ng/mL, detection range=7.80-500 ng/mL), according to the manufacturer's instructions. The results of Shapiro-Wilk test suggested that the data were normally distributed. Therefore, Independent t-test and Analysis of Covariance (ANCOVA) were used at the significance level of P<0.05, for data analysis.

3. Results

In this quasi-experimental study, 10 elderly (5 men and 5 women) living in the south of Khorramabad City participated. The pretest Mean±SD scores of BDNF levels in men and women were 5.53±0.45 and 5.59±0.56 ng/mL, respectively (total Mean±SD=5.56±0.48 ng/mL). Their post-test Mean±SD levels were 6.79±1.36 and 7.15±1.09 ng/mL, respectively (total Mean±SD=6.97±1.18 ng/mL). The pretest Mean±SD scores of IGF-1 levels in men and women were 189.09±3.32 and 179.02±20.80 ng/mL, respectively (total Mean±SD=184.06±15.01 ng/mL). In addition, their post-test Mean±SD score levels were 169.14±12.05 and 156.88±18.34 ng/mL, respectively (total Mean±SD=163.01±15.99 ng/mL).

T-test results revealed that, BDNF level increased and IGF-1 level decreased in the samples (P<0.05). In men, the increase in BDNF level was not significant (P>0.05), while the same was significant in women (P<0.05). In respect of the IGF-1 levels, the obtained results indicated that its concentration decreased significantly in both elderly men and women (P<0.05). The results of Levene's test indicated the equality of variances. ANCOVA test reported that the difference between men and women in terms of BDNF level was not significant (P>0.05). The percentage of BDNF level changes in men (22.78%) was lower than that in women

Table 1. Circuit training protocol

Movements	Methodology
Push-up	Three rounds to exhaustion + jogging (120 m) between each round
Bodyweight squat at 90°	3×30 repetitions + jogging (120 m) between each round
Triceps dips	15 repetitions + jogging (120 m) between each round×3
Plank	Three repetitions for 30 seconds + jogging (120 m) between each repetition
Side plank	Three repetitions for 30 seconds + jogging (120 m) between each repetition

(27.91%). The same was true for the changes in IGF-1 levels (-10.55% in men and -12.37% in women).

BDNF and IGF-1 are positive correlates of neurobiological adaptations that can be achieved through exercise and cognitive training [5, 8]. BDNF concentrations change with increased age. Neuron reduction is associated with low levels of BDNF in the elderly. Some studies have reported higher levels of BDNF in women compared to men, while others have not stated such difference [9].

The results of this study also did not suggest a significant difference between elderly men and women. However, BDNF level increased significantly in elderly women, while in elderly men, its increase was not significant. IGF-1 level decreased after exercise which may be taken up by other tissues such as brain. This could be because exercising increases the brain uptake of IGF-1 which enhances the neuronal differentiation of ancestral cells and the expression of the BDNF gene in the hippocampus [10, 11]. Animal model studies revealed that exercise, through increased IGF-1 uptake, prevents and protects the brain from damage [11].

4. Conclusion

In elderly women, one session of circuit training increased BDNF level and reduced IGF-1 level. In elderly men, IGF-1 level reduced; however, it did not significantly increase BDNF level. Also, there was no differences between base concentrations and their response to exercise in elderly men and women. Physical activity improves a number of physical diseases (e.g. cardiovascular disease, colorectal cancer, breast cancer, and obesity) and mental disorders (e.g. anxiety and depression). In addition, studies reported that aerobic training and resistance exercises are important lifestyle actions that affect cognitive functions [8, 12]. Therefore, according to the results of this study and other studies, it is suggested that elderly people perform aerobic exercises, muscle building exercises, flexibility training, and balance movements [13]. Such trainings must especially be combined with circular training for improving their mental and physical abilities. Moreover, with higher levels of fitness, the intensity of exercises should be higher, to create positive and significant effects.

Ethical Considerations

Compliance with ethical guidelines

This study has been approved by the Research Ethics Committee of Lorestan University of Medical Sciences.

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Authors contributions

Project Administration of this study was done by Vahid Valipour Dehnou.

Conflict of interest

The authors declared no conflict of interest.