THE EFFECT OF 8 WEEK RESISTANCE EXERCISES ON BLOOD LIPIDS AND BLOOD SUGAR LEVELS IN SEDENTARY WOMEN

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Aim. The purpose of this study was to investigate the effects of an eight-week resistance exercise program on blood fats and blood sugar in sedentary women. The study included 20 volunteers with a mean age of 31.70 ± 3.81 years. **Materials and methods.** Blood samples were taken by the experts in the appropriate laboratory environment in the morning before and after the resistance exercise program, which was administered 60 minutes 3 days a week for 8 weeks in the mornings on an empty stomach. Dependent groups t-test (Paired Sample T-Test) was applied to compare descriptive statistics with pre- and post-exercise values by using SPSS 22.0 package program. **Results.** There was a significant difference between GLU, Triglyceride, HDL, LDL, and total cholesterol levels before and after the resistance exercise program ($p > 0.05$). **Conclusions.** Resistance exercises have a positive effect on blood sugar and blood fat change. Therefore, we think that it can be used as protection from cardiovascular diseases, and if these exercises are applied regularly, they will have many positive results in terms of health.

Keywords: Resistance Exercise, Blood Lipids, Blood Sugar.

Introduction. Physical activity is the whole of body movements, and it requires the energy expenditure above the basal level, which leads to energy consumption as a result of the contraction of the skeletal muscles [14]. Even though physical activity is exercise-related; an exercise is a form of physical activity, and it is carried out to reach physical health or protection. Exercise is a planned, structured, repeatable, and continuous activity aiming to develop one or more elements of physical fitness [22].

The effect of physical activity on blood parameters has become an ongoing research area [11, 16]. It has been reported that various exercise programs and physical activities positively affect fats and carbohydrate metabolism, leading to a moderate reduction of body weight, fat stores [15], total cholesterol, and triglyceride [21]. Resistance exercises (RE) are intensely preferred by the masses.

Resistance exercise (RE) training is a special training method consisting of exercises designed to increase muscle strength. Resistance exercise training often comes to mind when we speak about strength training or weight training. With this being true, strength training constitutes only one form of RE training. Anything that allows muscles to work more rigidly can be classified as RE training. Stretching is also defined as RE training [4]. Regular resistance exercises are reported as causing significant changes in body composition and muscle size, especially in women [23].

The increase in the energy requirements of working muscles during regular exercises also increases the use of glucose and fats [8]. Also, it has been shown clinically that regular exercises decrease blood sugar, hemoglobin A1c levels, and insulin resistance [19].

The aim of this study was to investigate the effects of an eight-week resistance exercises program on weight, fat percentage, blood triglyceride, HDL, LDL, total cholesterol, and GLU levels in sedentary women. The paper represents an equal contribution of all authors.

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Materials and Methods

Subjects. A pre-test – post-test model was used in the study. Prior to the research, the participants were asked about any health problems. Twenty sedentary women with a mean age of 31.70 ± 3.81 years regularly involved in sports on the premises of a special sports facility in Bartın province participated in the study. The bioelectric impedance analyzer (TANITA TC-418, USA) was used to determine the weight and fat percentage of participants. During the study, the participants did not follow a special diet program.

Procedure. Blood Lipids Measurement Tests: Blood values were obtained by using the Abbott Architect c800 device to measure complete blood counts, GLU, LDL, HDL, total cholesterol, and triglycerides.

Exercise and Workout Program: The 8-week training program consisted of 60-minute resistance exercises 3 days a week. After a 10 minute-warm-up in each exercise period, the exercises from Table 1 were applied. The applied program also included 5-minute cooling exercises.

Table 1

Types of exercises and their duration

Exercises	Period
Push-ups with an exercise band	2*12 sets
Shoulder Lateral Raise and Front Raise with an exercise Band	2*12 sets
Resisted Squat to Shoulder with an exercise band	2*12 sets
Hip Thrust movement with an exercise band	2*12 sets
Stance position Biceps Curl with an exercise band	2*12 sets
Penguin Straight Leg Hip Extension movement with an exercise band	2*12 sets
Baseball swing movement with an exercise band	2*12 sets

Methods. *Statistical analysis:* SPSS 22.0 package program was used to analyze the data. To determine the differences between the pre-test and post-test values, t-test (paired sample t-test), which is one of the parametric tests, was used.

Results. The analysis and interpretation of the results were based on the statistical calculations presented in Tables 2 and 3 below.

Table 2

Physical Characteristics of Women Participating in the Study

	N	Age (year)	Lenght (cm)
Female	20	31.70 ± 3.81	159.55 ± 6.15

Table 2 shows the physical characteristics of women. Their age and height were determined as 31.70 ± 3.81 years and 159.55 ± 6.15 cm, respectively.

It was established that the mean pre-test weight values of the women included in the study were 81.52 ± 13.33 kg, and the mean post-test weight values were 73.67 ± 11.22 kg ($p < 0.01$). The mean fat percentage values before the resistance exercise program were 37.19 ± 7.28. It was registered that the mean fat percentage values in the final test were 33.39 ± 6.39 (statistically significant, $p < 0.01$). The mean pre-test triglyceride values in participants were 137.30 ± 83.63 mg/dl; the mean post-test triglycerides were 124.15 ± ± 66.90 mg/dl. This result is statistically significant ($p < 0.05$). The mean HDL values before the exercise program were 57.90 ± 16.49 mg/dl; the mean HDL values after the exercise program were 65.85 ± 15.34 mg/dl. The mean LDL pre-test values were 100.20 ± 31.00 mg/dl, and the final test values were 93.45 ± 28.76 mg/dl. The total cholesterol values before the exercise program applied again were 172.40 ± 51.04 mg/dl; the mean total cholesterol level was found to be 160.10 ± 46.67 mg/dl, and these results were statistically significant ($p < 0.01$). Finally, the same pre-exercise glucose values 102.85 ± 24.59 mg/dl. After exercise, the glucose values were found to be 92.70 ± 21.21 mg/dl, and this result was statistically significant ($p < 0.01$).

Conclusion

Regular physical exercises influence obesity, the cardiovascular system, blood pressure, physical well-being, body fat ratio, and healthy life in middle-aged people [3, 12, 13, 18].

Fenkci et al. (2006) investigated the effects of different exercise protocols in 60 obese women (Group 1 – aerobic exercises, Group 2 – resistance exercises, Group 3 – control) during 12 weeks. A significant decrease in the mass index and waist circumference values have been reported [7]. Amano et al. (2001) reported that the body fat percentage decreased from 29.6% to 26.6% after 18 days. It was registered that their participants dropped to 18.6 kg, and the lean body mass decreased from 52.4 kg to 51.7 kg [1]. Erbaş (2007) investigated the effect of a 6-month regular aerobic program in 54 middle-aged sedentary women (pre-test before training, 3-month post-test, and 6-month post-test). After the exercise program, the VA and VYY values of the subjects decreased significantly ($p < 0.05$) [6]. Kafkas et al. proved that there was a significant diffe-

**Differences between weight, fat percentage, and some blood parameters
before and after resistance exercises**

Measurements	N	Pre-test	Final test	Difference between averages	t	p
Weight	20	81.52 ± 13.33	73.67 ± 11.22	−7.85	8.31	0.000**
Fat Percentage %	20	37.19 ± 7.28	33.39 ± 6.39	−3.8	9.50	0.000**
Triglycerides (mg/dl)	20	137.30 ± 83.63	124.15 ± 66.90	−13.15	3.09	0.006*
HDL (mg/dl)	20	57.90 ± 16.49	65.85 ± 15.34	7.95	−8.81	0.000**
LDL (mg/dl)	20	100.20 ± 31.00	93.45 ± 28.76	−6.75	6.02	0.000**
Total cholesterol (mg/dl)	20	172.40 ± 51.04	160.10 ± 46.67	−12.3	5.66	0.000**
Glucose (mg/dl)	20	102.85 ± 24.59	92.70 ± 21.21	−10.15	8.91	0.000**

Note: $p < 0.01$**, $p < 0.05$*.

rence in the results of women and men after a 12-week aerobic-resistance exercise program (VA, VYO, BMI values) [2].

In our study, the mean pre-test weight values of the women included in the study were 81.52 ± ± 13.33 kg, and the final test weight mean values were 73.67 ± 11.22 kg ($p < 0.01$). Therefore, our research shows a parallel with other studies. Rhodes et al. (2000) in another study (n = 44) on sedentary women divided the participants into the control and exercise groups. As a result of a 52-week resistance exercises program, VA, EKK, BÇ, and VYO values of the groups did not change significantly. As can be seen from these results, the results may vary depending on the type and intensity of exercises [17].

In the study by Stasiulis et al. (2010), the experimental group worked 3 days a week for 60 minutes. At the end of an 8-week exercise program, BMI, VYY, and TG values demonstrated a significant decrease ($p < 0.01$) [20]. Karacan and Colakoglu (2003) in their study of sedentary middle-aged and young women conducted a 12-week aerobic training program (run-and-walk). Cholesterol and triglyceride values were measured [10]. At the end of the study, body weight, body fat percentage, body fat weight, body mass index, total cholesterol, and LDL cholesterol levels significantly decreased in both groups ($p < 0.05$). In our study, it was established that there was a positive difference between the pre-test values of triglycerides, HDL, LDL total cholesterol and the post-exercise values of triglyceride, HDL, LDL total cholesterol in women who participated in the study. This difference was found to be statistically significant ($p < 0.01$). The results of these studies support the results obtained in our study.

Hata et al (1998) studied 20 young women

(10 control group). Total cholesterol, HDL cholesterol, LDL cholesterol, and triglyceride values showed no significant changes after exercises ($p > 0.05$). This result is different compared to those obtained in our study [9].

An increase in insulin concentration was observed as a result of regular and long-term exercises, followed by a decrease to normal values. The relationship between glucose and insulin concentration is well-known. Therefore, the increase in insulin supply is due to high blood glucose levels at the beginning of training (Cochran, 1985). When we look at the results of the study, the pre-exercise glucose values during the resistance exercise program were 102.85 ± ± 24.59 mg/dl. After the exercise, glucose values were determined as 92.70 ± 21.21 mg/dl, and this significant decrease in glucose values was found to be statistically significant ($p < 0.01$) [5].

As a result; it was established that the eight-week resistance exercise program applied to sedentary women had a significant effect on blood parameters. As can be seen from the pre-test and post-test results of sedentary women, individuals with a sedentary lifestyle have decreased blood sugar after exercise. This program shows that the desired goal is reached.

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ВЛИЯНИЕ ВОСЬМИНЕДЕЛЬНОЙ ПРОГРАММЫ УПРАЖНЕНИЙ С СОПРОТИВЛЕНИЕМ НА ЗНАЧЕНИЯ САХАРА И ЖИРА В КРОВИ ЖЕНЩИН, ВЕДУЩИХ МАЛОПОДВИЖНЫЙ ОБРАЗ ЖИЗНИ

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Цель. Цель данного исследования – изучить влияние восьминедельной программы упражнений с сопротивлением на значения сахара и жира в крови у женщин, ведущих малоподвижный образ жизни. В исследовании участвовали 20 добровольцев в возрасте $31,70 \pm 3,81$ года. **Материалы и методы.** Образцы крови были взяты специалистами в соответствующей лаборатории перед выполнением программы упражнений и после. Занятия спортом продолжались 60 минут 3 раза в неделю в течение 8 недель утром натощак. Чтобы сравнить значения исследуемых параметров до и после упражнений, был использован t-тест для парных выборок в программе SPSS 22.0. **Результаты.** Авторами были выявлены статистически значимые отличия в показателях глюкозы, триглицеридов, ЛПВП, ЛПНП и общего холестерина до и после программы упражнений ($p > 0,05$). **Заключение.** Упражнения с сопротивлением оказывают положительное воздействие на показатели сахара и жира в крови. Таким образом, мы считаем, что полученные данные могут быть использованы для предотвращения сердечно-сосудистых заболеваний. Регулярное выполнение упражнений с сопротивлением имеет множество положительных эффектов для здоровья.
Ключевые слова: упражнения с сопротивлением, сахар крови, липиды крови.

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