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Investigation of the Effect of Walking and Running Exercises on Some Blood Parameters in Adults[i]

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Abstract This study was conducted in order to investigate the effects of walking and running exercises over some blood parameters of adult individuals. A total of 20 male volunteers with an age average of 48.05 ± 2.30 were included in the study. An exercise program consisting of regular walking and running exercises for 90 minutes per day in three days of a week and for a total of 8 weeks was taken by the volunteers. Participants were asked to continue without changing their diet program. Blood parameters of the participants were measured before and after the exercise program. Furthermore, their heights and body weights were measured, and their Body Mass Indexes were calculated. The results of the measurements taken after 8 weeks of exercise indicate that the pulse rate, systolic blood pressure, diastolic blood pressure, cholesterol, Low Density Lipoprotein (LDL), and triglyceride values of the participants had decreased significantly ($p<0.01$) compared to pre-exercise values. While hemoglobin and High Density Lipoprotein (HDL) values displayed meaningful increase ($p<0.01$), no statistically significant change was detected in body weight and body mass index parameters. As a result, jogging and running exercises were determined to have positive effects on the pulse rate, systolic blood pressure and diastolic blood pressure, as well as the other blood parameters evaluated in the study. Body weight and BMI values, on the other hand, were found to have not been affected at all.

Keywords Blood Parameters, Age, Body Weight, Exercise

1. Introduction

Average human life is 70 years. Yet if the time we spend for physical training and sports is evaluated in terms of actual physical training and sports activities, it spans at most 10 years of our lifetimes, which is mostly covered by the upper secondary education and higher education years. Is it normal that physical education starts with high school and ends in college years? Besides, this ten year period corresponds to approximately 14% of our total lifetime, which is considerably low. The time spent for sports as adults, and in every period of our lifetimes, just seems to be not implementable persistently.

Physical injuries in walking exercises are lower compared to that of other forms of exercises. Many studies report that older individuals avoid exercises due to risk of injuries, and walking exercises are the most preferred exercise type for elderly individuals. Regular free brisk walking exercises are reported to increase fitness levels, especially for young and middle aged individuals. Increased cardiovascular fitness reduces mortality rates, especially those related to cardiovascular origins. In a literature survey study where the positive effects of walking exercises over health were evaluated, the effects of walking over cardiovascular risk factors were inspected, and it was revealed that regular walking reduced blood pressure, corrected the lipid profile, reduced body fat ratio, increased emotional well-being, and reduced coronary artery diseases [1].

Running exercise is one of the finer sports and aids morale. Furthermore, it helps getting rid of fatigue and stress of the daily life. It regulates bodily condition and health. That being said, an individual needs to be free of health problems in order to be able to engage in proper running exercises. Individuals with heart conditions or other cardiovascular problems should only conduct running exercises with doctor supervision. It is also important to choose a proper location to engage in running exercises, considering safety, hygiene and air conditions. Prior warm-up exercises are also needed, as they prepare the body for running, increasing blood flow rate and body temperature. Running time, speed and repeat count should be suitable for the individual capabilities and individuals should not over-exert themselves. Initially, only the time and distance should be considered, while speed should only be arranged according to personal capacity. To prevent any potential injuries, it should be conducted every other day when beginning, letting the body getting used to the effort and giving it time to rest. It is also noted that conducting running and walking exercises together is effective [2]. There are many studies about how exercise affects hematological parameters. In fact, blood parameters affect the intensity and the type of exercise, exercise also affects blood parameters and it is important in terms of various blood pathologies [3]. Trainings can positively affect lipid and carbohydrate metabolism, leading to moderate reductions in LDL cholesterol and increases in antiatherogenic HDL cholesterol in body weight, fat stores, total cholesterol and serum triglycerides [4].

In this study, it was aimed to investigate whether the application of walking and running exercise program for 8 weeks with a mean age of 48.05 ± 2.30 years and applied to 20 male volunteer participants would change the health parameters of the participants.

Table 1. The Distribution of the Exercise Program Performed by the Participants over Weeks.

Elements of the Exercise / Weeks	Exercise	Distance (m)	Intensity (%)	Repeat Count	Rest Period Between Repeats (s)	Total Rest Time (s)	Rest Time Between Two Different Exercises (m)	Total Distance (m)
Week One	Walking	60	40	1 x 10	35	55	1.35	600
	Slow Running	500	40	1 x 2	40	90	2	1000
	Fast and then Slow Running	50	40	1 x 10	45	115	2.15	500
Week Two	Walking	80	45	1 x 12	45	90	1.45	960
	Slow Running	1000	45	1 x 1	------	115	2.25	1000
	Fast and then Slow Running	90	45	1 x 9	55	120	3	810
Week Three	Walking	1000	50	1 x 4	95	130	3.35	4000
	Slow Running	1500	50	1 x 1	------	155	2.55	1500
	Fast and then Slow Running	1000	50	1 x 3	165	165	3.10	3000
Week Four	Walking	2000	55	1 x 3	135	140	2.40	6000
	Slow Running	2000	55	1 x 1	-------	155	2.55	2000
	Fast and then Slow Running	1500	55	1 x 3	145	165	3.05	4500
Week Five	Walking	2500	60	1 x 2	105	145	2.55	5000
	Slow Running	2500	60	1 x 1	------	-----	3.05	2500
	Fast and then Slow Running	2000	60	1 x 2	115	175	3.25	4000
Week Six	Walking	3000	63	1 x 3	130	185	3.35	9000
	Slow Running	3000	63	1 x 2	135	195	3.45	6000
	Fast and then Slow Running	2500	63	1 x 3	140	190	3.55	7500
Week Seven	Walking	3500	65	1 x 2	------	195	3.55	7000
	Slow Running	3500	65	1 x 1	------	205	4.10	3500
	Fast and then Slow Running	2500	65	1 x 2	------	210	4.25	500
Week Eight	Walking	4000	67	1 x 1	------	200	3.55	4000
	Slow Running	4000	67	1 x 1	------	210	4.10	4000
	Fast and then Slow Running	3000	67	1 x 1	------	215		3000

2. Method

20 volunteer male participants with average age of 48.05±2.30 living in North Iraq were included in the study. During the selection of participants, not having a known disease and not using any drugs were applied as selection criteria. There were no interventions on the participants' diets. Participants were trained on the sports field of Sami Abdurrahman Park for three days a week for two months. An exercise program was applied to the participants for two months, three days a week. 2 cc blood sample were collected from each participant both before the exercise program and after it. The blood samples were transported to Rızgari Training and Research Hospital in order to be tested. Furthermore, the body weights, body-mass indexes, ages, pulse rates, systolic blood pressures, and diastolic blood pressures were measured and recorded both before and after the exercise program. The intensity of the exercise program was determined based on the pulse rates (PR) of the participants. According to this method, PR = (220-age) x 50% is the lower bound and (220-age) x 85% is the upper bound [5,6]. The pulse rates were measured by pressing the index and middle fingers to the carotid artery and counting for 15 seconds, then multiplying the result by 4. The resting intervals of participants during exercise were determined by a chronometer.

The measurements for body weights and heights: The body weights were measured with a scale of 0.1 kg sensitivity, while body heights were measured with a digital height meter. The participants attended the weigh-ins wearing only shorts, and measurements were taken with barefoot, with knees fully extended, heels together, and body upright.

Pulse rate measurement during rest: After having the participants sit in a chair for 5 minutes, their pulse rates were measured by placing a stethoscope over the heart and measuring for 15 seconds then multiplying the result by 4. The measurement was made twice and the lower result was recorded and used.

Body Mass Index: Body mass index was obtained by dividing the body weight to the square of the body height in meters (weight/height2) [5].

Using the continuous exercise method, the exercise program was performed by the participants for a period of 8 weeks, and three days per week (Sunday, Tuesday, and Thursday) in 90 minute programs. The exercises were conducted at 17:00 pm.

The resulting data of the study were analyzed in the SPSS 23.0 package software, using bivariate and paired samples t-test methods.

3. Findings

Table 2. The Direction and Significance Level of the Differences of Average Measurement Data before and After the Program

Parameters	N	Pre-Test	Post-test	Averages	t	P
		Med. ± Std. dev.	Ort.± Std. dev.	Difference between		
Pulse (Beat/min)	20	75.75±2.02	71.95±1.36	3.80±2.33	7.292	0.00
Systolic Blood Pressure(mm/Hg)	20	151.75±1.91	137.35±1.90	14.40±2.25	28.531	0.00
Diastolic Blood Pressure(mm/Hg)	20	83.05± 2.23	78.45±1.99	4.60±2.78	7.401	0.00
Hemoglobin (mg/dl)	20	10.69±.34	13.64±.34	-2.94±.49	-27.072	0.00
Cholesterol (mg/dl)	20	252.65±6.47	167.30±5.14	85.35±10.47	36.441	0.00
LDL (mg/dl)	20	79.70±9.12	69.30±7.01	10.40±10.86	4.281	0.00
HDL (mg/dl)	20	58.15±5.81	65.80±5.66	-7.65±7.31	-4.677	0.00
Triglyceride(mg/dl)	20	197.30±9.30	182±9.30	15.00±15.12	4.435	0.00

* $p<0.05$; ** $p<0.01$

Table 3. Direction and Significance Level of the Difference between Body Mass Index and Length Length Average Values of the Participants' Training Program

Parameters	N	Pre-Test	Post-test	Averages	t	P
		Med. ± Std. dev.	Ort.± Std. dev.	Difference between		
Body Weight (kg)	**20**	**74.40± 5.14**	**73.46± 5.40**	**0.94 ±4.91**	0.856	0.40
BKI(kg/m²)	20	26.98±4.81	26.49±3.81	0.49±1.91	1.145	0.26

Table 4. Pearson Correlation Coefficients between the Body Compositions and Blood Parameters of the Participants before the Exercise Program

Parameter	Pulse	Systolic Blood Pressure	Diastolic Blood Pressure	Hemoglo bin	Cholesterol	LDL	HDL	Triglyceride
	Beat/min	mm/ Hg	mm /Hg	Mg/dl	Mg/dl	Mg/dl	Mg/dl	Mg/dl
Height (cm)	0.950**	0.967**	0.979**	0.918**	0.997**	0.936**	0.927**	1.000**
Age (year)	0.972**	0.953**	0.974**	0.939**	0.958**	0.975**	0.970**	0.956**
BMI (kg/m²)	0.924**	0.943**	0.927**	0.930**	0.932**	0.920**	0.919**	0.923**
Body Weight (kg)	0.976**	0.950**	0.959**	0.941**	0.932**	0.984**	0.983**	0.923**

*p<0.05 ; ** p<0.01

Table 5. Pearson Correlation Coefficients between Body Compositions and Blood Parameters after Training Program

Parameter	Pulse	Systolic Blood Pressure	Diastolic Blood Pressure	Hemoglobin	Cholesterol	LDL	HDL	Triglyceride
	Beat/min	mm/ Hg	mm /Hg	Mg/dl	Mg/dl	Mg/dl	Mg/dl	Mg/dl
Height (cm)	0.129	0.316	0.075	- 0.070	0.134	0.132	0.218	-0.334
Age (year)	0.345	-0.165	0.072	-0.152	-0.089	-0.258	0.038	-0.425
BMI (kg/m²)	0.144	0.347	0.129	-0.106	0.113	0.069	0.236	-0.363
Body Weight (kg)	0.138	0.333	0.035	-0.072	0.142	0.104	0.215	-0.355

4. Discussion and Conclusion

The pulse rate averages before and after the exercise program were found to be 75.75±2.02 and 71.95±1.36 beats per minute, respectively. The difference between these values (3.80) was also found to be statistically significant (p<0.01). As can be seen, the obtained results indicate that the change in the heart rate display a reduced heart rate for the post-exercise period. In the literature, Ersöz et al. [7] conducted aerobic exercises on 17 women whose age vary between 30 and 45 for 8 weeks, and three days a week. The intensity of the exercises were between 50 - 75 %, and the results indicate a 6% reduction in systolic blood pressure, 10% reduction in resting heart beat rate, and 26% increase in MaxVO2, all of which were determined to be statistically significant. Mahanonda et al [8] evaluated the impact of regular exercises on cardiovascular risk factors, and determined the exercise levels of 3615 subjects who are under coronary risks. Even though they found that the regularly exercising group had significantly lower resting heart beat rate compared to the group who conducts exercises irregularly, they couldn't detect a significant difference between the blood pressure levels of the groups. In their study, Wilmore et al [9] detected a reduction in heart beat rate (p<0.05) after a 20 week period of exercise, revealing that medium and high intensity endurance exercises resulted in lowered resting heart beat rate. The findings of our own study are in line with the findings of the literature.

Systolic blood pressure levels in our study were found as 151.75±1.91 mm/hg before the exercise period and 137.35±1.90 mm/Hg afterwards. The difference between these values (14.40) was also found to be statistically significant (p<0.01). In the literature, Green et al. [10] conducted a study on chronic heart disease patients with age average of 62±3.4 where they performed circuit exercises, after which their systolic blood pressures were found to have decreased in a statistically significant manner (p<0.05). Parker et al. [11], conducted a study on women where they inspected the effects of submaximal walking exercises on heart beat rate and systolic blood pressure levels. In the study, women undertook an exercise for 16 weeks, 3 days a week, and one hour in each exercise day, after which their systolic blood pressure levels were found to have decreased in a statistically significant manner. As can be surmised, the findings of our study are also similar to the findings of the literature.

Similarly, the diastolic blood pressure levels of our participants were found as 83.05±2.23 mm/Hg and 78.45±1.99 mm/Hg before and after the exercise program, respectively. The difference between these values (4.60) were also found to be statistically significant (p<0.01). Sobush et al. [12] conducted a study where they evaluated the systolic and diastolic blood pressure levels of American students and found them to be 123.17±8.67 and 71.33±7.79, respectively. Kerrie et al. [13], conducted a study on postmenopausal women with hypertension, where they undertook walking exercises in the form of 3 km walks for 24 weeks. At the end of 12 weeks, a 6 mm/Hg reduction in systolic blood pressure was detected, while the reduction at the end of 24 weeks was 5 mm/Hg. They couldn't detect any change in the diastolic blood pressure.

Hemoglobin normal levels in a healthy person are between 14.0-17.5 g/dl. In our study, the participants' average hemoglobin levels before the exercise program was 10.69± 0.34 g/dl, while it was found to be 13.64±0.34 g/dl. The difference between these values (-2.94) was determined to be statistically significant ($p<0.01$). In his study, Yapıcı [14] determined statistically significant difference in the hemoglobin counts due to shuttle run exercises of football players. Gallagher et al. [15] conducted a study on individuals of 18-29 ages using normal diet and nutritional supplements in addition to 8 weeks of aerobic exercises, and determined significant hemoglobin level increases in both diet groups. In the study conducted by Erdoğan [16], the hemoglobin levels after shuttle runs compared to resting hemoglobin levels were found to have increased in a statistically significant manner. Nieman and Pedersen [17] also report similar increases in the hemoglobin levels of sedentary individuals after exercises. In their study, Büyükyazı and Turgay [18] also determined a statistically significant increase in hemoglobin levels of male sportspeople after exercises.

When the cholesterol levels of the participants in our study are inspected, it can be observed that the average cholesterol level was 252.65±6.47 mg/dl before the exercise, while this value changed to 167.30±5.14 mg/dl afterwards. The difference between these average values (85.35) was found to be statistically relevant. Temur et al. [19] conducted a study on 57 participants and inspected the difference between the cholesterol levels of sedentary and active individuals, and found it to be statistically insignificant ($p<0.05$). Saçaklı [20], conducted a study and tried to display that the exercise duration is significant. In their study, obese women took a bicycle exercise and passive gymnastic for one month, and failed to find a statistically relevant reduction in cholesterol levels. Thomas et al [21] reported that the individuals who performed various types of long-time (competition-recreational) exercises had lower triglyceride levels compared to sedentary individuals, but exercise types had no influence. While the findings of our study is not in line with the literature findings, the reason behind this is thought to be the difference in the age averages of the experiment populations.

LDL levels measured in our study was found to be 79.70±9.12mg/dl before the exercise. The post-exercise average value, on the other hand, was found as 69.30±7.01mg/dl. The difference between these (10.40) values were found to be statistically significant ($p<0.01$). Temur et al [22] compared individuals who performed regular exercises with sedentary ones, and found statistically significant LDL value difference between groups. Katzmarzyk et al. [23] conducted a study over 650 individuals of ages between 17-65 where the participants performed 20 weeks of aerobic fitness exercises, and inspected changes on blood lipids and body fat mass. After the exercise period, the participants achieved a 3.3% body fat loss, and statistically significant relations between the women's body fat mass and LDL-K, total cholesterol, total-K/HDL-K lipid change indexes were found. Ergen et al. [24], on the other hand, performed two different types of exercises to women between ages of 28-53 for 12 weeks. The first group took an interval gymnastic exercise, while the second group took walking and running exercises for 12 weeks, three days a week, and for one hour each exercise day. At the end of the exercise program, the rate of HDL cholesterol to LDL cholesterol was found to have increased significantly in both groups. In his study, Günay [25] also showed statistically significant difference between the two measurements of LDL levels of the participants. The findings of our study are completely in accordance with the literature.

When the average HDL levels of the participants are inspected, it can be observed that HDL levels had an average of 58.15±5.81 mg/dl before the exercise program, while it changed to 65.80±5.66 mg/dl afterwards. The exercise program has caused a change of 7.65, which was found to be statistically significant ($p<0.01$). In his study, Günay [25] displayed a statistically significant change between the initial and second HDL measurements for the studied groups. Similarly, Ergen et al. [24] conducted a study on overweight women with an age profile of 28-53, where they performed one of the two types of 12 week exercises. One group received interval gymnastic exercise, while the other group received walking and running exercises, three times a week and one hour for each exercise day. At the end of the study period, both groups were found to have increased HDL to LDL ratio in a statistically significant way. Karacan and Çolakoglu [26] applied an 8 week exercise program to their participants, after which HDL total cholesterol level was found to have decreased in a statistically significant manner ($p<0.05$). The findings of our study are in line with the literature findings. The increase in HDL after the exercise can be explained by decrease in the body fat percentage, which in turn leads to increased blood flow to the tissues.

The average triglyceride levels of the participants were found to be 197.30±9.30 before the exercise, while it was determined to be 182±9.30 mg/dl afterwards. The difference between these values (15.00) was found to be statistically significant ($p<0.01$). A study in this subject Yanagiborı, [27] reports that proper and regular exercises reduced triglyceride, LDL levels, while it increased HDL levels. After their 8 week exercise program, Karacan and Çolakoğlu [26], reports a meaningful decrease in triglyceride levels ($p<0.05$). Selçuk et al. [28] conducted a study on women with a six week exercise, after which they also determined statistically significant reduction in the triglyceride levels. The findings of our study are in line with the literature.

The body weight measurement averages of the participants of our study was found as 74.40±5.14 kg before the study, while this value changed to 73.46± 5.40 kg after the exercise period. The change in this parameter (0.94) was found to be statistically relevant ($p<0.05$). Helgerud et al. [29] conducted a study where they applied a 70% maximal heart beat rate running exercise for 45 minutes, and detected significant decrease in the body weight averages. Yüksel et al. [30] conducted a study where they compared interval exercises with regular exercises for eight weeks and three days per week, they have determined that interval exercises had no effect on the body weight, body fat percentage and anaerobic strength. Revan et al. [31] conducted an 8 week study, where they determined regular running method was more effective in reducing body weight compared to interval running method, while both method had similar positive effectiveness in reducing body fat rate and improving aerobic capacity. Koç et al., [32] conducted a study where they report 8 weeks of two types of running programs both reduced body weights and body mass indexes. Similarly, in his study with obese individuals, Ribeiro [33] applied a 12 week interval and regular swimming exercise of 5 days a week and 45 minutes a day, and reported that both types of exercises caused effects similar to weight loss. Erol et al. [34] conducted a study on male basketball players of 13-14 age where they applied a 10 week extensive interval exercise method, and reported 13.56% reduction in body fat percentage and 3.48% increase in fatless body weight averages. Karacan and Çolakoğlu [26] conducted a similar study and determined a statistically significant reduction in body weight ($p<0.05$). Temur et al. [35] conducted a study on 1000 individuals, and determined that those who conducted regular exercises had significantly lower body weights compared to those who don't exercise ($p<0.01$). The finding of our study is in accordance with the literature.

When the BMI of the participants are inspected, it can be seen that pre and post exercises averages were 26.98±4.81kg/m² and 26.49±3.81kg/m², respectively. The difference between these values (0.49) was determined to have a statistical significance level of $p<0.05$. İmamoğlu and et.al [36] conducted a study on middle aged sedentary women, and inspected the effects of 3 months of exercise on some physical and physiological parameters. After the exercise, the measurements on the women revealed a statistically meaningful reduction in the BMI values ($p<0.01$). Temur et al. [37] conducted a study where they applied 8 weeks of Pilates exercise and detected statistically meaningful reduction in BMI ($p<0.01$). Amano et al. [38] conducted a study on obese women and men with average age of 41.6 years where they applied a 12 week aerobic exercises, 3 days per week and 30 minutes each exercise day. Before the exercise the BMI of the participants were determined as 27.3±0.4 kg/m2, and they reported a statistically significant reduction after the exercise program. Furthermore, Karacan and Çolakoğlu [226] reported similar results for their own study as well. The findings of our study are supportive of the literature. It is thereby logical to assume that the reduction in BMI is related to the loss of fat mass.

When the correlation between the weight, height, age, BMI, and body weight values and pre-program systolic blood pressure, diastolic blood pressure, hemoglobin, cholesterol, LDL, HDL and triglyceride values were inspected, all of them were found to have a positive correlation with the body composition values with a factor of $p<0.01$. When the post-program values are inspected, the pre-program correlation between the parameters is seen to have disappeared, and for some of them have been reversed. For example, the pre-exercise BMI value had a ($r=0.920$) $p<0.01$ correlation with LDL value in the positive direction, while it has ($r=0.104$) positive correlation post-exercise, which has become statistically insignificant. On the other hand, pre-program body weight had a correlation with cholesterol with the intensity of ($r=0.932$) $p<0.01$ in the positive direction, while it has become ($r=0.089$) statistically insignificant.

According to the results, the pre and post-tests have variance in terms of heart beat, which is in countenance of the latter test. Experts consider the reason to be getting used to the exercise. Especially after the physical exercises, the cardiovascular system begins to display some changes, as the Heart and veins try to supply enough oxygen to the exercising tissues. Thereby, regular exercises create a habit in the tissues towards these changes, and in time create the aforementioned changes on the physiology. In the individuals who exercise regularly, the heart and the veins are particularly responsive as they try to be ready for action at any given time.

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[i] This article is produced from a master's thesis.