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Responses of Uric Acid, Glucose, Thyroid Hormones and Liver Enzymes to Aerobic and Combined Exercises in University Students

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Abstract

Physiological effects of aerobic and anaerobic exercises are frequently investigated. However, it is considered that combined exercises may be more effective. The aim of this study was to investigate the effect of aerobic and combined exercise program on some biochemical parameters. The study group consisted of 45 male volunteers with sedentary life. The participants were divided into three groups as control (n: 15), aerobic exercise (n: 15) and combined exercise (n: 15). The control group did not perform any exercise. Aerobic and combined exercise groups participated in the exercise program 4 days a week for 10 weeks. Blood samples were taken from the participants twice. TSH, T3, T4, AST, ALT, Uric acid and glucose levels were determined in blood samples. SPSS software was used for the analysis of the data and the significance level was accepted as $p < 0.05$. As a result of analysis; no difference was observed in the control group ($p > 0.05$). In the aerobic exercise group, T3, AST, Uric acid levels of post test were found to be different according to baseline, while in the combined exercise group, there were significant differences in T3, AST, Uric acid and glucose levels between pre and post test values ($p < 0.05$). As a result, it was determined that both aerobic and combined exercises had effects on biochemical parameters (thyroid hormones, liver enzymes, Uric acid and glucose). According to this study it can be said that combined exercises may be more effective than aerobic exercises.

Keywords: aerobic, anaerobic, exercise, biochemistry

1. Introduction

The benefits of exercise, which have many effects on human life, can be expressed as reducing the risk of cardiovascular disease, leading to improvements in blood pressure and blood lipids, and weight control (Carpenter & Gilleland, 2016). It is stated that aerobic exercise, which is one of the exercise types, improves cardiovascular fitness and increases its capacity to maintain activities without fatigue (Ploughman & Kelly, 2016). However, aerobic exercise has positive improvements in health-related factors such as metabolic syndrome, diabetes, and osteoporosis. It also makes important contributions to the maintenance of daily living activities and cognitive functions (Lazzer, Rejc, & Del Torto, 2017). The literature review shows that resistance exercises can be used as a therapeutic tool such as aerobic exercises in providing glycemic control; it even reveals the idea that two types of exercise can be combined (Balci, 2015). Combined exercises are reported to be effective in the development of all functional fitness components related to daily living activity (Sousa, Mendes, Abrantes, Sampaio, & Oliveira, 2014). The high level of uric acid, which is closely related to health, is associated with inflammation, oxidative stress, insulin resistance, dyslycemia, endothelial dysfunction, vascular, renal and cardiac stiffness, cardiac diastolic dysfunction, renal hyperfiltration, proteinuria, and all components of Cardiorenal metabolic syndrome (Chaudhary, Malhotra, Sowers, & Aroor, 2013). It is reported that moderate and intense physical activities help to decrease serum uric acid levels (Zhou et al., 2017). It has reported that blood glucose decreased with exercise in the type 2 diabetes model (Oksozlu, Sonmezer, Arikan, & Bayraktar, 2019). Many functions, including growth, development and metabolism, are directly or indirectly controlled by thyroid hormones in humans. For thyroid hormones to be fully functional, thyroxine (T4) must be deionized to triiodothyronine (T3) (Bal et al., 2015). It is known that exercises have significant effects on thyroid hormones, which have important effects on metabolism (Cinar, Akbulut, & Sarikaya, 2017). Aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma-glutamyl transferase (GGT) are known as markers of liver damage (Sanyal et al., 2015). Also, when BMI increases, known as body mass index, ALT increases and ALT is higher in males than females (Agrawal, Garg, & Kulkarni, 2018). Skrypnik et al. (2016) have investigated that the effects of exercise on liver function in women with abdominal obesity. 44 women participated in the study were divided into two equal groups as endurance and endurance-strength exercise group. They found that exercise had significant effects on liver enzymes of women after 3-week exercise programs for 3 months. They stated that combined exercises may be more effective than endurance exercises. It was emphasized that both AST and ALT levels decreased in the combined exercise group (Skrypnik et al., 2016). In the light of this information, it was aimed to determine the effects of aerobic and aerobic + core strength exercises on uric acid, glucose, thyroid hormones, AST and ALT levels in sedentary young male subjects.

2. Method

2.1 Subjects

The study was conducted without any health problems with an age range of 18-22 years forty-five sedentary male volunteers studying university. Before starting the research, the research was explained in detail to the participants and participation was provided on a voluntary basis. Individuals willing to participate in the study voluntarily signed the consent form. The study was conducted in accordance with the Declaration of Helsinki. The participants in the study were divided into three groups randomly as control group, aerobic exercise group and combined exercise group. The research groups were distributed homogeneously. The participants lived in the same dormitory. The study was conducted as parallel controlled group. No additional nutrition program was applied to the participants.

2.2 Exercise Programs

Control Group: The group that did not exercise for 10 weeks.

Aerobic exercise group: It was administered 4 days a week for 10 weeks. Over the 15-minute warm-up period, a 30-minute running exercise of 55-65% intensity was performed according to the continuous running method. The intensity of running was determined via maximal heart rate measurement called Karvonen method. Followed by a 15 minute cooling exercise.

Combined exercise group: It was administered 4 days a week for 10 weeks. After 15 minutes of warm-up, a core strength training program including push-ups, sit-ups, reverse sit-up, oblique sit-up (right, left), plank, reverse plank, side plank (right, left), and Superman (right, left) exercises were applied. Thereupon, a 20 minute running exercise 55-65% intensity was performed and then the cooling started. The intensity of 20 minutes running exercise was determined via maximal heart rate according to Karvonen method. Each core exercise was performed for 30 sec with moderate tempo, 2 repetitions. Resting was given for 30 sec between repetitions and 45 sec between exercises.

2.3 Biochemical Analysis

Blood samples were taken from the participants in the resting condition twice before and after 48 hours the study. Blood samples were collected by a gel biochemistry tube by experts. Blood samples were centrifuged at 4000 rpm for 10 minutes. They were kept in the refrigerator under suitable conditions until the working day. TSH, T3, T4, AST, ALT, Uric acid and glucose levels were determined in blood samples using auto analyzer.

2.4 Statistical Analysis

SPSS software was used for the analysis of the obtained data. The normality of the distribution was tested and parametric tests were performed. Mean, percentage and standard deviation were used in the presentation of the data. Variance analysis was performed to determine the differences between the groups and the findings were not included because there was no difference. Paired Samples t test was used to evaluate intra-group differences. Significance level was accepted as $p < 0.05$.

3. Results

Table 1. Analysis of Thyroid Values of Research Groups

Variables	Group	Pre test	Post test	p
		Mean ±Sd	Mean ±Sd	
TSH (mIU/L)	Control	1,46 ±0,85	1,56 ±0,74	0,479
	Aerobic	1,90 ±0,86	1,56 ±0,49	0,140
	Combined	1,62 ±0,78	1,45 ±0,72	0,074
T3 (ng/L)	Control	3,62 ±0,20	3,59 ±0,29	0,833
	Aerobic	3,52 ±0,32	3,97 ±0,21	0,010*
	Combined	3,55 ±0,30	3,82 ±0,27	0,021*
T4 (ng/dL)	Control	0,92 ±0,07	0,93 ±0,11	0,791
	Aerobic	0,91 ±0,09	0,88 ±0,11	0,090
	Combined	0,92 ±0,07	0,92 ±0,11	0,875

* There is a significant difference between the tests (p <0.05). Sd: Standart Deviation

When examined Table 1; No significant difference was observed in the control group (p> 0.05), but it was found that there was a significant difference in the T3 values of the aerobic and combined exercise groups (p <0.05).

Table 2. Analysis of Some Biochemical Values of Research Groups

Variables	Group	Pre test	Post test	p
		Mean ±Sd	Mean ±Sd	
AST (U/L)	Control	27,38 ±9,06	25,58 ±7,80	0,275
	Aerobic	25,63 ±7,98	22,63 ±6,54	0,046*
	Combined	28,61 ±10,87	23,75 ±6,34	0,025*
ALT (U/L)	Control	21,85 ±5,81	22,54 ±17,57	0,879
	Aerobic	20,75 ±7,55	19,63 ±7,90	0,465
	Combined	21,54 ±6,02	21,14 ±12,63	0,853
Uric Acid (mg/dL)	Control	5,35 ±0,46	5,35 ±0,68	0,982
	Aerobic	5,32 ±1,14	4,59 ±1,00	0,000*
	Combined	5,45 ±0,81	5,09 ±0,83	0,016*
Glucose (mg/dL)	Control	86,00 ±8,21	80,38 ±10,54	0,102
	Aerobic	84,88 ±18,13	78,38 ±17,36	0,416
	Combined	88,43 ±13,65	80,93 ±11,82	0,019*

* There is a significant difference between the tests (p <0.05). Sd: Standart Deviation

When examined Table 2; There was no difference between the pre-test and post-test values of the control group (p> 0.05), while there were significant differences in AST and Uric acid in the aerobic exercise group (p <0.05), and the combined exercise group had significant differences in AST, Uric acid and Glucose levels (p <0.05).

4. Discussion

Thyroid hormones, liver enzymes, uric acid and glucose levels were investigated in aerobic and combined (aerobic-core strength) exercises. When the results were evaluated, it was determined that thyroid hormones produced some responses to exercise, especially T3 levels changed in both exercises. The relationship between exercise and thyroid hormones has been the subject of some research results. In one of these studies, the effects of jogging (1 hour a day) for 3 months were examined in patients with hypothyroid disease. As a result of the study, it was determined that TSH level decreased but T3 and T4 levels increased (Bansal, Kaushik, Singh, Sharma, & Singh, 2015). In another study, it was found that aerobic, resistance and flexibility exercise program performed at home for 12 weeks in thyroid cancer patients who had undergone thyroidectomy did not cause a change in TSH and T4 levels but caused an increase in T3 level (Kim et al., 2018). In another study, it was found that the aerobic exercise program, which was administered 60 minutes a day for 3 days a week for 12 weeks, did not cause any change in thyroid hormone levels (Onsori & Galedari, 2015). Similarly, it was found that diet and exercise program performed in obese individuals for 3 months caused a decrease in body weight and adipose tissue but no change in thyroid hormones (Kouidrat, Diouf, Desailloud, & Louhou, 2019). Similarly, in sedentary women, plates exercises performed for 3 weeks and 60 minutes for 8 weeks did not affect thyroid hormones (Mehrevar, 2018). Regulation of metabolic adaptation by thyroid hormones during long-term physical exercise is important but controversial (Arkader, Rosa, & Moretti, 2016). Therefore, it is clear that new studies with different groups are needed. It was concluded that aerobic and combined exercises led to improvements in liver enzyme levels; The decrease in ALT level was not statistically significant but the decrease in AST level was found to be statistically significant in both groups. In a study conducted on this subject, it was determined that the aerobic exercise program applied in 60-75% intensity for 5 weeks in elderly men did not cause a change in both AST and ALT levels (Sun et al., 2018). In the same way, it was emphasized that the aerobic exercise program, which was applied for 60 minutes at 50-80% intensity for 5 days a week for 8 weeks in elderly obese women, did not change the AST and ALT values (Park, Kim, Han, Kang, & Park 2019). It has been reported that long-term regular exercise decreases AST and ALT levels in individuals with liver disorder (Peng, Chen, Chen, Shao, & Yuan, 2018). It has been stated that combined exercise leads to an increase in AST and ALT values in women with overweight and type 2 diabetes (Banitalebi, Faramarzi, Nasiri, Mardaniyan, & Rabiee, 2019). Current results show that more research is needed. Changes caused by exercise are not limited to thyroid hormones and liver enzymes; it was determined that both aerobic and combined exercises caused differences in uric acid and glucose levels. Differences in uric acid levels were statistically significant in both groups, whereas changes in glucose levels were significant only in the combined exercise group. It has been shown that walking program which is 120 minutes per week for 12 weeks does not change uric acid level in elderly women (Kawamoto et al., 2016). In another study, moderate intensity exercises were performed for 8 weeks in subjects with type 2 diabetes. As a result, it was determined that exercise program leads to decrease in uric acid level (Tangvarasittichai, Lertsinthai, Taechasubamorn, Veerapun, & Tangvarasittichai, 2017). In another study, it was found that an aerobic exercise program administered to elderly women at a intensity of 50-70% for 45 weeks to 8 weeks 3 days a week led to a decrease in uric acid level (Moghadam, 2015). In a study, it was emphasized that glucose and uric acid levels were lower in individuals who participated in aerobic or strength training (Fragala, Bi, Chaump, Kaufman, & Kroll, 2017). It was determined that aerobic exercises applied to elderly obese women for 60 minutes at a intensity of 50-80% 5 days a week for 8 weeks caused a decrease in glucose level (Park et al., 2019). It was determined that aerobic exercise program administered 60 minutes a day for 12 weeks 3 days a week to women with chronic degenerative diseases caused a decrease in glucose level (Roas et al., 2019). In a different study with similar results with our research findings, it was shown that aerobic exercise program with a intensity of 70% and 40 min per day 3 days a week for 8 weeks and reduced glucose levels in obese young males (Cho & Roh, 2016). As a result, there are positive results of exercise in human organism. Both aerobic and combined exercises have effects on thyroid hormones, liver enzymes, uric acid and glucose. However, it can be said that combined exercises may be more effective in terms of the number of parameters it affects statistically. Considering the current research results, more research is needed to use clearer expressions.

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