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Original Article

The Effect of Resistance Exercise on the Acute Response of Lipid Profile and Blood Lipid Factors in Three Different Age Groups of Wrestling Champions of Golestan province

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Abstract
Background: Sports activity is one of the ways to improve lifestyle, and its beneficial effects on factors related to cardiovascular diseases have been well demonstrated. This study examines the effect of strenuous exercise in different age groups of wrestlers.
Methods: This semi-experimental study was conducted on 21 wrestling champions of Golestan province in three age groups, including teenagers, young adults, and adults (7 people in each age group), using the availability sampling method. First, the anthropometric indices were measured, and then the lipid profile was determined before and after running on the treadmill until stagnation was achieved. To compare intra-group and inter-group averages, the paired t-test was used in dependent variables, and one-way analysis of variance statistical test was used in independent variables, and the results of lipid profile and blood lipid factors were analyzed at a significance level of $P<0.05$.
Results: The studied wrestlers had no significant differences in terms of triglyceride (TG), total cholesterol (TC), and low-density lipoprotein (LDL) indices before and after the implementation of the training protocol. However, the level of high-density lipoprotein (HDL) increased by 25% in adults compared to young adults. However, intra-group and inter-group changes in TG ($P=0.785$), TC ($P=0.780$), LDL ($P=0.551$), and HDL ($P=0.180$) were not statistically significant in any of the three groups.
Conclusion: According to the effect of an intense resistance training session on the lipid profile in this research, to have a greater effect on training and body adaptation, it is possible to look for exercises that have the three characteristics of regularity, continuity, and moderate intensity.
Keywords: Wrestling champions, Lipid profile, Anthropometry

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Introduction

Cardiovascular diseases are among the most important causes of death in human societies. The pathological changes of serum lipids and lipoproteins are some of the risk factors for cardiovascular diseases. The increase in low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), total cholesterol (TC), and triglyceride (TG) and the decrease in high-density lipoprotein (HDL) are among the most important of these factors. The fats in the blood are not free and generally move around the body by binding to special proteins called lipoproteins (1). LDL, called "bad" cholesterol, is responsible for carrying 75% of the cholesterol to different parts (cells) of the body. LDL adheres to and accumulates on the walls of arteries and reduces the level of nitric oxide in the blood. An increase in blood LDL increases the risk of cardiovascular diseases (1,2). HDL is responsible for returning cholesterol from the blood to the liver, is effective in reducing the severity of atherosclerosis, and is therefore known as "good" cholesterol. TC refers to total blood cholesterol and the higher the ratio of TC to HDL, the higher the risk of cardiovascular diseases. This ratio is very suitable for estimating the risk of atherosclerosis. The higher the ratio, the higher the risk of atherosclerosis. A TG is a type of fat that is used for energy storage and energy provision in muscles (3).

Regarding the effect of exercise on lipid profiles, it can be stated that training and regular physical activity can cause changes in blood lipoproteins, which include a decrease in LDL and TC and an increase in HDL (2,4). However, the effect of the type of exercise on such changes has always interested researchers. In this regard, aerobic exercises have received more attention. It has been found that regular resistance training increases muscle strength and hypertrophy and increases energy expenditure, which ultimately reduces cardiovascular

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risk factors by increasing fatty acid metabolism (5). Many other factors also affect the percentage of body fat and blood lipid profile, including age, heredity, overweight, smoking, hypertension, gender, stress, lifestyle, diet, etc (6). It has been observed that endurance training causes a significant increase in HDL-C and a decrease in LDL and TG in both men and women after a period of training; typically, a 20% to 30% difference in lipid profile has been shown between endurance athletes and inactive groups. In addition, it appears that there is a dose-response relationship between the amount of exercise and the increase of HDL-C and decrease of LDL and TG, as well as between the intensity of exercise and the increase of HDL-C and decrease of LDL and TG (7).

The small number of studies done on wrestlers shows insufficient attention to physical fitness and the increase of cardiac risk factors in athletes of power sports (1). Inadequate physical activity is one of the causes of fat disorders, and regular physical activity is one of the important factors in correcting fat disorders (8).

There are differences in the reports on the effect of physical activity on blood lipids in different sports (9). In general, much research has been conducted on physical factors in various sports, for example, Apostolidis et al. investigated lipid profile changes of elite basketball and football players after games and compared it with inactive individuals and concluded that playing football leads to a greater decrease in TG, TC, and LDL-C and a greater increase in HDL-C compared to playing basketball. The findings of another study supported the beneficial effects of basketball, football, and physical activity on cardiovascular health (10). However, it appears that lipid profile changes in athletes of individual sports, especially wrestling, have rarely been studied in our country, and more research is needed in this field.

Physical and performance differences among athletes are not easily observable and require careful research and measurement. The characteristics needed to be a champion in the field of wrestling are closely related to the athlete's performance. Therefore, it is necessary to understand the factors causing the optimal performance of the champions in sports arenas. One of these factors is the amount of blood lipids and their changes during professional training. Due to the lack of necessary research on the effect of sports activity intensity on lipid profiles and lipid factors in athletes of individual sports, especially wrestling, it is necessary to conduct more research in this field.

Methods

This semi-experimental study was conducted on 21 wrestling champions of the Golestan province in three age groups, including teenagers (14 to 16 years old), young adults (17 to 18 years old), and adults (19 to 24 years old). There were 7 athletes in each age group, and the convenience sampling method was. All subjects voluntarily participated in the research and signed a consent form. First, the participants were informed about the purpose and nature of the research and how to cooperate with the researcher.

In this study, after an expert doctor measured the subjects' blood pressure, their height was measured using a scale (Iranian scale model with height measurement function) with an accuracy of 5 mm, their weight was measured with an accuracy of 100 grams, and their body fat percentage was measured using a bioelectrical impedance device (body analyzer Medicit made in Sweden). The body mass index (BMI) was calculated by dividing the body weight by the square of the height in meters. To ensure accurate results, the participants refrained from eating or drinking for four hours before measurements and also emptied their bladder and intestines. Blood samples were taken before and after the exercise protocol to measure TG, TC, and LDL indices of wrestlers. Commercial kits (Pars Azmoun Co., Iran under license of Germany) were used for biochemical tests of HDL-C and TC, while a biosystem kit (Koogh Co., Spain) was used to measure LDL-C and TG.

To begin the training protocol, the subjects performed a 3-minute warm-up exercise on the treadmill at a speed of 5 km/h and zero-degree incline. After that, the incline was increased by one degree and the speed by one km/h every minute. This means that during the first phase, the incline was 1 degree and the speed was 6 km/h. The increase in incline and speed continued gradually until the athlete reached failure. At the end of each training phase, the athlete's heart rate was recorded using a Polar chest strap.

The data analysis was carried out using SPSS version 15 software. Shapiro-Wilk's exploratory statistical test was used to confirm the normality of the theoretical distribution of the data, and Levene's test was employed to check the homogeneity of variances. To compare intra-group and inter-group averages, a paired t-test was used in dependent groups, and a one-way analysis of variance statistical test was used in independent groups. A significance level of $P < 0.05$ was considered to determine the significance of the results.

Results

The demographic characteristics of the three groups of teenagers, young adults, and adults including age, height, weight, body mass index, and body fat percentage are shown in Table 1.

The average TG levels of the three groups of teenagers, young adults, and adults before training were 89.29, 86.45, and 110.66, respectively, and there was no significant difference between the three groups ($P = 0.893$). In addition, the average TG levels of these groups after training were 87.28, 83.43, and 106.67, respectively, and

Table 1. Demographic characteristics of study participants

Groups	Age	Height (cm)	Weight (kg)	BMI (kg/m²)	Body fat percentage %
Teenagers	14 to 16	172.7±44.71	73.19±22.09	24.5±48.53	13.9±67.58
Young adults	17 to 18	176.5±13.11	77.17±50.32	24.5±81.26	14.6±20.21
Adults	19 to 25	175.7±13.37	76.8±63.33	24.1±97.99	18.8±87.64

Abbreviation: BMI, body mass index.

there was no significant difference observed between them ($P = 0.758$). Finally, comparing the averages of the three groups before and after training showed that there was no significant difference between the two measurements ($P = 0.785$) (Table 2).

The average TC of teenagers, young adults, and adults before training was 144.26, 151.24, and 154.36, respectively, and there was no significant difference between the three groups ($P = 0.928$). In addition, the TC levels of these groups after training were 141.27, 148.23, and 151.37, respectively, with no significant difference observed ($P = 0.815$). The difference between the averages of the three groups before and after training also showed no significant difference between the two measurements ($P = 0.780$) (Table 2).

The average LDL-C levels of teenagers, young adults, and adults before training were 84.25, 96.20, and 86.27, respectively, with no significant difference between the three groups ($P = 0.625$), and the LDL-C levels of these groups after training was 81.26, 93.18, and 82.25, respectively, and no significant difference was observed ($P = 0.798$). The difference between the averages of the three groups before and after training also indicated no significant difference between the two measurements ($P = 0.551$) (Table 2).

The average HDL-C levels of the three groups of teenagers, young adults, and adults before training were 41.7, 46.9, and 52.15, respectively, and there was no significant difference between the three groups ($P = 0.758$). In addition, the comparison of the HDL-C data of these groups after training was 48.6, 51.8, and 69.16, respectively, and no significant difference was observed ($P = 0.963$). The difference between the averages of the three groups before and after training also indicated no significant difference between the two measurements ($P = 0.180$) (Table 2).

Discussion

The present study aimed to assess the resistance exercise on the acute response of lipid profile and blood lipid factors in three different age groups of wrestling champions of Golestan province. This research revealed that there was no significant difference in the lipid profile of wrestlers caused by the intense training sessions in the three age groups, but the level of HDL increased to some degree with the increase in the age of the wrestlers. The research conducted by Aghababaeyan et al showed that after five weeks of resistance training, there was no change in the indices of HDL, TC, and TG (10).

In addition, Cetin S and et al. compared some lipid indices between football players and wrestlers. The results of this research showed that There was a significant difference in body weight and body mass index between the wrestlers and the soccer players ($P < 0.05$). Moreover, there were significant differences in plasma TC, LDL-C, and HDL-C values between the wrestlers and soccer players (all, $P < 0.05$). However, there was no significant difference in plasma TG values between the wrestlers and the soccer players (11).

In another study, Aghababaeyan et al examined the changes in the lipid profile of elite basketball and football players after the game and compared them with inactive people, which showed that playing football leads to a greater decrease in TG, TC, and LDL-C and a greater increase in HDL-C compared to playing basketball. They demonstrated that basketball and football can be effective in cardiovascular health (10). In a study conducted on rats, Ghanbari-Niaki et al showed that running on a treadmill for 90 minutes a day, five sessions a week, for six weeks, did not cause significant changes in the LDL-C, TG, and TC values of the subjects, while it caused a significant increase in HDL-C (12). A study conducted by Mann et al. found that the duration of the sports activity can affect the changes in lipid profile. By increasing the number of training sessions per week or increasing the duration of each session (more than 60 minutes of activity), desirable changes, specifically an increase in the level of HDL and a decrease in the level of LDL, can be achieved. Although fewer training sessions may not affect the levels of these variables, they can reduce the percentage of fat and blood pressure and increase aerobic capacity (13). The above findings are to some extent inconsistent with the present study.

It appears that the nature, intensity, and duration of sports have varying effects on lipid profiles. Even a single session of either resistance or aerobic training can have different effects. Each exercise involves different energy supply systems, mobilization of fatty acids, and glucose metabolism. In addition to physical activity, the levels of thyroid and sex hormones can also affect the level of cholesterol and lipoproteins in the blood (14). This effect can be associated with the activation of lipoprotein lipase and lecithin cholesterol acyltransferase enzymes and the reduction of liver lipase enzyme activity. It appears that the absence of significant change in the level of HDL may have been partly due to the function of these enzymes.

Table 2. Comparison of changes in inter-group averages of lipid profiles of wrestlers in the three different age groups.

Indicators	Groups	Before training	After training	*P* value Comparison of before and after the intervention
TG (mg/dL)	Teenagers	89.29±22.22	87.28±39.31	0.81
	Young adults	86.45±75.04	83.43±82.25	0.87
	Adults	110.66±57.21	106.67±49.09	0.66
P value		0.893	0.758	0.785
TC (mg/dL)	Teenagers	144.26±78.83	141.27±28.13	0.65
	Young adults	151.24±88.96	148.23±29.35	0.66
	Adults	154.36±86.85	151.37±35.92	0.65
P-value		0.928	0.815	0.780
LDL (mg/dL)	Teenagers	84.25±23.35	81.26±13.21	0.65
	Young adults	96.20±98.82	93.18±29.87	0.66
	Adults	86.27±65.95	82.25±16.84	0.65
P value		0.625	0.798	0.551
HDL (mg/dL)	Teenagers	41.7±95.82	48.6±72.78	0.77
	Young adults	46.9±77.25	51.8±17.15	0.75
	Adults	52.15±77.87	69.16±77.75	0.95
P value		0.758	0.963	0.180

Additionally, regular exercise can increase HDL levels by stimulating the production of pre-beta HDL and reversing the transportation of cholesterol (14). Therefore, the absence of change in these factors may be also related to thyroid and sex hormones. In this research, in the elderly age group, physical activity led to an increase in HDL levels. Perhaps this increase in HDL levels can be attributed to long-term training adaptations. Sports activity in the long term can affect the concentration of TC in plasma and its distribution in LDL and HDL. The TC concentration of endurance athletes was lower than those of untrained individuals. However, this issue is apparently due to lower body weight and body fat weight, which is usually observed in physically active people. On the other hand, the reduction of TC, TG, and LDL and an increase in HDL due to aerobic activity are independent of changes in body weight or body fat weight. This issue is different in strength athletes. Triacylglycerols (TG), and the concentrations of TC, HDL-C, and LDL-C of strength athletes do not change compared to non-trained individuals. Regarding the intensity of resistance training on lipid profiles, the findings showed that when the intensity of resistance training is moderate and the number of repetitions is high, the level of HDL increases, compared to when the intensity is higher and the number of repetitions is lower. On average, the amount of energy consumed in wrestling is 13 to 14 kcal per minute, and about 560 kcal of energy is consumed in one hour of wrestling training. Therefore, continuous sports activities with high energy consumption (1200 to 2200 kcal/wk) can cause favorable changes, i.e., a decrease in TC and an increase in HDL-C of plasma (15).

Conclusion

This study found that performing an intense training session that is performed to the limit of the athlete's ability in different age groups in wrestling will not have a significant effect on the lipid profile. It appears that the effect of exercise on the lipid profile depends on the intensity and duration of the activity. According to the effect of an intense resistance training session on the lipid profile in this research, to have a greater effect on training and body adaptation, it is possible to look for exercises that have the three characteristics of regularity, continuity, and moderate intensity.

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Competing Interests

The authors hereby declare that there was no conflict of interest.

Ethical Approval

In the current study, the research articles used followed ethical considerations, and an effort was made to create the necessary transparency for the audience in the transfer of the findings and results of previous studies and to avoid any bias in reporting the results. Honesty and trustworthiness have also been observed in the analysis of texts and citations. This article was registered with the Research Vice-Chancellor of Golestan University of Medical Sciences with the ethical code 340791022020.

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