

Changes in body composition and blood parameters in sedentary women during 12 weeks of complex exercises

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Abstract

Background and Study Aim There are studies examining the effects of exercise programs on body and blood parameters in sedentary individuals, but there are few studies examining the effects of resistance and cardio exercises in combination. The aim of this study was to investigate the effects of step-aerobic, cardio and resistance training on body composition and blood parameters in sedentary women for 12 weeks.

Material and Methods Step- Aerobic, Cardio and Resistance exercises were applied to the volunteers participating in the study for 12 weeks, 3 days a week for 1 hour each. Body weight, body mass index, body fat percentage and body muscle percentage values were determined from body composition measurements before and after the application. Glucose, Vitamin D3, Triglyceride, Cholesterol, High-density lipoprotein and Low-density values were measured from blood parameters. There is no exercise planning was done in the control group.

Results After the exercise program, a significant decrease ($p < 0.05$) in body weight, body mass index, body fat ratio, Glucose, Vitamin D3, Triglyceride, Cholesterol and Low-density values and a significant increase ($p < 0.05$) in High-density lipoprotein and values were determined in the study group. In the control group, no significant change was observed in both body composition and blood parameters ($p > 0.05$).

Conclusions In the this study, it was found resistance, cardio and step-aerobic exercise programs had a positive effect on body composition and blood parameters in sedentary women. In the control group, there is no positive data for the end of the this study and there is no significant change not only body parametres bu also blood measurement in the control group.

Keywords: exercise, blood parameters, physical fitness, body mass index.

Introduction

Technological developments facilitate our daily lives and save our time. However, this situation negatively affects human health and increases the incidence of various diseases such as cardiovascular disorders, diabetes, obesity, posture disorders. Obesity is linked to cancer, diabetes and heart diseases [1, 2, 3, 4]. Epidemiologic studies indicate that time spent watching television or sitting increases mortality rates and that a sedentary lifestyle has a positive relationship with the risk of type 2 diabetes [2]. Especially in countries with high income levels, the incidence of conditions such as smoking, excessive alcohol consumption, hypertension is increasing rapidly [3, 4]. People use the words exercise, physical activity and sport as if they are the same practices, but they are not fully aware of the differences in these practices. Physical activity is defined as all movements in which the human organism expends energy regardless of form, space and intensity; exercise and sports practices are generally accepted as sub-dimensions of physical activity [5]. In the US Department of Health reports, it is stated that participation in adopted physical

activity is an indicator of an active lifestyle [6].

In humans, body composition is defined as lean body weight, muscle mass and bone ratio [7]. An exercise prescription built on the correct configuration increases the initial motivation in sedentary individuals and increases the dependence of individuals on the exercise program [8]. It is stated that an exercise program planned in line with this planning causes the muscles to use a large amount of glucose during the activity and the increased sensitivity of the muscles to insulin after exercise, the effect of insulin made after the intensive exercise program is faster and thus blood sugar decreases [9].

Triglyceride is a measurement that is investigated with blood pressure and cholesterol levels to detect cardiovascular risk factors. In the simplest terms, triglyceride is the ratio of fat in the blood. The rate of fat in the blood can vary after a properly planned exercise program [10]. Cholesterol plays an important role in the human body for cell construction and sex hormone production. When cholesterol levels are high in the blood, there is an increase in cardiovascular risk factors [11]. High-density lipoprotein (HDL) is a fat-like substance that collects cholesterol in tissues and allows it to

be excreted. The reasons for the high presence of cholesterol in the blood; It is stated that there are factors such as old age, diabetes, sedentary life, obesity, stress factors, genetic conditions [12]. High HDL may mean that cardiovascular risk factors are low. HDL ratio increases with regular exercise [13]. Low levels of lipoprotein (LDL) in the blood are produced in the liver and transported through the blood. LDL is a parameter that is analyzed to determine people's heart health risk factors. These two measurements provide a high degree of information about the heart health of individuals [14]. In the literature, it is stated that vitamin D3 has a positive effect on being healthy status such as bone health and muscle fibril structure in adult humans. According to specialist vitamin D3 in humans has been shown to positively influence musculoskeletal health, muscle strength increased in older adults [15]. Vitamin d3 is include natural supplement and a lot of humans is using for skin exposure to ultraviolet [16].

Body mass index (BMI) is a method used to estimate people's body weight in relation to their health problems. Obesity is a condition in which people are excessively fat. Cholesterol, triglycerides, insulin levels, high blood pressure, orthopedic disorders and mental problems are considered as risk factors for obesity [17]. According to the World Health Organization, body mass index classification states that those with 25 kg/m^2 and above are overweight, those with $25-29.9 \text{ kg/m}^2$ are pre-obese, those with $30-34.9 \text{ kg/m}^2$ are 1st degree obese, those with $35-39 \text{ kg/m}^2$ are 2nd degree obese, and those with 40 kg/m^2 and above are 3rd degree obese [18].

In the literature, there are various studies investigating the effects of exercise programs on body composition and blood parameters [7, 8, 10, 14]. However, the number of studies using 3 different exercise protocols is quite low.

The aim of this study was to investigate the effects of step-aerobic, cardio and resistance exercise programs using three different exercise types on body composition and blood parameters in sedentary women for 12 weeks.

Materials and Methods

Participants

Twenty-seven sedentary women participated in the study as volunteers. The volunteers were divided into two groups as study group and control group. The study group consisted of 15 volunteers with a mean age of 32.2 ± 7.3 (years) and 3 volunteers from this group voluntarily left the study. The control group consisted of 12 volunteers with a mean age of 32.1 ± 7.2 years (mean age 32.1 ± 7.2 years) and no exercise program was applied to this group and they were asked to continue their daily routine lives.

Research Design

The content of the exercise program applied to the experimental group is presented in Table 1. Under the supervision of expert trainers, the study group underwent an exercise program of 70 to 90 minutes for a total of 36 days, 3 days a week for a 12-week period. Exercise practices were planned as 10-15 min warm-up phase, 40-50 min training program, 10-15 min cool-down phase. Resistance exercises were performed with resistance band squats, bend over rows, lunges, triceps extension, reverse crunch, diagonal wood chops movements using yellow theraband (low difficulty level) 1 day a week. Cardio exercises were performed 1 day a week at a pulse rate of 40-60% using elliptical bicycle, normal bicycle and treadmill. Step-aerobic exercise program was applied with an intensity between 60-80%.

Blood Analyzes and Body Composition Measurements

In our study, the individuals in the experimental and control groups were instructed not to change their daily eating habits during the exercise program (12-week period). Total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglyceride (T), glucose (G), vitamin D3 values were evaluated in blood samples taken from all volunteers. In the blood samples taken from the experimental and control groups, 10ml biochemical kits were used and the data obtained were analyzed in the laboratory of Kayseri City Hospital. In addition, body weight, body mass index, body fat

Table 1. Exercise program during the 12 weeks resistance, step-aerobic, cardio exercise of the experimental group

Resistance Exercises			Step-Aerobic			Cardio Exercises		
Week	Set	Reps	Week	Day	Intensity.	Week	Day	Intensity.
1	2	8-10	1	1	%60-80	1	1	%40-60
2	2	10	2	1	%60-80	2	1	%40-60
3	2	10	3	1	%60-80	3	1	%40-60
4	3	12	4	1	%60-80	4	1	%40-60
5	3	12	5	1	%60-80	5	1	%40-60
6-12	3	12	6-12	1	%60-80	6-12	1	%40-60

and muscle ratios were taken from the participants before and after exercise using Tanita BC 601 body analyzer.

Statistical Analysis

SPSS 24 program was used in the statistical analysis of the research. In order to determine the skewness kurtosis value of the data, the level of (1.5>X>1.5) was determined and it was decided to use parametric test. Paired sample t test was used for significance analysis between measurements. Significance level p<0.01-0.05 was accepted.

Results

In our study, the mean age of the experimental group was 32.7±7 (years) and the mean height was 160.5±6 (cm), while the mean age of the control group was 32.1±7.2 (years) and the mean height was 166.3±7.4 (cm).

The body composition findings of the experimental group are given in Table 2. According to Table 2, a significant decrease was found in the BW, BMI and BFR values of the volunteers after the exercise program (p<0.05). No significant difference was observed in BMR values (p>0.05).

Blood measurement findings of the experimental group are given in Table 3. According to Table 3, a significant difference was found in the triglyceride, cholesterol, ldl, values of the volunteers after the exercise program (p<0.05). No significant difference was observed in hdl, vitamin d3, cholesterol values (p>0.05).

Body composition findings of the control group are given in Table 4. According to Table 4, no significant difference was found in the BW, BMI, BFR, BMR values of the control group (p>0.05).

Blood measurement findings of the control group are given in Table 5. According to Table 5, no

Table 2. Comprasion of body weight, body mass index, body fat ratio and body muscle ratio measurements of the experimental group (Paired Sample t Test)

Variable	n	Min.	Max.	Mean Std.	t	p
Body Weight ^{kg} Pre-test	12	58.1	78.2	72.7±5.8	3.029	.011*
Body Weight ^{kg} Post-test	12	59.1	76.9	71.6±5.2		
Body Mass İndeks ^{kg/m²} Pre-test	12	23.6	32.9	28.2±2.8	3.100	.010*
Body Mass İndeks ^{kg/m²} Post-test	12	24.0	32.4	27.8±2.8		
Body Fat Ratio% Pre-test	12	16.3	41.6	30.2±9.2	3.447	.005*
Body Fat Ratio% Post -test	12	17.5	40.3	29.2±8.6		
Body Muscle Ratio ^{kg} Pre-test	12	41.5	52.0	47.9±3.4	1.542	.151
Body Muscle Ratio ^{kg} Post-test	12	41.6	51.3	47.5±3.3		

Note: *p <0.05; BW - body weight; BMI -body mass index; BFR – body fat ratio ; BMR – Body Muscle Ratio

Table 3. Comprasion of Glucose, Vitamin D3, Triglyceride, Cholesterol, HDL, LDL analysis results of the experimental group (Paired Samle t Test)

Variable	n	Min.	Max.	Mean.Std	t	p
Glucose ^{mg/ dl} pretest	12	69.0	112.0	87.3±12.3	.925	.375
Glucose ^{mg/ dl} posttest	12	68.0	106.0	85.8±11.7		
Vitamin d3 ^{ng/ml} pretest	12	16.8	34.0	24.7±6.2	1.509	.160
Vitamin d3 ^{ng/ml} posttest	12	17.1	29.0	23.3±4.		
Triglyceride ^{mg/ dl} pretest	12	53.0	162.0	91.9±38.9	2.461	.032*
Triglyceride ^{mg/ dl} posttest	12	37.0	148.0	82.3±34.4		
Cholesterol ^{mg/ dl} pretest	12	147.0	248.0	171.1±27	5.802	.000*
Cholesterol ^{mg/ dl} posttest	12	139.0	242.0	163±27		
HDL ^{mg/ dl} pretest	12	35.0	108.0	57.7±19	1.068	.309
HDL ^{mg/ dl} posttest	12	30.0	101.0	69.8±18.4		
LDL ^{mg/ dl} pretest	12	44.8	149.3	94.8±29.9	1.637	.030*
LDL ^{mg/ dl} posttest	12	37.3	155.2	91.1± 31		

Note: *p <0.05; HDL - high-density lipoprotein; LDL - low-density lipoprotein

Table 4. Comprasion of Body Weight, Body Mass Index, Body Fat Ratio and Body Muscle Ratio Measurements of the control group (Paired Samle t Test)

Variable	n	Min.	Max.	Mean Std	t	p
Body Weight ^{kg} Pre-test	12	69.7	86.4	77.1±5.9	-4.380	.129
Body Weight ^{kg} Post-test	12	70	87.1	73.3±6.3		
Body Mass İndeks ^{kg/m²} Pre-test	12	21.8	32.7	26.9±3.7	1.672	.984
Body Mass İndeks ^{kg/m²} Post-test	12	21.5	33.1	27±3.7		
Body Fat Ratio [%] Pre-test	12	19.7	35.7	25.9±6.7	-1.883	.571
Body Fat Ratio [%] Post -test	12	19.5	39.4	26.9±7.2		
Body Muscle Ratio ^{kg} Pre-test	12	41.8	57.	49.8±5.2	-3.189	.134
Body Muscle Ratio ^{kg} Pre-test	12	44.6	57.2	51.1±4.6		

Note: *p <0.05; BW - body weight; BMI -body mass index; BFR – body fat ratio ; BMR – body muscle ratio

Table 5. Comprasion Glucose, Vitamin D3, Triglyceride, Cholesterol, HDL, LDL analysis results of the control group. (Paired Sample t test)

Variable	n	Min.	Max.	Mean.Std	t	p
Glucose ^{mg/ dl} pretest	10	66	100	89±.9	-2.112	.581
Glucose ^{mg/ dl} posttest	10	68	101	89.9±.9		
Vitamin d3 ^{ng/ml} pretest	10	17.1	24.5	20.3±2.5	-1.144	.311
Vitamin d3 ^{ng/ml} posttest	10	17.5	24.2	20.6±2.5		
Triglyceride ^{mg/ dl} pretest	10	55	100	78.1±12.5	-3.681	.117
Triglyceride ^{mg/ dl} posttest	10	57	98	80.1±10.8		
Cholesterol ^{mg/ dl} pretest	10	69	167	190.1±30	-1.558	.089
Cholesterol ^{mg/ dl} posttest	10	76	165.7	190.8±28.4		
HDL ^{mg/ dl} pretest	10	73.2	139.1	55.2±11.6	-1.146	.093
HDL ^{mg/ dl} posttest	10	68.7	170.8	61.5±11.4		
LDL ^{mg/ dl} pretest	10	44.8	100.5	87±18.5	-2.265	.536
LDL ^{mg/ dl} pretest	10	43.1	100.4	87.7±19.6		

Note: *p <0.05; HDL - high-density lipoprotein; LDL - low-density lipoprotein

significant difference was found in glucose, vitamin d3, triglyceride, cholesterol, hdl, ldl values (p>0.05).

Discussion

Optimally performed exercise planning contributes to insulin sensitivity in non-diabetic individuals who are effective in determining blood glucose levels and helps control blood glucose levels in the group with diabetes. The American Diabetes Association emphasizes that a low-level exercise program applied every week is effective in reducing blood glucose levels [19]. Endurance and short-term high intensity exercises reduce blood glucose levels [20]. There are studies with similar and different results in the literature. Mergen Dalyanoğlu et al. [21] reported a significant change (p<0.05) in blood glucose levels after exercise. In the study applied on performance athletes, it was found that the exercise program had a significant effect (p<0.05) on blood

glucose levels [22]. It is seen that there is a no statistical decrease (p>0.05) in blood glucose levels with participation in the applied exercise program.

It is stated that elevated triglyceride levels, which are responsible for maintaining order in the endocrine system, may cause some risk factors. It is stated that the effect of exercise practices on triglyceride levels in the blood varies according to the duration, frequency and protocol of exercise [23]. In our study, it was observed that the triglyceride values of the participants showed a significant decrease in the post-test (p<0.05) (Table 3). In the similar study found a significant (p<0.05) decrease in triglyceride measurements in their study and reached similar results with our current study [4].

Kraus et al. found that there was a significant decrease in triglyceride levels after the exercise program in their study with the participation of sedentary individuals [24]. In the study in which endurance training protocol was applied, it was

found that exercise increased triglyceride levels initially [25]. In a study conducted on elite wrestlers, it was found that there was no change after the exercise program [26]. Şekeroğlu et al. found in their study that acute and programmed exercise in sedentary individuals caused a sudden increase in blood triglyceride level, while there was a decrease at the end of the program [27]. Based on these findings, it is thought that the effect of exercises on blood triglyceride levels may also be effective from aerobic exercises included in the exercise content, the increase in HDL measurements may have an effect on the significant change in this parameter, and dietary habits after starting the exercise program may also be effective in this process.

Cholesterol is an indispensable molecule for humans (for the synthesis of steroids and other important molecules) as well as being necessary for its structural functions [28]. In the present study, a significant decrease ($p < 0.05$) was observed in the averages after the exercise program in the experimental group (Table 3), while no change was observed in the control group (Table 5). Selçuk et al. determined that there was a decrease in total cholesterol level in women as a result of an 8-week exercise program, but this decrease was not significant and a different result was reached from our study [29]. Guskowska [30] found that there was a decrease in favor of the last test in all group measurements participating in the study. Similar findings were found in studies in which cholesterol levels were found to differ after exercise in middle-aged male individuals [31]. In our current study, the exercise program was limited to 12 weeks. It is thought that factors such as the sports history of the individuals in the sample groups in the studies and the year of participation in exercise may be effective in reaching different findings.

The effect of regular exercise on HDL values depends on several factors. These are; the intensity of exercise and the characteristics of the participant [13]. In our study, there is no ($p < 0.05$) significant increase was found in the mean HDL values of the participants (Table 3). No significant change was observed in HDL values in the control group (Table 5). In a similar study, it was found that a 14-week exercise program caused a 6% increase in HDL values [32]. According to the content of the exercise protocol, an increase in HDL values occurs and it is stated that the continuation of these activities has a positive effect [33, 34]. In their study, İri et al. found that there was a significant increase in HDL values at the end of 8 weeks [35].

High levels of LDL cholesterol in the blood are reported to be an indicator of lipids in the blood

and cardiovascular risk factors and the level of 100-130 mg/dl is accepted as the reference range [36]. In this study, it was found that there was a significant decrease ($p < 0.05$) in LDL values after the exercise program in blood measurements in the experimental group (Table 3), while no difference was detected in the control group (Table 5). Mergen Dalyanoğlu et al. reported that although there was a decrease in LDL levels in his study with sedentary women, this decrease did not show statistical significance ($p > 0.05$) and reached a different result from our study [21]. It is seen that the applied exercise program had a positive effect on the HDL and LDL values of the volunteers. No change was observed in the control group. From these findings, it is thought that participation in a regular exercise program has a positive effect on the reduction of risk factors in individuals.

In our study, it was found that there were decreases in the mean Body Weight, Body Mass Index, Body Fat Ratio, Body Muscle Ratio of the participants and this decrease was significant in Body Weight, Body Fat Ratio, Body Mass Index measurements ($p < 0.05$) (Table 2). There are studies in the literature with similar results with the measurements in these parameters. Among these studies, Schneider et al. [37], Burrowes [38] reached similar results in their study.

It is thought that the significant changes in Body Weight, Body Fat Ratio and Body Mass Index values in the experimental group are due to the effect of exercise participation. It is thought that appropriate exercise program and food consumption may contribute to physical fitness in individuals of all age groups and continuity of physical activities may affect these parameters.

Conclusion

In this study, it was found that there was a significant change in Body Weight, Body Mass Index, Body Muscle Ratio, Low Density Lipoprotein, Triglyceride and Cholesterol values of sedentary women with the combined application of resistance, cardio and step-aerobic exercises ($p < 0.05$). There are studies with similar and different findings in the literature. It is thought that this differentiation may be due to factors such as the protocol of the exercise applied, the change in body weight caused by exercise application, nutritional habits, and drug use.

Conflict of interests

The authors reported no potential conflict of interest.

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