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Comparison of Resistance, Aerobic and Combined Trainings Effects on the FGF21 Serum Levels in Active Elderly Men

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Abstract

Introduction: The FGF-21 biomarker is an essential factor in reducing the incidence of various cancers and improving the metabolic status of individuals, and improving the metabolic of heart cells. This study aimed to assess the difference between the effect of resistance, aerobic, and combined training on the salivary levels of FGF-21 in active older men.

Methods: The present study method was semi-experimental and performed with a pre-post-test design and three experimental groups. The subjects were randomly assigned to study 36 divided into three groups 1. Resistance training, 2. Aerobic training, and 3. Combined training (n = 12). The serum FGF-21 salivary value in subjects was evaluated and recorded using special sandwich analysis methods by special kits according to the kit brochure's method. The subjects then performed relevant training protocols for eight weeks, after which the post-test data training was evaluated and recorded similar to the pretest conditions. Statistical analysis was performed using descriptive statistical tests, dependent t-test, one-way ANOVA, and Scheffe post hoc in SPSS version 24. The significant level was 0.05.

Results: The results showed that the number of salivary FGF-21 increased significantly after applying aerobic, resistance, and combined training, and this increase was 38.9%, 23.8%, and 14.7% for combined, resistance, and aerobic activity, respectively.

Conclusions: According to the findings of this study, combined exercises should be used to improve metabolic risk factors and reduce the risk of cancer due to increased FGF-21 levels in the elderly community.

INTRODUCTION

Experts and scholars have dramatically considered a healthy lifestyle from such fields as health, well-being, and sports physiology in recent years. Therefore, many studies have been done on nourishment, daily exercise, metabolism, cardiovascular diseases, and conformity outcomes from doing sports. Sports activities and training are among the best non-medical strategies against heart diseases and related older adults [1]. Taking exercise regularly, for instance, can prevent the onset of such problems as obesity, heart attack, hypertension, atherosclerosis, while inactivity could provide the grounds for their development [1]. Likewise, aerobics can reduce the risk of such cases as hypertension, insulin drop, overweight, blood glucose, resistance to insulin, cholesterol, and triglyceride levels [2].

Accordingly, various studies have suggested that taking exercise and doing sports can widely be used in treating cardiovascular problems. Activity reduces the risk factors thereof, especially in older people who, in many cases, have a problem taking effective medicine for obesity, hypertension, and diabetes [3]. For instance, Vaseriz et al. (2013) reviewed the number of 87 articles. They concluded that aerobic exercise can reduce the

bulk of visceral fat (more than 30 square centimeters) and the signs of metabolic syndrome even when there are no calorie restrictions. As was mentioned above, certain physical activities can improve cardiovascular diseases, metabolic problems and postpone the onset of all sorts of cancers. FGF-21 hormone is actively discharged by such tissues as the liver, pancreas, skeletal fat, and muscle and conforms to the role of FGF-12 as a hemostasis controller of energy [4, 5].

FGF-21 mediates metabolic changes such as liver lipid oxidation, ketogenesis, and glycogens, which remind one of the body's conformity with hunger [6]. An increase in FGF-21 blood circulation up to two times was observed in diabetic people, fat and dyslipidemia, which is related to the reduction in sensitivity of insulin, HDL-cholesterol and the clinical signs of metabolic syndrome such as the increase in the fat bulk, blood glucose, insulin, and triglyceride [7, 8]. Old age comes with cardiac changes such as decreased heartbeat, hypertrophy of remaining cardiomyocytes, and vascular and interstitial around fibrosis. Metabolic problems increase the release of calcium from the contractile proteins related to calcium and delay intracellular calcium absorption into the sarcoplasmic network. These changes usually lead to a decrease in ventricular conformity and thus, provide the ground for the development of HF, reserved injection fraction and usually come along with hypertension and hypertrophy of the left ventricle [9].

Experts rightly believe that proper nourishment can increase lifespan and more healthy life. Besides this, sports and exercise can also increase the lifespan and the quality of life because it is amply documented that such activities enhance one's cardiovascular health and physical and mental performance. Along with these, the effects of aerobic power, muscular power, and flexibility can lead to improvement in biological age from 10 t0 20 years, delay in old age, and increase in the quality of life [10]. Therefore, the factors determining the health and motor actions in older people are primary elements, especially genetics, and the secondary ones. Yet, the biomarker FGF-21 is a vital factor in reducing all sorts of cancers, improving people's metabolic conditions, and improving cardiac cells' metabolism. Thus, the present study aims at determining the effects of resistance, aerobics, and combined exercises on the serum levels of FGF-21 of active older adults.

METHODS

The present study is semi-experimental based on a pretest and post-test approach. The subjects included the older men in the Abhar city, Iran. Volunteers among these people attended the introductory class in which they were given information about the process of conducting the project, its aims, and the courses to be taken. Then specific assessments were carried out to select the sample from among the volunteers. Estimates include controlling the health state of the subjects, not having cardiovascular diseases, diabetes, hypertension, being nonsmokers, not being addicted to alcohol, and not taking any drug or medicine. Upon receiving agreement from the subjects and finding out about their physical and mental health, 60 were selected as the study sample. They were then divided into three groups of 1- resistance training, 2- aerobic training, and 3- combined training to be studied. One week before conducting the present study protocols, pretest assessments were carried, including physical composition, fitness, and biochemical evaluations. Written consent was obtained from the subjects. A commitment was made to report the results without mentioning the subject's name and freely withdraw from the research if they were not satisfied and willing to cooperate.

Next, the variables of physical composition were measured, which included such cases as height (by the Seca wall height gauge 222), weight (by a calibrated scale), MBI index (weight in kilogram divided by squared height in meter). The Borg Quest Test was used to measure the training intensity, and training was observed through this test and performed with good power and period. One week after the primary measurements (pretest), the subjects were subjected to the particular protocol of training for eight weeks, three sessions per week. Forty-eight hours after the last session of the study's protocols devised, all the measurements for the physical composition, fitness, and biochemical assessments (in pretest) were repeated.

A. Resistance Training Protocol

After making the direct measurements (pretest), the subjects from the training group (RT) took the resistant training three sessions per week for eight weeks. This group's training protocol consists of 10 minutes of warmup, the main body of the activity (consisting of 8 primary movements in three sets with ten times of repetition and 70 percent of IRM), and 10 minutes for cooldown (stretching movements). And the main exercises in three groups with ten times of recurrence and 70 percent of IRM include such moves as feet press, front thigh, instep, shin, bench press, boat, triceps, and biceps. The training protocol also included a gradual increase in the training's intensity and period for the two first weeks to minimize muscular fatigue and reduce the harm [11].

B. Aerobic Training Protocol

For the aerobic training group, continual exercises were designed and designated, including jogging, smooth running, and finally, running in a paceclose to the subjects' heartbeat rhythm. This training protocol was designed and conducted based on the principles, percepts, and remarkable advice of the American College of Sports Medicine (ACSM) for the older people and according to the previous studies' evidence.

At the start of the training session, five minutes of mild stretching exercise was done for conducting this protocol, 10 minutes for warmup as smooth running, and 5 minutes of a warmup for increasing the subjects' pulse rate up to 120 beats per minute. Then, the training session's central part would begin, which lasted for 30 minutes of jogging, soft running, and fast running. As in the case of the resistance training, this protocol also lasted for 8, 3-session weeks. And finally, for controlling the correct range of the pulse rate percentage, the Polar stethoscope, the Pox 1000 model, made in Japan, was used [12].

The Protocol of Selected Combined Training

Based on previous studies results, this training protocol consisted of a combination of resistance and endurance exercises, which were done in each session. Each session consisted of 10 minutes of warmup, 40 to 50 minutes for the central part of the course that included 15 minutes (first week) to 20 minutes (the eighth week) of endurance exercise. After which and upon taking two minutes of rest, the resistance exercise was carried out for 25 minutes (first week) to 30 minutes (the eighth session) followed by 10 minutes of cooldown.

The Methods for Measuring the Serum Levels of FGF-21

The serum levels of FGF-21, the sandwich Eliza method was applied through the use of special kits (Human growth differentiation factor 15ELISA KIT), made by the Chinese company of Cusabio and based on the instructions given in the manual.

Statistical Analysis

The Smirnov-Kolmogorov test was used for measuring the normality of data distribution. After ensuring the normality of the data and homogeneity of variance of the data, one-way variance analysis tested, and Scheffe post hoc test was used to analyze the data. All statistical analysis processes were conducted in SPSS software, version 24, with the significance level set as $0.05 \geq P$.

RESULTS

Unique features of the subjects are presented in Table 1 below. The one-way variance analysis test for age, height, mass, and BMI was significantly different among the three groups ($P > 0.05$). Thus, the three groups' subjects had a homogenous variance in the mentioned factors, and the groups are homogenous.

Table 1. Personal Information of the Subjects in Three Groups

Group	Age (year)	Mass (kg)	Height (cm.)	BMI
Resistance	69±3.3	69.1±8.6	146.8±4.6	25.74±3.2
Aerobic	71±4.1	71.8±7.2	166.26±6.3	25.81±2.8
Combined	68.6±2.9	73.4±9.5	171.34±4.9	25.01±2.9

Table 2. Combined and Resistance, Combined and Aerobic, Aerobic and Resistance

	ANOVA				
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Pre					
Between Groups	22.389	2	11.194	1.078	.352
Within Groups	342.583	33	10.381		
Total	364.972	35			
Post					
Between Groups	11568.667	2	5784.333	916.238	.000
Within Groups	208.333	33	6.313		
Total	11777.000	35			

Table 3. Percentage of Changes in FGF-21 after Applying the Three Training Protocols

Group	Pretest	Post-Test	Percentage of Changes
Aerobic	170.91	195.66	14.7
Resistance	172.66	213.50	23.8
Combined	172.50	239.33	38.9

One-way variance analysis (F) was used to analyze the gathered data and decide about the difference among the three methods applied. One-way variance analysis (F) was used. The F test results did not show any significant differences among the data from the three groups ($P > 0.05$). Therefore, the subjects were homogenous in the FGF-21 factor.

For the post-test time, data gained in the three groups were evaluated by the F test, which showed significant differences among the three groups ($P = 0.001$). For determining the source of the differences observed, the Scheffe post hoc test was carried out, which again showed significant differences among the three groups ($P = 0.001$).

Regarding the differences in the pre and post-test data in each of the three groups, it was proved that performing the three training protocol have had significant effects on the serum level of FGF-21 of older adults under study.

And for determining the training protocol with the most significant effects on the serum levels of FGF-21 in the subjects, the percentage of increase in the data from the post-test compared with those of the pretest was measured. This comparison shows the data changes in

pre and post-test states from three groups are presented in Table 3.

Thus, a review of the results indicates that applying the combined training method has had the most significant effects on the serum level of FGF-21. In contrast, the aerobic protocol has left the smallest degree of impact on it.

DISCUSSION

The present study aims to study and determine the differences in the three resistance, aerobic and combined training or exercise protocols on the serum levels of FGF-21 in active older people. After taking the aerobic, resistance, and combined training courses, significant increases in this hormone were measured to be up to38.9%, 23.8%, and 14.7% for mixed, resistance, and aerobic methods, respectively.

Regarding this finding, our results agree with those of ShanhuiXie et al. (2019), who reported an increase in FGF-21 along with the rise of the activating protein of fibroblast. Likewise, they accord with results from the study of Eskandarpour et al. (2019). The latter also found a notable increase in serum FGF-21after taking a resistance training course and complementary effects from thyme. Karami et al. (2017) have seen an increase in FGF-21 after taking eight HIT weeks and combined training. Their findings accord with those of the present study about the effects of combined training in increasing serum levels of FGF-21.

Results from a study by Thomas et al. (2018) indicated an increase in FGF-21 levels after the subjects had taken endurance exercises, and this agreed with the results from the present study. They reported a decrease in FGF-21 levels after taking a resistance training test, which does not agree with the current study's results. The reasons for this disagreement between the consequences might be the difference in the training protocols, their timespan, the exercises devised, and the number of sets the subjects had taken them.

Ramezani et al. (2016) studied endurance, resistance, and combined training courses resulted in notable increases in FGF-21 levels. This finding conforms with those of the current research project. The only difference in the results from the two studies was that in Ramezani et al., changes in FGF-21 after endurance training were found to be greater than those caused by resistance and combined exercises. But in the present study, differences were more significant after taking the combined practices.

Based on results from this study about the effects of the three applied protocols in increasing the serum levels of FGF-21 in the subjects and regarding the fact that there was a greater degree of increase in FGF-21 after taking the combined training protocol, it is suggested that for improving the metabolic conditions and reducing the risk of cancer as a result of the increase in FGF-21 levels in the older people, they use the combined method of exercise.

CONCLUSION

There is a significant increase after aerobic, resistance and combination exercises. However, this increase was 14.7% after aerobic training, 23.8% after resistance training and 38.9% after combination training.

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Ethical Considerations

The samples participating in this study are completely voluntary and with written consent.

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