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Research Paper

The Effects of TRX and Traditional Resistance Training on Some of Cardiovascular Risk Factors in Sedentary Women

Mohsen Akbarpour Beni[1*], Marziyeh Alishirazi[1]

1. Department of Sports Sciences, Faculty of Literature and Human Sciences, University of Qom, Qom, Iran.

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ABSTRACT

Background and Aim: Disorders of lipid metabolism threaten human life in all countries with different percentages and causes of cardiovascular diseases and reduced physical activity has accelerated the spread of these complications. The aim of this study was to compare the effect of eight weeks of TRX training and traditional resistance training on some cardiovascular risk factors in sedentary women.

Materials and Methods: In this quasi-experimental study, 28 inactive women with a Mean±SD age of 21.07±1.41 years and a Body Mass Index (BMI) of 22.52±4.25 kg/m^2 were randomly divided into three exercise groups of TRX, traditional resistance training, and control. The experimental groups performed the traditional resistance training protocol and TRX three sessions per week for eight weeks, while the control group did not participate in any training program during the study. Blood samples were taken from all subjects before and 48 hours after the last training session for analysis of total cholesterol (TC), triglyceride (TG), low-density lipoprotein (LDL), and very-low-density lipoprotein (VLDL), high-density lipoprotein (HDL) and TC/HDL ratio were used. Data were statistically analyzed using the Kolmogorov-Smirnov test, T-dependence test, and one-way analysis of variance, and the significance level was P<0.05.

Results: In the intragroup evaluation of TC indices (P=0.001), TG (P=0.023), LDL (P=0.024), VLDL (P=0.023), and TC/HDL ratio (P=0.021) in the traditional resistance training group, and TG indices (P=0.001), VLDL (P= 0.001) and TC/HDL ratio (P=0.004) in the TRX group from the pre-test stage to the post-test showed a significant decrease, while the amount of HDL decreased in the traditional resistance group and increased in the TRX group, which this decrease and the increase was not statistically significant. Also, the results of the one-way analysis of variance showed a significant difference in some indicators in both experimental groups than the control group, but no significant difference was observed between the two experimental groups in any of the indicators.

Conclusion: According to the findings of this study, it can be said that regular TRX and traditional resistance exercise both lead to improved lipid profile that is associated with cardiovascular disease and is a useful factor in preventing cardiovascular disease and inactive women. Both TRX and traditional resistance training programs can be used in this regard.

*** Corresponding Author:**
Mohsen Akbarpour Beni, PhD.
Address: *Department of Sports Sciences, Faculty of Literature and Human Sciences, University of Qom, Qom, Iran.*
Phone: *+98 (??) 989131839198*
E-mail: *akbarpour.mohsen@gmail.com*

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1. Introduction

Due to the industrialization of societies and an increase in industrial facilities and equipment, immobility has increased among the people of the society [1]. In the meantime, Iranian women due to the wrong lifestyle and restrictions that traditionally have been involved in sports are more affected by the disadvantages of lack of physical activity. Obesity is the first consequence of low physical activity [2]. In sedentary people, obesity and weight gain are associated with the spread of diseases, such as fevers. They have high blood pressure, blood lipids, and insulin resistance, all of which are risk factors for cardiovascular disease [3] and disorders of fat metabolism, especially an increase in cholesterol and triglycerides and a decrease in High-Density Lipoprotein (HDL) levels make people prone to atherosclerosis [4].

Regarding the prevention of cardiovascular diseases, there is an inverse relationship between high HDL and the amount of fat deposition in the arteries. Thus, strategies to reduce Low-Density Lipoprotein (LDL) and Triglyceride (TG), and increase HDL can play a role in preventing cardiovascular diseases [5].

Sports exercises with beneficial effects on metabolic status and body composition will play a preventive factor. These activities reduce mortality due to cardiovascular diseases [6]. A type of exercise, which can be effective in these cases is resistance training. In this regard, although valid and professional instructions have always emphasized aerobic and endurance exercises in order to lose and maintain weight [7], recently, various studies have stated that resistance training can also be effective in reducing and maintaining weight and reducing fat mass [8]. Brit et al. investigated the effect of six weeks of resistance training on cardiovascular risk factors and it was found that resistance training has beneficial effects on lowering blood pressure and blood lipid profile [9]. Benz et al. found that resistance training significantly reduced waist fat and Pelvis fat but TG, LDL-C, and HDL-C levels remained unchanged after ten weeks of training [10].

Vincent et al. showed that resistance training has no effect on blood lipid profile [11] and training for six weeks increased HDL-C in some researchers, such as the study by Swain et al., but it had no effect on LDL-C [12]. Therefore, by reviewing the research background, conflicting information on the impact of resistance training is seen on cardiovascular indices that these ambiguities may be influenced by factors, such as type, duration, and intensity of exercise and the status of the research subjects (age, sex, and level of physical fitness), which is a reason for inconsistent results.

TRX is one of the newest training methods done by most women today. In TRX, in any movement, balance, harmony, flexibility, strength, endurance, speed, and agility are enhanced at the same time. Hence, in the shortest time, the resistance of the whole body goes up a lot. The TRX includes a parachute strap, with two handles, in which no traction is used and is strong and durable [13] In TRX, due to hanging from the strap and maintaining the balance of the person, calories burned per hour are 200 to 1000 calories depending on the type of exercise program. This burned calorie can cure cardiovascular disease [14, 15]. Accordingly, Kyung Hun Yu et al. stated that the combined resistance training and TRX for 12 weeks o, despite the differences in these two types of training, improved body composition and fitness among swimmers [16]. Also, Hemmatie et al. showed that 12 weeks of TRX training and resistance training increased HDL and decreased LDL and very-low-density lipoprotein (VLDL) and reversed the cholesterol transfer process of healthy non-athlete women [17].

Although inactivity and obesity have been increasing and considering that physical activity is an effective way to reduce cardiovascular disease and does not have harmful effects of the drugs and also TRX is a type of practice, which is increasingly used in the community every day, little information is available about its benefits and effects. Therefore, in the present study, we tried to answer whether there is a difference between resistance training and applied training (TRX) effects on women's cardiovascular risk factors.

2. Materials and Methods

In this quasi-experimental research, after the approval of this research by the research and ethics committee of Qom University (IR.QOM.REC.1399.014), through the announcement of a research call at Qom University in fall 2019, inactive volunteered girl students answered the questionnaire containing demographic characteristics, health history, smoking, and received and completed physical activity. Among the 167 volunteers who were eligible to participate in this study, 45 people were randomly selected with alternatives. The inactive age of the subjects ranged 18-25 years and their Mean±SD body mass index was 22.52±4.25 Kg/m^2.

They had no history of smoking and allergies, and at least two weeks before the start of the study and during

this period, they did not take any medication and had their usual diet.

The subjects also completed and signed the consent form. The selected subjects included 45 people who were randomly divided into three groups: TRX training, traditional resistance training (RT), and control. During the research protocol, 17 people from subjects were excluded from the test due to illness or personal reasons. Therefore, the research was done with nine people in the experimental groups and ten people in the control group.

Exercise protocol

The experimental groups first were acquainted with the training program and how to implement it for two sessions in sessions and participants were explained that the main purpose of these sessions was to acquaint the subjects with various resistance and TRX activities with the use of weight training machines and TRX straps, as well as their familiarity with performing a maximum repetition test (1-RM). The training program was performed for the experimental group for eight weeks, three sessions per week, and 90 minutes per session. Each session exercises included 15 minutes of warm-up, specific exercises for 65 minutes, and 10 minutes of stretching exercises to cool down. The specialized program of the traditional resistance group also consisted of eight movements (barbell chest press, elbows with dumbbells, below boat harness with a machine, ground plank, back of the thigh with a machine, squat, forearm with wire, and back of arm with wire). The movements in the traditional resistance training protocol were like the TRX. Since the exercises of the experimental groups are in three sets and in the range of 8 to 12 repetitions and rest between each set for one minute, the resting time between movements was three minutes. These exercises were performed in accordance with the principle of overload so that traditional resistance training was performed for the first two weeks of training with an intensity of 65% of a maximum repetition and then, was repeated every two weeks for 5%. The maximum intensity of training was increased so that the intensity of training reached 80% of a maximum repetition in the eighth week.

TRX also had an intensity of 65 to 80% of a maximum repetition on the Borg scale of ten ranks, i.e. in the range of perception. The pressure was five to eight and an increased unit was applied every two weeks for overload. Due to the development of neural adaptation muscle and an increase in muscle strength, once every two weeks, we calculated a maximum repetition of subjects and the intensity of the exercise program based on a new maximum iteration [18, 19].

Method of measuring research variables

To examine the biochemical variables, in the first stage, the subjects of each group were asked to do not to participate in any exercise and maintain a normal diet two days before the test. Then, blood sampling (5 ml of blood after 12 hours of fasting from the left antecubital vein in the sitting position and at rest) was performed at 8 am in the experimental and control groups. After this stage, the experimental groups performed a traditional resistance training program and TRX for eight weeks. Also, after eight weeks of resistance training and TRX and 48 hours after the last training session, and 12 hours of fasting, the second stage of blood sampling of subjects of the experimental and control groups was performed again similar to the first step. In order to measure TC and TG concentrations, the calorimetry method was and to measure HDL and LDL concentrations, the photometric method was used.

The mentioned variables were assessed by the Delta Treatment Part kits with a sensitivity of 0.93%, 1.27%, 0.85%, and 1.70 mg/dl and coefficient changes of 1.25, 1.14, 2, and %2.23, respectively using an automatic analyzer (Prestige 24i; Tokyo, Japan). The level of VLDL was determined by the TG/5 computational method.

Dietary intake during the study was checked using a 24-hour food recall questionnaire and standardized by the nutrition department of Tehran University of Medical Sciences, in two non-consecutive days, at weeks zero, four, and eight. After completing the 24-hour food recall questionnaire, the amount of food consumed was converted to grams per day, and then, the level of macronutrients, micronutrients, and energy intake was determined using Processor Food Dorosti software containing food composition tables and Iran Composition table. Due to the fact that there was no information about the main groups of the food pyramid in this software, this information was added to it using the Plus Analysis Diet software and the amount of food received by the main groups of the food pyramid was also calculated.

Statistical method

The Kolmogorov-Smirnov test was used to detect the normal distribution of data, to examine the differences between groups Unilateral analysis of variance (ANOVA) test and intragroup differences test by correlated t-test (correlated t) were used. The statistical analysis was

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Table 1. General characteristics of the subjects

Variables \ Groups	Mean±SD/ Groups (n=10)			P
	TRX	RT	CON	
Age (y)	21.22±1.39	21±1.11	21±1.76	0.84
Weight (kg)	63.25±12.25	60.44±6.53	55.34±13.6	0.87
Height (cm)	160.75±3.69	164.33±2.63	160.81±4.74	0.07
BMI (kg/m^2)	24.30±4.79	22.16±2.31	21.25±4.89	0.85

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performed by SPSS software, v. 22. The significance level was considered at P<0.05.

3. Results

The general characteristics of the subjects are presented in Table 1, which presents the descriptive characteristics of the subjects and as can be seen, there was no statistically significant difference in the values of body mass index, age, height, and weight at the beginning of the study (P>0.05) and the groups were completely homogeneous Using one-way analysis of variance, a significant difference was found between groups after eight weeks in some indices of blood lipid profile (P>0.05) so that the levels of TC, LDL, and TC/HDL in both experimental groups showed a significant difference with the control group, but there was no significant difference between two experimental groups. Also, a between-group analysis of the data showed that the levels of TC, TG, LDL, VLDL, and TC/HDL in the resistance

Table 2. Changes of research variables in the experimental and control groups before and after eight weeks

Variables	Groups	Mean±SD	
		Pre-test	Post-test
Total cholesterol (mg/dl)	TRX	145.66±7.71	140.88±10.08‡
	RT	156.66±8.13	135.00±8.88‡†
	CON	166.10±7.00	157.00±6.60
Triglyceride (mg/dl)	TRX	93.77±11.41	59.33±7.90†
	RT	100.11±10.94	62.77±7.57†
	CON	83.90±6.10	66.50±7.61
HDL (mg/dl)	TRX	39.66±2.62	41.88±2.20
	RT	41.33±2.98	40.22±3.16
	CON	45.30±3.08	43.80±2.70
LDL (mg/dl)	TRX	70.55±6.51	66.77±7.86‡
	RT	74.33±6.30	64.44±6.32‡†
	CON	82.60±6.43	80.70±5.48
VLDL (mg/dl)	TRX	18.75±2.28	11.86±1.58†
	RT	20.02±2.18	12.55±1.51†
	CON	16.78±1.22	13.30±1.52
TC/HDL	TRX	3.82±0.35	3.41±0.27†‡
	RT	3.92±0.29	3.46±0.29‡†
	CON	3.60±0.27	3.71±0.29

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†: Significant difference with the pre-test stage (P<0.05); ‡: Significant difference between the experimental groups and the control group (P<0.05).

group, and TG, VLDL, and TC/HDL were significantly reduced in the TRX group. In the resistance group, the levels of TC, TG, LDL, VLDL, and TC/HDL, were respectively 13.82, 37.29, 13.30, 37.31, and 11.73% after week eight of training and in the TRX group, the levels of TG, VLDL, and TC/HDL were respectively 36.72, 36.74, and 10.73% and showed a significant decrease. [TC (P=0.001), TG (P=0.023), LDL (P=0.024), VLDL (P=0.023), and TC/HDL (P=0.021) in the traditional resistance group, and TG (P=0.001), VLDL (P=0.001), and TC/HDL ratio (P=0.004) in the TRX group]. TRX also lowered TC and LDL levels and increased HDL, but this decrease and increase were not statistically significant (P>0.05) (Table 2).

4. Discussion

According to the results of this study, the implementation of training protocols caused some changes in the values of blood lipid profile (TC, TG, HDL, LDL, VLDL, and TC/HDL). Also, the results of this study generally showed that performing eight weeks of traditional resistance training and TRX in inactive women can improve some cardiovascular risk factors. Although many studies have been done on the effect of endurance and strength activities on lipid profile, there is little research on the effect of traditional resistance training and TRX on lipid profile. The results of the present study showed a decrease in plasma TC and LDL levels in inactive women after eight weeks of traditional resistance training and TRX, indicating differences in both experimental groups and the control group. Also, a significant decrease in these factors was observed in the traditional resistance group from pre-test to post-test. These results are consistent with other reports [4, 20, 21]. On the other hand, they are inconsistent with some other studies [22, 23]. This contradiction could be due to differences in the race of the studies groups, length of the training period, intensity, duration, and type of training.

The plasma TG and VLDL levels significantly reduced after eight weeks of traditional resistance training and TRX, but the ratio TC/HDL showed a significant difference between both experimental groups and the control group. There was also a significant difference in TG, VLDL, and TC/HDL ratio of plasma in experimental groups from pre-test to post-test. TG, VLDL, and TC/HDL ratio reduction due to eight weeks of traditional resistance training and TRX is likely to be a preventative factor for cardiovascular diseases. Decreased levels of TG, VLDL, and TC/HDL ratio following resistances and TRX activity in this study are consistent with the results of other studies [21, 24]. These researchers reported that resistance and TRX training improved fat profile, but this result contradicts the results of Azerbaijan et al. and Amirkhani et al. [25, 26]. This may be due to differences in age, gender, and the type, intensity, and duration of training. Regarding HDL, the results of this study showed significant differences among the groups; these findings were consistent with the results of Amirkhani et al. and Mogharnasi et al. [26, 27] and are not consistent with other reports [21, 24]. Some researchers believe that HDL and LDL are severely affected by exercise, and specifically, HDL is affected by the intensity and volume of exercise, not by diet or weight loss [28].

In general, the results of this study showed that the levels of TG, VLDL, and TC/HDL in the two traditional resistance and TRX groups and TC and LDL levels only in the traditional resistance group (P<0.05) decreased after eight weeks of training in post-test compared to the pre-test so that this decrease in the traditional resistance training group was more significant, and regarding HDL, this difference was not significant in the experimental groups. Many researchers have studied the effects of resistance training on fat metabolism and reported that glycogen and Intramuscular TG decreased after resistance training; thus, it is possible that TG is used as fuel during activity [29].

The changes in TC and LDL-C are consistent with each other, and in almost all research, the amount of TC and LDL-C showed similar changes, and factors that can affect LDL-C also affect TC. Thus, the factors mentioned affecting TC can also affect LDL-C. In general, traditional resistance training has a better effect on the percentage of body fat and fat distribution [30, 31]. One of the main effective mechanisms in this field can be due to increased LPL enzyme. This enzyme releases fatty acids broken down by TG of adipose and muscle tissue and increases total catabolism of TG and triglyceride-rich lipoproteins and facilitates TG uptake into the bloodstream slowly, which further confirms that no changes in body composition cause this decrease in TG [32]. Physical activity of appropriate intensity through several protective effects against cardiovascular disease increases blood volume and plasma, decreases blood viscosity, increases shock volume, and maximizes oxygen consumption of the body [33]. Therefore, due to the relationship between regular physical activity and protective effects against cardiovascular diseases, it can be said that moderate-intensity resistance training caused a decrease in LDL-C and body fat mass and also, an increase in the maximum oxygen consumption is an anti-atherogenic agent and reduces the risk factors for lipid profile that can have a protective effect against cardiovascular diseases in overweight and inactive people [27, 33, 34].

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On the other hand, studies have shown that after regular exercise, the hepatic lipase enzyme is reduced and inhibited [35]. Therefore, the production of TG in LDL-C and VLDL-C is reduced. Due to some reasons regarding the changes in the fat and lipoprotein profile of plasma, it should be noted that the tissues fat has many capillaries and autonomic nerves; thus, all their metabolic functions are due to hormonal factors and the nerve is controlled and only one cause cannot be mentioned to increase or decrease a variable. Another important cause of increased lipolysis is the stimulation of adipose tissue beta-adrenergic receptors so that exercise leads to the activity of the sympathetic nervous system and epinephrine and norepinephrine are rapidly released and trigger lipolysis. It is also a stimulant exercise to increase growth hormone, which is another important factor in lipolysis [36]. HDL concentration is inversely related to coronary heart disease [4].

Different studies about the effect of exercise on HDL levels have reported an increase in HDL levels [21] and some studies have reported no change [25] in response to exercise. The present study showed that HDL levels in experimental groups did not change after eight weeks of traditional resistance and TRX training because the formation and regeneration of HDL by plasma is a complex process and depends on several factors, such as lipoprotein lipase (LPL), lecithin cholesterol acyltransferase (LCAT), phospholipid transporter protein (PLTP), and requires ATP-dependent transmitters (ABC) [37, 38]. Therefore, according to the results of this study, HDL cannot be an effective factor for the prevention and improvement of risk factors for cardiovascular disease. Hence, it is suggested to use other lipid profile concentrations that are somewhat indicative of the prevention and improvement of cardiovascular disease [39].

This study is consistent with studies that show that there is a relationship between physical fitness and disease risk factors and there is a negative correlation between cardiovascular and exercise improves the lipid profile [40]. Finally, it seems that TRX and traditional resistance training can affect how the plasma lipid profile is changed [41]. Therefore, according to the findings of this study, it can be said that both regular TRX and traditional resistance training improve the lipid profile that is associated with cardiovascular disease and is a useful factor for the prevention of cardiovascular diseases and inactive women can benefit from both TRX and traditional resistance training.

5. Conclusion

Overall, it can be inferred that both traditional resistance and TRX training improve the lipid profile that is associated with cardiovascular disease, and according to the results of the study, it seems that the improvement of lipid profile reduces the potential risk of cardiovascular disease, which can be considered as an effective non-pharmacological treatment for prevention of these diseases.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the University of QOM (Code: IR.QOM.REC.1399.014).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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