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The Effect of a Period of TRX Training on Lipid Profile and Body Composition in Overweight Women

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Abstract Suspension training is a combination of unique training movements aimed at improving strength, endurance, coordination, flexibility, power, and core stability within a single workout. Suspension training is marketed as a cardiovascular and resistance training exercise modality performed like a circuit-training workout, in which a series of exercises are performed in rotation with minimal rest time. **Objective**: The purpose of this study was the analysis of the effect a period of TRX training on lipid profile and body composition in overweight women. **Methods**: 24 cases of overweight women, at the age of 29/41 ± 4.48, height 162/35 ± 4.97cm, weight 73.4 ± 5.47kg and BMI 27.85 ± 2.02 kg/m^2 were randomly divided into two control and experimental groups consisting of 12 people. The exercise program was accomplished in eight weeks with three training sessions per week. The training duration from the first week up to the last week increased from 12 to 30 minutes and the exercise intensity from 50 to 80 HRmax. Prior to the implementation of the training program, the performance indicators and body composition were measured and blood test was also conducted for determining the lipid profile. After eight weeks of practicing, all of these tests were taken once more. In experimental group after eight weeks of practicing, fat percentage of body reduced from 39.8 to 36. 97 ($p = 0.001$) and body fat mass decreased from 28. 22 to 26. 32 ($p = 0.001$) and the muscle strength increased from 13.85 to 15. 21 Kg ($p=0.001$) while the lower body muscle strength indicates a rise from 126.78 to 132.24 ($p=0.001$), and the VO2max from 55.05 to 61. 89 ml.kg.min ($p= 0.002$). **Conclusions**: A period time of TRX affects performance indicators significantly and body composition.

Keywords Body Composition, Training, Lipid Profile, Performance, TRX

1. Introduction

The prevalence of obesity is increasing and based on predictions, the number of people in the world suffering from obesity will be 300 million by the year 2025 [12]. Obesity and lipid disorders are considered to be the main causes of cardiovascular diseases and consequently increasing the mortality rate [9]. Low levels of physical activity and receiving additional calories considered as the main factors of obesity and its related metabolic disorders [9, 12]. The rate of obesity prevalence and being overweight in Iranian adults shows the prevalence of being overweight (BMI≥25) in men is 42.8% and in women as 57% and the prevalence of obesity (BMI≥30) is in turn in men and women as 11.1 and 25.2% [30]. Undoubtedly, this problem should be considered the result of such factors as changes in life style, reduction of physical activity rate and High-calorie food intake in recent decades [22]. Due to risk increment of obesity and diseases caused by it, research and review to find ways to deal with it is important. Exercise and proper diet are two General and proper methods for prevention of this phenomenon.

Up to now, Several research have been done to examine the effects of different types of exercises on lipid profile and body composition of overweight individuals. On this basis, Brith (2006) studied the effect of six week resistance exercise on cardiovascular risk factors and specified the resistance exercises resulted in reduction of blood pressure and blood lipid profile efficiently [9]. While Banz (2003) during the research observed that resistance exercises significantly decreased fat around waist to hips, but levels of Triglycerides (TG), LDL-C and HDL-C remained unchanged after 10 weeks of training [8]. In another study, Vincent (2003) showed that resistance exercises had no effect on blood lipid profile [38]. Some researchers as Swain (2006) reported that resistance training for six weeks increased HDL-C, but had no effect on LDL-C [32].

TRX or in other words Total Body Resistance is the growing development Exercise in recent decades and has been introduced to the world since 1990 [2]. The equipment and exercises which can be done by means of TRX reached its peak of evolution in 2005. The TRX suspension trainer is a unique modality of exercise that consists of two straps and handles that uses one's own body weight as resistance and can be easily fixed and used in several environments [5].

Wesley and his colleagues during an exercise session by

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the TRX suspension system to determine the effects of exercise on the metabolic and physiologic indexes of performance and intensity in body learned that TRX has highly significant effects on some physiological factors. It indicated a TRX suspension exercises system during 30 seconds rest and 30 seconds work provides moderate cardiovascular system benefits in less time compared other methods of training [39]. Dalibor showed that TRX strengthens muscles of human body increases joint stability, strengthens the ligaments and the stability of a group of muscle, especially back muscles while improving the capacity of the lungs [13]. Kyung Hun Yu indicated both resistance exercises and TRX will improve body composition and fitness among Ballet swimmers after 12 weeks of combined or hybrid resistance exercises and TRX despite the differences in these two types of exercise [23]. Mario et al., proved that traditional resistance exercise, increase exercised muscle energy potential leading to overall increase of strength qualities in the muscles while practical exercise with TRX improved control and accurate harmonization of the muscles [24]. Jeffrey showed that TRX improved variables of muscular fitness in both young and middle-aged adults while its results are generally derived from traditional resistance exercise. [21]. According to the research mentioned, the objective of this study is to review eight weeks exercise by TRX effects on lipid profile and physical composition of overweight women.

2. Methods

This method is a type of quasi-experimental study which has been accomplished with pre-test, post-test and control group. In the first stage the research notice installed by the researcher led to identifying those young and overweight women in west of Tehran, willing to exercise for modulation of their weight and improvement in the physiological status. Among the 50 volunteers, 24 were chosen with the index of physical mass BMI between 25 to 30 Kg/m^2 having no exercise and specific disease without any drug or supplement consumption during the past six months. Then subjects were divided into two groups, upon random odd and even initial ranking as experimental and control groups. The experimental group, with average age of 29/00 ± 4.05 years, the weight of 71.54 ± 5.53 kg and height of 162.08 ± 5.44 cm and the control group with an average age 30.67 ± 4.21 years, the weight as 73.77 ± 6/28 and the height 162.08 ± 5.44 were specified. After a physical examination, the physician issued the permission for activity. The subjects cooperated with full consent during the implementation of the study. Furthermore, observance of safety issues to prevent possible injuries during exercise has been predicted. Based on their self-declaration, they had a natural menstrual cycle.

2.1. Anthropometric Measurement

Anthropometric indicators measurement includes height, weight, body mass index, blood pressure and waist-to- hip ratio (WHR) of both groups performed prior to the exercises. Height in cm, without shoes and socks were measured by a handmade wooden device three times and the average height was recorded as the height of each individual. Body composition including measurable factors of weight, BMI, Skeletal Muscle Mass (SMM), Body Fat Mass (BFM), Percent Body Fat (PBF) and waist -hip ratio (WHR) measured by the device of Body Composition model Inbody 230. The muscle strength of the Subjects was measured with calculation of 1RM or one maximum muscle strength repeat. To measure 1RM of upper body muscles, the chest press with barbell and for lower body muscles the seated leg press machine were applied. 1RM was calculated based on indirect method upon Brzycki formula. In order to control the intensity of the exercise according to heart beats the sport watch Suunto, model M2 was used.

2.2. Biochemical Measurement

Blood sampling was performed after at least 12 hours fasting in the stage of pre-test and 48 hours after the last training session in the stage of post -test as 5 cc blood taken in vitro from the Antecubital vein of the subjects. Sampling was done at a certain hour of the day (8 am). For feeding control, all the subjects consumed the same diet as planned by an athletic nutrition expert. The subjects recommended to control their diets during the implementation of the study and refuse changing the diets. They were also recommended not to take any supplement without physician prescription and in case of physician recommendation the researcher to be informed accordingly.

2.3. Exercise Protocol

The control group in 8 -week period just adhered to the diet and abstained from intensive physical activity. Among the subjects, the experimental group consisting of 6 persons has been chosen fully randomly and equipped with a sport watch Suunto model M2, for the calorie measurement and heart rate per exercise session, from the start of training until the end of exercise protocol where an exercise protocol was planned by a researcher for this project. In planning this protocol, Anguis research applied to some extent in order to measure the slope and mark the signs on the ground as well [3]. In this protocol the method stepped overload was used in which load increase was applied once every two weeks. The exercise protocol is shown in table 1.

The subjects exercised for 8 weeks (24 sessions), 3 sessions per week. The duration of each exercise session was increased every two weeks from 12 minutes to 30 minutes. The duration of each move was 30 seconds and the break between each move was also considered 30 seconds. The first and second week mostly were of educational nature to familiarize and train the subjects to run devices and master movements. In the first two weeks, the gradient 1 was used whose distance from the hanging point was 50 cm for exercises- back to the hanging point such as chest press. In the final two weeks the gradient would be level 4 and

distance 95 cm. For the exercises facing the hanging point such as Scott, upgrade from 147 cm to 177 cm. The intensity of the exercise was between 50-60% of HRmax that in the last two weeks was increased to 80% of HRmax while regularly measured during the exercise. The number of the exercises increased from 12 exercises including four lower body, four upper bodyand four abdominal exercises to 30 exercises including 10 lower body, 10 upper body and 10 abdominal.

Table 1. Exercise protocol

	Weeks			
	First & Second	Third & Fourth	Fifth & Sixth	Seventh & Eighth
Level	1	2	3	4
Distance from hanging point for exercises towards to the hanging point (cm)	147	157	167	177
Distance from hanging point for exercises backed to the hanging point (cm)	50	65	80	95
Intensity (heart rate)	50 – 60%	60 – 70%	70 – 75%	75 – 80%
Exercise number	12	20	30	30
Exercise time (s)	30	30	30	30
Rest (s)	30	30	30	30
Set	1	1	1	1
Total time (min)	12	20	30	30

2.4. Statical Analysis

In order to describe the research data, the average statistics and standard deviation were used. Data distribution was evaluated by applying kelmogr Smirnov test. Initially, the amount of changes of each variable from pre-test up to post-test was calculated (the difference between the pre-test and post-test) then using independent t-test, the amount of changes between the two groups was compared. Statistical computing using SPSS software version 21 was performed. A significant level of 5.0 was considered.

3. Results

The results showed that weight (P = 0.175) and BMI (P = 0.219) in both test and control groups after the test reduced and this reduction in test group was more although not with a significant difference (table 3). In addition, the results showed that the amount of SMM (P = 0.001) in the test group (3.15% increment) in the post-test significantly increased compared to the control group, but a slight decrease in the control group (0.15%) was observed (table 3). Also, the BFM (P = 0.000) (6.6% reduction) and PBF (P = 0.000) (5.4% reduction) in test group in the post-test significantly reduced compared to the control group (table 3). But the WHR in two groups did not show a significant difference between test and control groups (P = 0.596) (Figure 1 and table 3). The results showed that none of the lipid profile indexes made significant changes compared to the control group (P = 0.551) (table 3). The results showed that in the post-test, the strength of lower membranes (P = 0.000) (4.3% increment) and chest press strength (P = 0.001) (1.10% increment) of test Group increased significantly compared to the control group (P < 0.05) (Figure 2 and table 3). Also, the maximum oxygen consumption (P = 0.002) (12.4% increment) compared to test group in the post-test increased significantly while in the control group it dropped slightly (P < 0.05) (Figure 2 and table 3).

Table 2. Average and standard deviation of the values/indicators of the body composition, lipid profile indices and performance indicators in the pre-test and post- experimental control in both control and experimental groups

	Experimental		Control	
	Pre-test	Post-test	Pre-test	Post-test
Weight (kg)	71.54 ± 5.53	70.73 ± 4.95	73.77 ± 6.28	73.50 ± 6.43
BMI (kg/m^2)	27.21 ± 1.83	26.86 ± 1.33	28.12 ± 2.31	28.03 ± 2.32
SMM (kg)	24.07 ± 3.32	24.87 ± 3.56	24.97 ± 1.92	24.94 ± 2.02
BFM (kg)	28.22 ± 4.53	26.36 ± 4.0	29.35 ± 7.78	28.89 ± 7.79
PBF (%)	39.08 ± 5.04	36.97 ± 4.99	36.67 ± 6.79	38.22 ± 6.67
WHR	0.93 ± 0.03	0.94 ± 0.03	0.94 ± 0.02	0.95 ± 0.02
1RM- Leg (kg)	126.78 ± 26.53	132.24 ± 26.78	128.17 ± 13.88	128.75 ± 13.56
1RM-Chest (kg)	13.85 ± 5.52	15.21 ± 5.27	17.11 ± 3.52	17.32 ± 3.50
Cholesterol (mg/dl)	179.58 ± 28.44	168.08 ± 21.57	216.08 ± 30.44	208.58 ± 16.59
Triglyceride (mg/dl)	119.42 ± 40.51	98.75 ± 46.83	106.42 ± 71.81	93.40 ± 49.30
HDL (mg/dl)	47.42 ± 10.82	46.50 ± 8.27	54.33 ± 17.82	54.83 ± 17.27
LDL (mg/dl)	117.08 ± 23.91	97.83 ± 19.07	144.00 ± 33.43	132.00 ± 14.98
LDL/HDL (mg/dl)	2.62 ± 0.91	2.21 ± 0.77	3.05 ± 1.49	2.66 ± 0.91
Vo_{2max} (ml.kg.min)	55.05 ± 17.11	61.89 ± 18.35	53.75 ± 27.85	53.55 ± 24.38

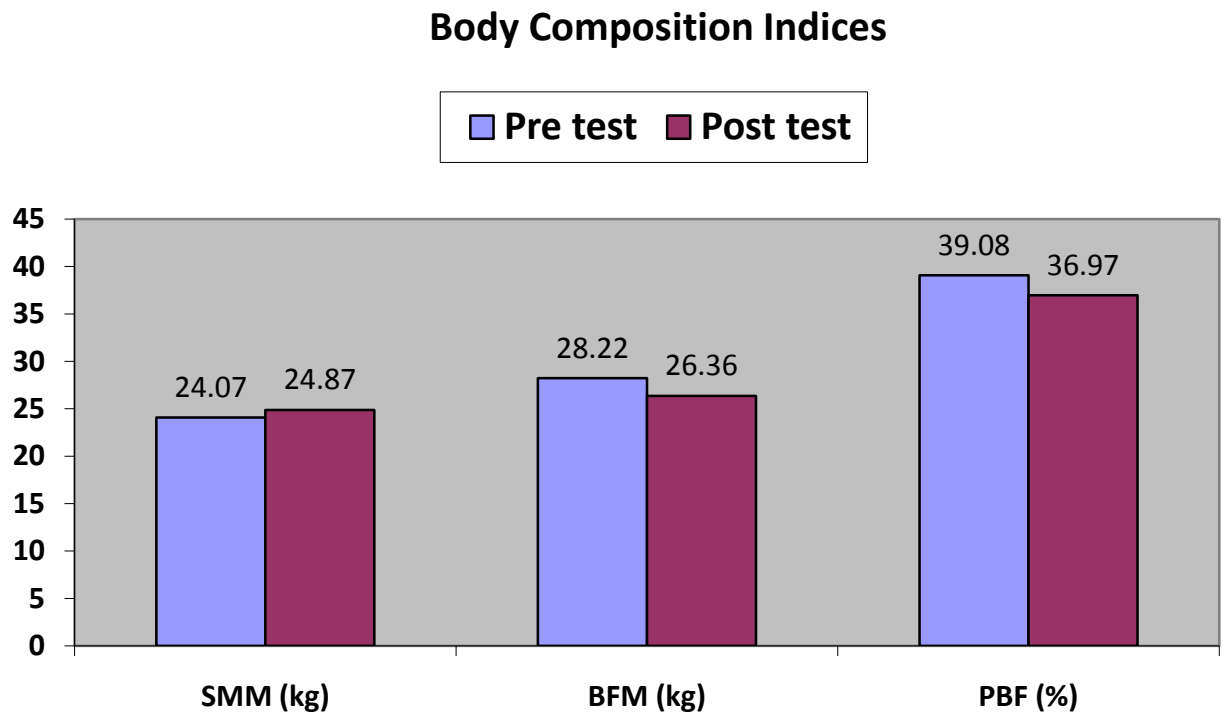

Figure 1. Average index of body composition in pre-test and post- test of test /experimental group

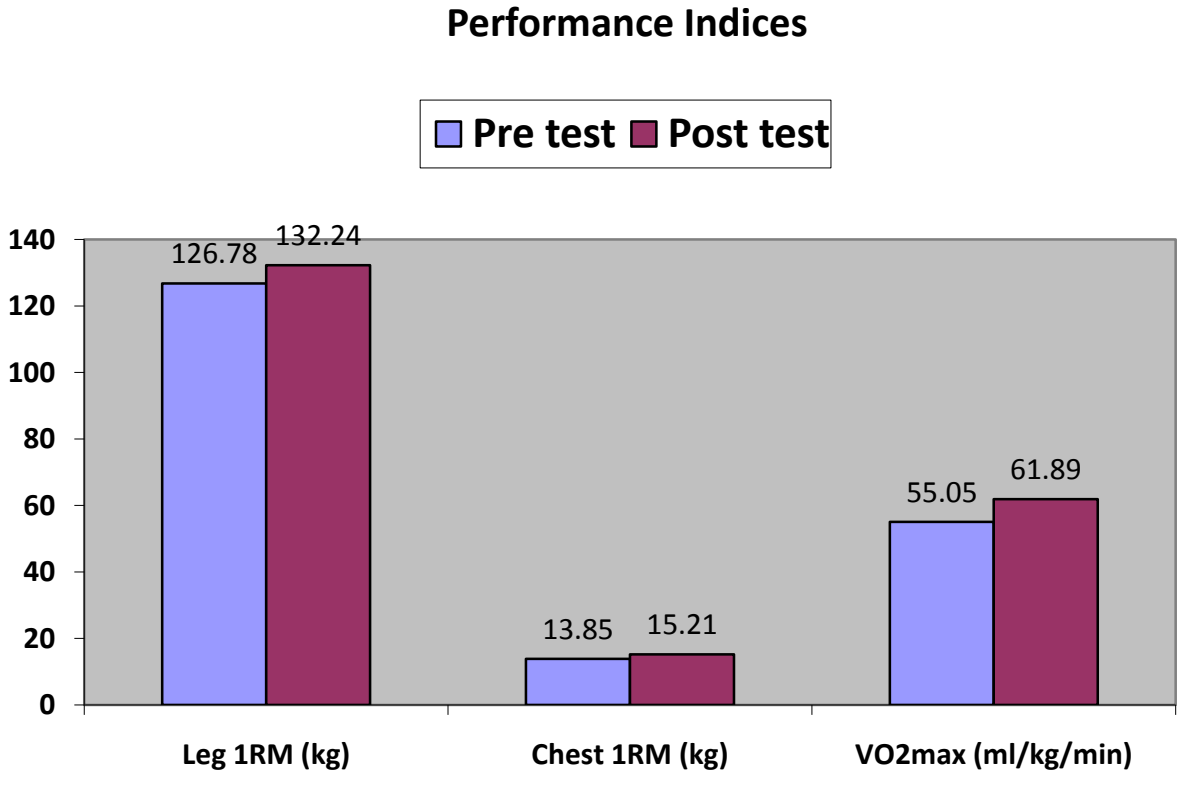

Figure 2. Average index of body composition in pre-test and post- test of test /experimental group

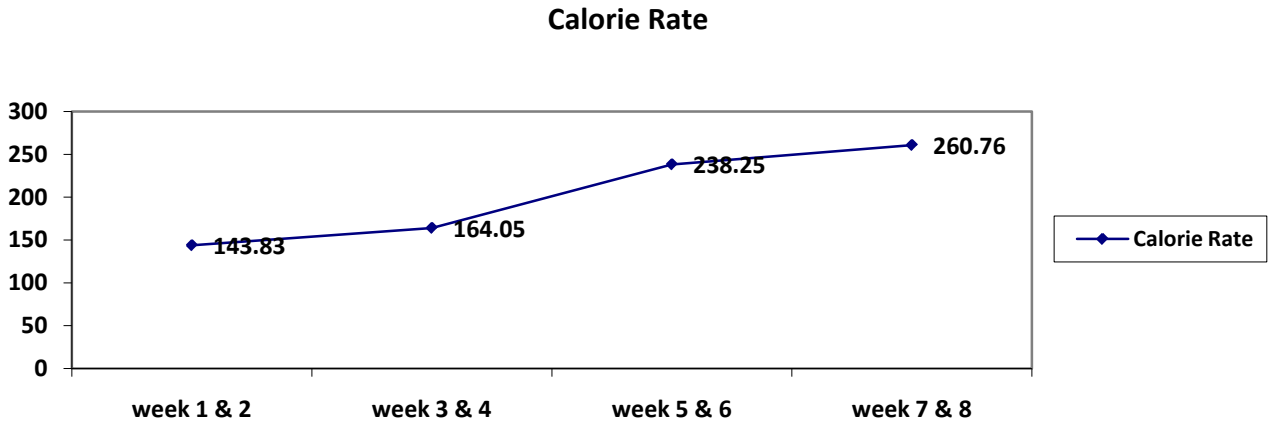

Figure 3. The results of the average calorie intake by experimental group during eight-week trainin

Table 3. Summaries of the results of the independent t-test to compare the changes of the body composition, the lipid profile, and performance indicators of experimental and control groups of overweight women

	The amount of changes of M ± SD		Independent t-test results
	Experimental	Control	
Weight (kg)	-0.82 ± 1.29	-0.27 ± 0.26	$t_{11.89} = 1.442$, sig = 0.175
BMI (kg/m^2)	-0.33 ± 0.65	-0.08 ± 0.09	$t_{11.52} = 1.301$, sig = 0.219
SMM (kg)	0.80 ± 0.63	-0.25 ± 0.33	$t_{22} = 4.026$, sig = 0.001*
BFM (kg)	-1.87 ± 0.83	-0.46 ± 0.25	$t_{12.93} = 5.638$, sig = 0.000*
PBF (%)	-2.11 ± 0.62	-0.44 ± 0.31	$t_{22} = 8.415$, sig = 0.001*
WHR	0.01 ± 0.02	0.006 ± 0.008	$t_{22} = 0.538$, sig = 0.596
Cholesterol (mg/dl)	-11.50 ± 14.97	-7.50 ± 15.81	$t_{22} = 0.636$, sig = 0.531
Triglyceride (mg/dl)	-20.75 ± 42.15	-13.00 ± 23.70	$t_{22} = 0.555$, sig = 0.584
HDL (mg/dl)	-0.92 ± 5.48	0.50 ± 0.90	$t_{11.59} = 0.883$, sig = 0.395
LDL (mg/dl)	-19.25 ± 10.33	-12.00 ± 23.18	$t_{15.20} = 0.990$, sig = 0.338
LDL/HDL (mg/dl)	-0.40 ± 0.29	-0.37 ± 0.68	$t_{14.83} = 0.117$, sig = 0.909
1RM- Leg (kg)	5.46 ± 0.00	0.58 ± 1.72	$t_{22} = 8.987$, sig = 0.001*
1RM-Chest (kg)	1.36 ± 0.94	-0.21 ± 0.22	$t_{12.22} = 4.104$, sig = 0.001*
Vo_{2max} (ml.kg.min)	6.83 ± 4.87	-0.20 ± 5.17	$t_{22} = 3.430$, sig = 0.002*

*** Significant difference between the test and control group changes (P < 0.05).**

4. Discussion

In the present study, body fat mass and body fat percent decreased significantly after 8 weeks of training, and these results corresponded with improvements in athletic performance are consistent [15, 17]. Body composition can be used to estimate athletic performance and forecast improvements in athletic performance; body fat negatively impacts athletic performance through its effects on jumping ability, quickness, and speed [11]. In addition, there was a significant increase in muscle mass which may be due to the nature of the TRX resistance exercise being inconsistent with some indications of the past research [34]. On the other hand, this study reported lack of significant change in body weight and BMI that was in accordance with some studies [7] and disagreed with a number of them [33]. There were no differences in body composition changes between the groups after 8 weeks of training, perhaps because of the duration and intensity of the exercise and the type of subjects. Major changes were not observed in body weight and BMI. In the strength /ability exercises, the changes of body weight and BMI is not usually significant because of concurrent reduction in fat mass and increase of the fatless mass at least in short term (less than 6months). The results of this study indicate that performing strength exercises regularly is capable of maintaining considerable changes in fat mass and fatless mass. The average amount of calories intake in resistance athletic with 70 to 75% 1RM in 90 minutes was 484 kcal and the resistance exercises with 80 to 85% intensity of 1RM in 90 minutes have been reported as 560 kcal [19]. In this study, the average calorie consumed at the first and second week with 50-60% of heart rate 12 minutes was 143 kcal, and in the third and fourth week with 60 to 70% of heart rate in 20 minutes was 164 kcal, in the fifth and sixth week with 70 to 75% of heart rate in 30 minutes it was 238 kcal while in the seventh and eighth week with 75 to

80% of heart rate in 30 minutes it was 260 kcal which complies with the previous research findings.

Maximum isotonic muscular strength (1RM) represents maximum muscular strength [23]. In the present study, the 1RM of both the chest and leg press And VO2max increased and significant differences were observed. Therefore, it can be stated that the implementation of TRX exercises plays a key role to increase strength and maximize oxygen consumption of the subjects (not equal to aerobic exercise) which is consistent with Amanda findings on the impact of TRX exercises on physical functions during eight weeks on the elderly and also to Arazi research which applied combination of resisting -aerobic exercises [5, 6].

Muscles take longer to reach a steady rate of oxygen consumption following moderate- to high-intensity aerobic exercise which elicits a considerably greater oxygen deficit than low intensity exercise. Elevated oxygen uptake following moderate intensity exercise leads to slightly elevated levels of physiologic function by replenishing high-energy-phosphates depleted during the suspension-training workout [27]. Elevated oxygen consumption post-exercise will result in increased energy consumption that contributes to the overall metabolic cost of an exercise bout [36] which significantly increased after the 8-week training program. Increased muscular strength is very important for subjects and athletes because of the ability in the performance of the exercises. Chest and leg muscle strength assessment for possible changes of the muscles of the entire body was performed. The 4.3% (leg 1RM) and 10.01% (chest 1RM) increased over 8 weeks in the present study which is approximately equal to the 7.6% increase reported by Song's study [20]; therefore, the training program in the present study appears to be effective for appropriate stimulation of the lower extremity muscles for subjects. The TRX suspension trainer is a unique mode of exercise because it requires the participant to use their hands to support them during the functional exercises. Theoretically, handgrip strengths should have improved after 8 weeks of functional training with the TRX [5] that complies with the results of this research. Some studies also have reported that a course of TRX exercises improves muscular performance, movement skills and strength and functional mobility [1, 10, 25, 29, 35, 37]. This might be due to the program that primarily focuses on strength. As a result, it was expected that TRX training, which utilizes body performance indexes based on the results support this hypothesis. It is also likely that TRX can improve co-activation and coordination of the neuromuscular system.

Isotonic training leads not only to improved joint range of motion but also changes in resistance as the subject keeps a steady pace [31]. Therefore, it enables precise examination of myofunctionat various angular velocities and rehabilitation and strengthening of muscles based on the results [16]. The explanation for a greater increase in the muscular strength in extension may involve only the ground-based TRX and resistance training. The present study results showed that a course of TRX resistance training has no effect on the lipid profile. Since the majority of the researchers view the resistance and endurance exercises as important factors in cardiovascular health and reducing the risk factors, it was expected to observe appreciable improvement in the lipid profile. The results of this part of the study of is in accordance with Taleb Amouzad and et a l. (1981), Ehsan Mir and et al. (2014), Catherine, et al. (2001) [4, 26, 14, 32]. But it is differs from with the findings of Hidetaka et al. (1981) and Brith (2006) [18, 9]. Researchers believe that LDL and HDL is hardly affected by the exercises, especially HDL, which is affected by the intensity of the workout and maybe, duration and intensity of the exercises could be considered as causes of the achievements due to these results. The initial levels of the indicators at the start of training are an effective factor as well so that as far as the amount of blood lipids is high, tangible changes will be shown [28]. In the present study, the amount of HDL, LDL, TG and TC of the subjects were normal. And maybe that is why lipid indexes have no significant changes. On the other hand, nutrition and diet of the participants have not been modified. Considering this factor in future research can be helpful. The type, intensity and duration of the training exercises can also be considered other factors that we can get more clear perspective about them in the future research through proceeding more accurate investigations.

5. Conclusions

Although eight weeks of TRX resistance athletic activities was not sufficient and effective to improve the lipid profile of overweight women, it improved the performance indicators and some indicators of body composition. The results of this study indicates that TRX exercises will reduce body fat and increase muscle mass at the same time. Thus it can be said that TRX exercises with the aim of reducing the body fat and increase muscle mass, is actually the proper way for overweight women to lose fat and TRX can replaced traditional resistance training exercise.

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