Research Paper: Comparing the Effect of Eight Weeks Selected Football Practice and Corrective Movements on Abnormalities and Body Composition in Students

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ABSTRACT

Purpose: Physical condition and posture are related to bio-psychological health. Overweight in the children is also associated with musculoskeletal deformities. The current study aimed to compare the effect of conducting an 8-week of selected football activities and corrective exercises on postural deformities, the factors of physical readiness, and body composition in three male groups, including children, teenagers, and youth.

Methods: In this quasi-experimental study, 60 male students were selected through stratified simple random sampling method and divided into the groups of children (n=20, Mean±SD age=12.25±0.78 y), teenagers (n=20, Mean±SD age=14.30±0.65 y), and youth (n=20, Mean±SD age=16.40±0.50 y). Using a chessboard, flexible ruler and the New York test, the subjects' personal characteristics were investigated. The program of selected exercises included an 8 weeks of three sessions of 45-60 minutes with an intensity of 60% to 70% of the heart rate reserve. To compare the intragroup and intergroup mean scores, Student's t-test and the Analysis of Covariance (ANCOVA) were used.

Results: The obtained results suggested that body weight, waist, and hip circumference significantly decreased in all three groups. However, body mass index significantly decreased in children and youth. Physical readiness, cardiorespiratory endurance, anaerobic power, agility, muscular endurance, and muscular strength were statistically significant in all groups. Speed significantly improved in children and teenagers. Postural deformities, forward head posture, kyphosis, lordosis, and Genu Varum improved in all study groups.

Conclusion: An eight weeks of selected football activities and corrective exercises improved the performance of physical motor fitness, body composition, and postural deformities in all study groups.

Keywords:
Abnormalities, Physical fitness, Body composition

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Highlights

● The selected football practice and corrective movements significantly decreased body weight, waist, and hip circumference.

● The selected football practice and corrective movements improved postural deformities, forward head, kyphosis, lordosis, and genu varum in all groups.

Plain Language Summary

The effectiveness of performing football exercises and selected corrective exercises highlights those as a nonpharmacological method for improving body composition and the indicators of physical readiness and postural deformities in children, teenagers, and youth. Therefore, the exercises and follow-up courses are recommended to be longer for the participants. Different strength and stretching training with corrective moves are also advised to be investigated in all three groups of participants.

1. Introduction

Studies indicate that physical deformities among students are important [1]. These deformities which are not often severe can be improved by simple exercises. Although correct body posture is not adequate for being healthy, it includes a part of the general health of individuals [2]. Physical condition and posture are related to bio-psychological health [3]. Additionally, overweight in children is associated with musculoskeletal deformities [4]. Postural deformities are highly prevalent in Iran [5, 6]. In this regard, Daneshmandi et al. reported that 80.68% of students have spinal deformities which are more frequent in girls than boys [7].

Prevention is more important than treatment. Prevention also depends on teaching correct principles and maintaining correct postures to a great extent [8]. Appropriate methods for preventing and improving postural deformities include implementing physical activities, being capable of improving all affecting factors on physical readiness and health [9], and help the correction and maintenance of body posture through muscular balance [10]. Karimian et al. investigated the prevalence rate of postural deformities and its relationship with sports activities in 148 children. They reported a significant difference between the natural and unnatural posture of children.

There was also a significant difference between the number of skeletal deformities and sports activities in male and female children. According to them, lordosis had the highest prevalence rate in boys; lordosis and kyphosis were the highest and lowest prevalent complications in girls, respectively [11]. Emery et al. investigated the effect of 12 weeks of Pilates exercises performed twice per week for 60 minutes per session on the flexibility of 19 subjects. Their results indicated a significant improvement in kyphosis, increased neck power and flexibility in the upper chest area which can prevent the deformities of neck and shoulders [12].

Spinal postural deformities are highly prevalent; however, the correction of those have been neglected. Thus, improving physical posture by corrective exercises has been of researchers' interest. Therefore, many people with kyphosis or lordosis can be contributed through corrective exercises to prevent deformities and the high costs of treatment. Proposing the desired profile about the prevalence of postural deformities in students can provide an opportunity to scientifically develop educational and corrective programs and ideally use the existing facilities and knowledge. Therefore, it is important to identify and investigate the deformities prevalence. We compared the prevalence rate of postural deformities in children, teenagers, and youth. Therefore, the current study aimed to compare the effect of eight weeks of selected football exercises and corrective movements on abnormalities, physical fitness factors and body composition in three different age groups, including children, teenagers, and youth.

2. Materials and Methods

This quasi-experimental study was conducted on three experimental groups. The statistical sample of this study included 60 football player students from Kazemiyan football college in Mashhad City, Iran, in 2018. The samples were selected through stratified simple random sampling method. The study participants were first familiarized with the nature and manner of cooperation with the study. The inclusion criteria were no substance intake, no smoking and being bio-psychologically healthy. The students voluntarily participated in the study and provided informed consent forms. They were then divided into children (n=20, Mean±SD age=12.25±0.78 y), teenagers (n=20, Mean±SD age=14.30±0.65 y), and youth (n=20, Mean±SD age=16.40±0.50 y) groups.

To evaluate the body compositions, the height of participants was measured by Seca Stadiometer (made in Germany) with a sensitivity of 5 mm, hip and waist circumference by band meter (Mabis, Japan) with a precision of 5 mm, weight by the digital scale (Beurer, Germany; model: PS07-PS06). Body Mass Index (BMI) was obtained by body weight divided by height squared (kg/m^2). To measure the ratio of waist to hip circumference, band meter (Mabis, Japan) with a precision of 5 mm was used. The ratio of waist to hip circumference was determined by the division of minimum waist circumference and maximum hip circumference.

To measure postural deformities, a chessboard was used. The middle line of the chessboard with a distinctive color was considered as plummet which is a framework with the dimensions of 100×200 cm, longitudinally and latitudinally divided into 5-cm grid squares. The New York test and plummet were used for investigating forward head posture, rounded shoulder, kyphosis, scoliosis, piriformis, and lordosis. These tests are appropriate for determining any disorders in the lateral, posterior and anterior sides. Genu Varum was determined by the executors given the gaps between ankle and knee. Flat feet were evaluated measuring the foot arc height and hallux light from the foot length by the flow.

To evaluate the level of dorsal curvature (kyphosis angle), the study participants with bare torso comfortably stand backward (the eyes staring forward, the distance of feet is almost 15cm, and the hands hanging by sides, waiting for approximately 3 min; then, the measurement is conducted). The spinous process of T12 and T4 vertebrae are determined. Then, the flexible ruler is placed on the spinous process of T12 and T4 vertebrae, where it exactly matches the curvature of the study participant. Then, without changing the position, the ruler is placed on a paper and the surface curvature of the ruler placed on the skin is drawn.

Both ends of the curve are connected to create an L-shaped line; then, the most curved point on the back is

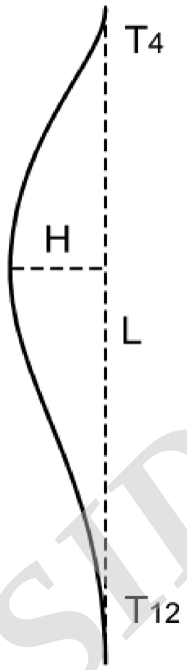

Figure 1. Θ=4arc tan (2H/2)

connected to the L-shape to create an H-shaped line. Then, kyphosis angle is obtained through the formula in Figure 1. For a better validity, the back curve of each participant was measured twice by this method and the mean score of these 3 angles were considered [13]. Scores of ≥40° angle were considered as back hyperkyphosis.

The physiological indicators of this study included aerobic power (540 meters' test), speed (36m sprint), anaerobic power (vertical or sergeant jump), explosive power (pair jump), muscular endurance (sit-ups), and general agility (4×9 meter test).

Each session of the program included symmetrical and asymmetrical stretching exercises.

Cat stretching

The goal was high length stretching the spinal cord and recovering its correct direction.

Sitting body rotation

The goal was active mobility; recovering correct direction of the spinal cord; and stretching rotator muscles.

One-way body stretching while lying on the side

The goal was passive stretching of the lateral muscles towards concavity.

Cat camel mobility

The goal was improving mobility and flexibility and increasing the deep sense in the muscles and spinal cord (mobility exercise).

Lying body stretching

The goal was improving the power, especially the endurance of extensor muscles; emphasizing on recovering the direction of the spinal cord (strength training with an emphasis on endurance).

Lateral flection of body while lying on the side

The goal was improving the power, especially the strength of lateral muscles and spinal rotators often towards curvature convexity.

Side or diagonal plank

The goal was improving the performance of muscles, especially in the central part of the body, and generally, the side muscles of the body with an emphasis on the contraction and increase of muscular strength; strengthening stability to recover and maintain the correct direction of spinal cord.

Complete plank

The goal was similar to number 7; however, the concentration is on the extensor and multifidus muscles [14].

The selected sports activities used in this study were specific to football, and practiced for 8 weeks, three times a week. The exercise program included a 10-min general warm up (walking, slow running, stretching moves and mobility), a 10-min particular warm up given the physiological and mental features, including short and speed starts, shuffle movements with a ball; and 10 starts of 10-15 meters. Then, the main football exercises were conducted for 45-60 min with an intensity of 60% to 75% of hearing bites; at the end of each session, the cool up (slow running, walking and stretching moves) were conducted for 10 minutes to return the body to the initial mood [15].

The collected data were analyzed by SPSS. After verifying the normal distribution of the obtained data, the Shapiro-Wilk test was used. In addition, the convergence of variances was examined by the Levene's test; to compare the intergroup and intragroup mean scores, Analysis of Covariance (ANCOVA) was applied, and Tukey's post hoc test was used to examine the differences between groups. The significance level was set at $P<0.05$.

3. Results

The characteristics and postural deformities of study participants are presented in Tables 1 and 2. As per Table 3, body weight, waist, and hip circumference significantly decreased in all groups of children, teenagers, and youth. However, BMI only significantly decreased in children and youth groups. The mean scores of intergroup changes were significantly different in all groups in respect of BMI, body weight, waist, and hip circumference. According to Table 4, the results of Tukey's post hoc test indicated that there were significant intragroup differences in the mean scores of weight, BMI, waist, hip, and WHR between the three groups ($P=0.001$).

Table 5 reveals that physical readiness, cardiorespiratory endurance, anaerobic power, agility, muscular endurance, and muscular strength were statistically significant in all groups. The record of speed significantly decreased in the children and teenagers. The mean scores of intergroup changes were significantly different in all groups; the records of male students' physical readiness significantly differed in physical readiness, cardiorespiratory endurance, anaerobic power, agility, muscular endurance, and muscular strength.

Table 1. The subjects' characteristics (n=20)

Groups	Variables (Mean±SD)			
	Age (yr)	Height (m)	Weight (kg)	BMI (kg/m²)
Children	12.25±0.78	149.92±7.09	38.13±7.05	16.86±2.24
Teenagers	14.30±0.65	163.70±9.22	51.13±8.49	18.53±2.18
Youth	16.40±0.50	174.20±7.36	60.65±5.88	20.05±2.33

PHYSICAL TREATMENTS

Table 2. The abnormalities of students in different study groups

Abnormalities \ Groups	Children		Teenagers		Youth	
	n	%	n	%	n	%
Forward head posture	14	70	12	60	9	45
Uneven shoulder	12	60	11	55	14	70
Scoliosis, mm	5	25	8	40	1	5
Kyphosis, o	12	60	9	45	11	55
Flat back	7	35	6	30	5	25
Lordosis, o	17	85	11	55	12	60
Genu Varum (cm)	11	55	11	55	12	60
Genu Valgum (cm)	8	40	3	15	3	15
Flat foot	12	60	11	55	10	50
Hallux valgus	2	10	4	20	2	10

PHYSICAL TREATMENTS

Table 3. Changes in the body composition of students in different study groups

Variables	Groups	Stages Mean±SD		Variations			
		Pretest	Posttest	t	P*	F	P**
Weight (kg)	Children	38.13±7.05	37.68±6.91	3.13	0.005†	48.06	0.001†
	Teenagers	51.13±8.49	50.72±8.44	11.77	0.001†		
	Youth	60.65±5.88	59.37±5.44	2.41	0.026†		
BMI (Kg/m²)	Children	16.86±2.24	16.67±2.22	3.40	0.003†	8.19	0.001†
	Teenagers	18.53±2.18	18.92±2.88	-0.72	0.47		
	Youth	20.05±2.33	19.61±20.1	2.27	0.03†		
Waist (cm)	Children	62.30±6.63	61.40±6.47	5.23	0.001†	17.43	0.001†
	Teenagers	69.70±7.00	68.94±7.15	4.88	0.001†		
	Youth	73.65±4.55	72.54±4.25	4.77	0.001†		
Hip (cm)	Children	74.80±6.42	73.85±6.65	4.49	0.001†	27.53	0.001†
	Teenagers	82.20±6.35	81.00±6.33	6.43	0.001†		
	Youth	87.90±3.49	86.90±2.93	2.36	0.02†		
WHR (cm)	Children	0.83±0.03	0.83±0.03	0.27	0.78	1.50	0.231
	Teenagers	0.84±0.04	0.84±0.03	-1.71	0.10		
	Youth	0.83±0.03	0.83±0.02	0.89	0.38		

† Sig.: P<0.05; * P of within group comparison; ** P of between group comparison

PHYSICAL TREATMENTS

Table 4. The results of Tukey's post hoc test, the intragroup mean score differences of body composition

Variables	Groups		Mean Difference	SE	Sig.
Weight (kg)	Children	Teenagers	-13.04	2.22	0.001†
		Youth	-21.69	2.22	0.001†
	Teenagers	Youth	-8.65	2.22	0.001†
BMI (kg/m²)	Children	Teenagers	-2.25	0.76	0.001†
		Youth	-2.94	0.76	0.001†
	Teenagers	Youth	-0.69	0.76	0.001†
Waist (cm)	Children	Teenagers	-7.54	1.92	0.001†
		Youth	-3.59	1.92	0.001†
	Teenagers	Youth	11.14	1.92	0.06
Hip (cm)	Children	Teenagers	-7.15	1.76	0.001†
		Youth	-13.05	1.76	0.001†
	Teenagers	Youth	-5.90	1.76	0.001†
WHR (cm)	Children	Teenagers	-0.01	0.01	0.11
		Youth	-0.003	0.01	0.78
	Teenagers	Youth	0.01	0.01	0.18

† Sig.: P<0.05; SE: Standard Error

PHYSICAL TREATMENTS

Table 5. Changes in the physical fitness factors of students in different study groups

Variables	Groups	Stages Mean±SD		Variations			
		Pretest	Posttest	t	P*	F	P**
Cardiovascular fitness (min)	Children	2.21±0.13	2.06±0.20	3.48	0.003†	36.05	0.001†
	Teenagers	1.99±0.24	1.75±0.25	4.03	0.001†		
	Youth	1.70±0.26	1.51±0.12	3.62	0.002†		
Anaerobic power (cm)	Children	25.02±3.33	27.15±4.05	-2.41	0.02†	36.54	0.001†
	Teenagers	32.42±5.60	35.20±4.62	-2.08	0.05†		
	Youth	41.62±6.21	45.30±4.96	-5.36	0.001†		
Speed (s)	Children	6.35±0.39	6.11±0.28	3.33	0.003†	27.95	0.001†
	Teenagers	6.08±0.45	5.75±0.45	2.48	0.02†		
	Youth	5.22±0.36	5.22±0.36	1.12	0.27		
Agility (s)	Children	10.51±0.63	10.02±0.47	5.13	0.001†	19.84	0.001†
	Teenagers	9.98±0.43	9.70±0.45	5.33	0.001†		
	Youth	9.52±0.55	9.19±0.32	2.52	0.02†		
Muscle endurance (rep)	Children	39.50±8.39	44.20±6.72	-3.77	0.001†	6.76	0.002†
	Teenagers	41.20±9.56	47.05±7.24	-3.74	0.001†		
	Youth	47.10±7.99	52.25±7.07	-2.32	0.03†		
Power (m)	Children	1.66±0.18	1.72±0.15	-2.12	0.04†	79.36	0.001†
	Teenagers	1.73±0.20	1.90±0.17	-4.45	0.001†		
	Youth	2.10±0.15	2.18±0.18	-2.02	0.05†		

† Sig.: P<0.05; * P of within group comparison; ** P of between group comparison

PHYSICAL TREATMENTS

Table 6. The results of Tukey's post hoc test, the intra-group mean score differences of physical fitness factors

Variable	Groups		Mean Difference	SE	Sig.
Cardiovascular fitness (min)	Children	Teenagers	0.30	0.06	0.001†
		Youth	0.54	0.06	0.001†
	Teenagers	Youth	0.23	0.06	0.001†
Anaerobic power (cm)	Children	Teenagers	-8.05	1.44	0.001†
		Youth	-18.15	1.44	0.001†
	Teenagers	Youth	-10.10	1.44	0.001†
Speed (s)	Children	Teenagers	0.34	0.11	0.001†
		Youth	0.88	0.11	0.001†
	Teenagers	Youth	0.54	0.11	0.001†
Agility (s)	Children	Teenagers	0.32	0.13	0.018†
		Youth	0.83	0.13	0.001†
	Teenagers	Youth	0.51	0.13	0.001†
Muscle endurance (rep)	Children	Teenagers	-2.85	2.21	0.20
		Youth	-8.05	2.21	0.001†
	Teenagers	Youth	-5.20	2.21	0.20
Power (m)	Children	Teenagers	-0.18	0.05	0.002†
		Youth	-0.46	0.05	0.001†
	Teenagers	Youth	-0.28	0.05	0.001†

† Sig.: P<0.05; SE: Standard Error

PHYSICAL TREATMENTS

Table 7. Changes in the position abnormalities of students in different study groups

Variable	Groups	Stages Mean±SD		Variations			
		Pretest	Posttest	t	P*	F	P**
Forward head posture	Children	32.00±1.37	31.15±1.26	3.84	0.001†	4.59	0.001†
	Teenagers	30.45±1.50	29.65±1.63	2.88	0.009†		
	Youth	30.85±1.87	30.35±1.75	2.93	0.008†		
Scoliosis (mm)	Children	41.04±1.11	40.80±1.00	2.43	0.02†	2.66	0.07
	Teenagers	40.38±1.66	40.19±1.66	2.70	0.01†		
	Youth	39.93±0.92	39.91±0.94	1.00	0.33		
Kyphosis (o)	Children	29.55±1.76	28.60±2.21	3.44	0.003†	2.68	0.07
	Teenagers	30.20±1.50	28.55±2.16	2.81	0.01†		
	Youth	30.35±1.13	29.80±1.28	2.97	0.008†		
Lordosis (o)	Children	29.15±1.34	27.65±1.59	5.43	0.001†	0.53	0.58
	Teenagers	29.10±1.29	27.60±2.11	3.37	0.003†		
	Youth	29.70±1.52	28.20±2.33	4.17	0.001†		
Genu Varum (cm)	Children	2.17±0.79	1.85±0.56	4.33	0.001†	4.92	0.01†
	Teenagers	2.77±0.91	2.47±0.78	2.34	0.03†		
	Youth	2.52±0.63	2.35±0.63	3.19	0.005†		

† Sig.: P<0.05; * P of within group comparison; ** P of between group comparison

PHYSICAL TREATMENTS

Table 8. The results of Tukey's post hoc test, the mean score intra-group differences of abnormalities position

Variable	Groups		Mean Difference	SE	Sig.
Forward head posture	Children	Teenagers	1.50	0.49	0.004†
		Youth	0.08	0.49	0.112
	Teenagers	Youth	-0.7	0.49	0.163
Scoliosis (mm)	Children	Teenagers	0.61	0.39	0.127
		Youth	0.89	0.39	0.028†
	Teenagers	Youth	0.28	0.39	0.481
Kyphosis (o)	Children	Teenagers	0.05	0.61	0.935
		Youth	-1.20	0.61	0.045†
	Teenagers	Youth	-1.25	0.61	0.055
Lordosis (o)	Children	Teenagers	0.05	0.64	0.938
		Youth	-0.55	0.64	0.397
	Teenagers	Youth	-0.60	0.64	0.356
Genu Varum (cm)	Children	Teenagers	-1.00	0.10	0.364
		Youth	0.00	0.10	1.000
	Teenagers	Youth	0.100	0.10	0.364

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† Sig.: P<0.05; SE: Standard Error

According to Table 6, the results of Tukey's post hoc test suggested that the intragroup differences in terms of the mean scores of cardiovascular fitness, anaerobic power, speed, agility, and power were significant between all the three groups (P=0.001).

Based on Table 7, abnormalities such as forward head posture, kyphosis, lordosis, and Genu Varum were significant in all three age groups. Regarding the scoliosis variable, only two groups of children and teenagers had meaningful results. The mean score of changes in intermediate groups in the three age groups were significantly different between the three groups in forward head posture and Genu Varum.

According to Table 8, the results of Tukey's post hoc test indicated that the intragroup differences in the mean scores of forward head posture were only significant between the children and teenagers groups (P=0.004). Scoliosis was only significantly different between the children and youth groups (P=0.028). Kyphosis was only significantly different between the children and youth groups (P=0.045).

4. Discussion

According to the obtained results, body weight, waist, and hip circumference significantly decreased in all three groups. However, BMI only significantly decreased in children and youth groups. The obtained data are consistent with the results of Andersen et al. and De Campos et al. [16, 17], but inconsistent with the findings of Donnelly and associates [18]. Andersen et al. investigated the effects of 52 weeks of football and endurance exercises on unexercised men; they concluded that BMI significantly decreased and the muscular mass significantly increased in the samples [16].

De Campos et al. argued that the maximum level of energy and anaerobic power of participants significantly increased at the end of course; however, there was no significant change in body weight, BMI and body fat percentage [17]. In this case, race differences and the nutrition diet of participants have not been controlled; the level of pre-exercise physical readiness and the manner of body compatibility and the response of participants are very important. One of the most important reasons of reducing body composition is the increased fat oxidation by enhanced beta-oxidation enzymes and the Kreb's cycle after exercise. Therefore, the increased fat metabolism in athletes decreases the rate of fat and improves the anthropometric factors in them [19].

During sport exercises, by the increase of epinephrine, norepinephrine, cortisol, and growth hormone, the endocrine system enhances the fat oxidation; also by the increase of recalling and use of free fatty acids, the energy is supplied; thus, the body mass will be reduced. Therefore, in addition to an increase in energy and fat oxidation, the intercellular changes of muscles and capillary network seem to be effective [20]. The level of cardiorespiratory endurance, anaerobic power, agility, muscular endurance, and muscular strength was statistically significant in all three studied age groups. The record of speed significantly decreased in children and teenagers.

The present study is consistent with the results of Shafabakhsh et al. [21], but inconsistent with the findings of Lesinski and colleagues [22]. Shafabakhsh et al. reported that cardiorespiratory endurance, flexibility, muscular endurance, and raw power have significantly improved in male students [21]. Lesinski et al. investigated the effect of football exercises on anthropometric features, body composition, and the physical fitness factors of young female football players. They concluded that BMI significantly increased and body balance and endurance improved in the subjects. There was no significant change in muscular power, speed, and changing the direction in speed. Muscle strength of knee extensor muscles decreased [22].

There was no significant change in muscular strength/endurance, speed, and directional change in speed. The muscle strength of thigh muscle was reduced [22]. The selected football exercises had significantly affected participants' agility. Unlike the researchers' idea regarding the ineffectiveness of exercising on agility, some studies reported that agility is affected by different muscular body types; thus, it can be considered as the compatibility of cardiovascular, muscular and metabolic systems to aerobic exercises.

The increase of maximum consumed energy and decrease of heart rate, and resting after exercise are probably because of the increased aerobic capacity of muscles, increased total hemoglobin, increased fat metabolism, increased end-diastolic volume, decreased end-diastolic volume, and increased impact volume. The increase in maximum oxygen can be due to the increased difference in arteriovenous oxygen, the increased activity of the Kreb's cycle and the electron transfer system, the increased number and size of mitochondria, and increased muscular tissue and its efficiency [23, 24].

According to the obtained results, postural deformities, forward head posture, kyphosis, lordosis, and Genu Varum improved in all groups. The achieved results indicated that corrective exercises, including strength and stretching exercises, significantly affect people and its power section affects the muscular length, moves different skeletal parts, and causes the stability of ligaments. Stretching exercises are used for coordinating agonist and antagonist muscles and increase the length of involved muscles such as iliacus muscle and spine extensor [25]. Participating in stretching exercising increases the mobility of the lower limbs of individuals and age does not limit it. Therefore, stretching exercises are of a great role in returning the appropriate posture of muscles [26].

The most important factor in increasing muscular power is a neural system which will not be gained without the emergence of neural compatibilities. After exercising, neural compatibility is reflected through an improved neural coordination, the increased efficiency of mobilizing motor neurons, increased neural activation, the decreased inhibitory action of Golgi tendon organ, and the activation of passive or weak neural communications [27].

Ethical Considerations

Compliance with ethical guidelines

The steps of tests were approved by the Ethics Committee of the Faculty of Humanities and Basic Sciences, Toos Institute of Higher Education.

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Authors' contributions

All authors contributed in designing, running, and writing all parts of the research.

Conflict of interest

The authors declared no conflict of interest.

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