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The effect of 8 weeks of Circuit Resistance Training on metabolic syndrome risk factors and body composition in women over age 50 with diabetes mellitus type 2

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Abstract

The prevalence of type 2 diabetes mellitus (T2DM) has been developed in the last three decades. Discover an effective solution is necessary to manage and prevent this disease. Physical activity and exercise training is an effective way for metabolic syndrome risk factors in type 2 diabetes mellitus (T2DM) patients. However, there are some uncertainties in effects of Circuit Resistance Training (CRT) program on patients T2DM. The purpose of this study is to investigation the effect of 8 weeks of Circuit resistance training (CRT) on metabolic syndrome and body composition in women over age 50 with T2DM.Twenty women over 50 years old with diabetes Referred to diabetes Center of 17 Shahrivar hospital in Amol and they were divided randomly into two groups; Circuit resistance (n=10) and Control (n=10). Resistance training consisted of 10 stations for 8 weeks and 3 sessions per week (Intensity 60-80% 1RM). Levels of Lipid profile and body composition before and after eight weeks training in both groups were measured. Statistical analysis of the data was carried out by SPSS (v. 22).Fasting Blood Sugar (FBS) levels (*P*=0.021), Triglycerides (0.010), high-density lipoprotein cholesterol (0.042), significant decreased in CRT. Also after 8 weeks circuit resistance training, BMI (P= 0.003), WHR (P=0.004) and body fat present (0.019) significant decreased in CRT.According to our results, CRT was an effective approach to improve the Anthropometrics, FBS, lipid profile in women over age 50 with diabetes mellitus type 2. Moreover, CRT did have influence on LDL level.

Keywords: Circuit resistance training, insulin resistance, metabolic syndrome, body composition

Introduction

Metabolic syndrome is associated with the risk of developing cardiovascular disease and type 2 diabetes[1, 2]. A quarter of the USA s adult population Are afflicted with metabolic syndrome, and the prevalence increases with age, and its depend on racial ethnic minorities[3, 4]. This syndrome is related to overweight and obesity also it can be a risk factor for diabetes cardiovascular disease [6 ,5]. Nowadays, metabolic syndrome is one of Major health problems and researchers believe that this syndrome increased risk of death, diabetes and cardiovascular complications ,7] [8. Insulin resistance probably represents the metabolic syndrome, and it has been associated with higher risk of developing heart disease. Insulin resistance can be sign of type 2 diabetes (T2D). Two main factors for rise of insulin resistance are including Genetic (inherited) and lifestyle. some of the most important signs of metabolic syndrome are central obesity, overweight with adipose tissue accumulation particularly around the waist and trunk and Furthermore high blood pressure, decreased fasting serum, HDL, cholesterol, elevated fasting serum triglyceride level (VLDL triglyceride),impaired fasting glucose, insulin resistance, or prediabetes are the Other signs of metabolic syndrome [9]. Obesity is a strong risk factor for type 2 diabetes and it has negative impact on diabetes type 2 progression and treatments. Studies show that weight loss through medicine and surgery also has a positive impact on the improvement of diabetes symptoms[11 ,10]. Weight loss programs are most successful when we use combination of diet and physical activity. Exercise interventions that are recommended for glycemic control and improving cardiovascular risk factor (150 min fast walking per week) that is not usually enough for losing weight. Optimal exercise volume for continued weight loss is probably higher than the mentioned program[12]. 7 hours Moderate exercise to severe exercises Can cause weight loss[13] . In a research has been investigated the effect of combined aerobic and resistance exercise training on abdominal fat in obese middle-aged women. It shown that Combined exercises can decres subcutaneous and visceral fat than resistance exercise[14] . Several studies have shown (revealed) that resistant training can increase the lean muscle mass and glucose uptake. The nature of strength training (glucose uptake and hypertrophy) caused that it is used to treat and control a number of diseases. Also it has been shown that these types of exercises are effective for the elderly and obese[16 ,15] . Some evidence has shown that the intensity variable in resistance exercises is more effective than training volume in treating patients with type 2 diabetes and also it's effective in insulin resistance improvement, metabolic control and cardiac function in these patients[17] . Elderly people experience significant decrease in strength and muscle mass and also the results of recent studies have shown that Middle-aged people with type 2 diabetes in comparison to healthy people are Face to losing more muscle mass drop muscle quality and increase visceral fat; Therefore, resistance training for these patients is more beneficial[18] . In same study Investigated the effect of 14 weeks of resistance training in premenopausal women (n = 24). In this study intensity of training was 85 % of one maximal repetition (85 % 1 RM) [19]. One maximal repetition(1RM) was the maximal load that can be lifted once for a given exercise[20]. Participants had been divided randomly in to tow groups, resistance training and non-exercising control. Resistance Training has been done 14 weeks and 3 sessions per week and the time of each session was 40–50 min. Significant ($p < 0.05$) decreases in total cholesterol and LDL cholesterol were observed, along with lowered body fat. Fett et al. [21]incorporated resistance training into circuit training sessions in which no specific

weight was specified but a specific time duration was allocated to each exercise. Circuit Resistance Training has been done in 2 periods that have included 4 weeks and three times weekly each sessions lasted 60 min and four times weekly for the second month. Significant reductions were reported in total cholesterol and triglycerides, further adding to the speculation that the volume of movement may be just as important as—or even more important than—the amount of weight lifted. The design of circular exercises training is usually very diverse. In this way, in a short time, they do a lot of work. In per session the trainings are whole body. It can be a good way for those who want to increase muscle and weight Loss [22]. The Studies about resistance exercise training are not sufficient Therefore the purpose of this study was to investigation the effect of 8 weeks of Circuit resistance training (CRT) on metabolic syndrome and body composition in women over age 50 with T2DM.

Methods

20 Women, aged over 50 years with diabetes type 2 volunteered to participate in the study. Subjects' history of the disease were more than 2 years and they did not have any regular exercise at least 6 months ago. The subjects were selected according to WHO's guidelines (FBS or FPG more than 126 mg/dl and 2-h post load glucose more than 200mg/dl). In this study conducted a randomized controlled trial. The eligible participants were recruited from the outpatient department of 17 shahrivar hospital. Demographic and clinical data were obtained from medical charts and by surveying the participants. All of the participants received baseline assessments before randomization. After the baseline assessment, a week before that the research was done, subjects have been familiar with different training protocol steps and have informed how the research steps and its goals will be done correctly and given the opportunity to become accustomed to the selected exercises. The participants were classified randomly in two groups: Circuit resistance group (n=10) and Control group (n=10). Individual characteristics of subjects and other individual variables are shown in Table 1..

TABLE 1. Subjects' characteristics at baseline (means ± SD).

group	Number	M ± SD		
		age	Height (cm)	Wight (Kg)
Training	10	54.5± 1.147	158.3± 2.11	68±2.82
Control	10	58.1± 2.203	158.9±1.67	74.20±5

Anthropometry and body composition: Height (cm) was measured using a Holtan stadiometer. BMI was determined by body weight and height as kilograms per meters squared. Body weight (kg) was assessed using SECA 786 scales to the nearest 0.1 kg. Waist circumference was measured using a non-elastic measuring tape at the midpoint between the lower border of the ribcage and the iliac crest. 7 Skinfold measurement utilized for calculated body fat percent, it was measured utilizing fiberglass caliper. All scanning and analyses were performed by the same operator.

Muscle strength: Before the determination of their initial 1-RM, at first the subjects familiarization with training technique by trainer and then there's 1RM was determined. Exercise intensity was expressed as the intensity relative to 1 repetition maximum. In studies wherein the intensity was expressed as the number of repetitions to reach fatigue, relative intensity was estimated using this formula

$$1RM = \frac{weight}{1.0278 - (0.0278 \times Repeat)}$$

Clinical and laboratory measurements Blood samples were obtained from each participant's antecubital vein after an overnight fast for the

determination of plasma glucose, serum insulin, lipids and lipoproteins all samples were collected at least 48 h post exercise. Plasma glucose levels were measured by bionic kits. Within 12 hours of collection using the ROTOFIX 46/46 H Benchtop centrifuges. Total Serum cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides also were measured by bionic kits (the ROTOFIX 46/46 H Benchtop centrifuges).

Interventions The exercise group performed RT in a fitness facility under instructions and supervision of licensed physical therapists**.** Circuit Resistance Training has been done in 2 periods that have included 4 weeks. Resistance training consisted of 10 stations for 8 weeks and 3 sessions per week and the time of each session was 75 minute. Each session was included 10 minutes warming, Circuit Resistance Training for 50 minutes and 10 minutes recovery. Subjects followed an individually monitored progressive resistance training program using free weights and a multiple-station weight machine. CRT has been done in 10 stations, including rowing, chest press,

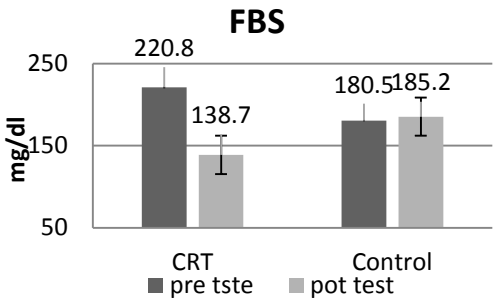
Statistical analysis The SPSS 23.0 software package (SPSS Inc., Illinois) has been used in all of the statistical analyses. Continuous data are presented as mean (standard deviation [SD]) and drawing table.in part of inferential statistics Kolmogorov–Smirnov test utilized to Normal distribution and levenes test was applied for data homogeneity test. Independent *t* tests have been done in order to assess between group comparisons at baseline and sample t test to assess intergroup comparisons. Results were considered statistically significant if the *P* value was 0.05.

Results

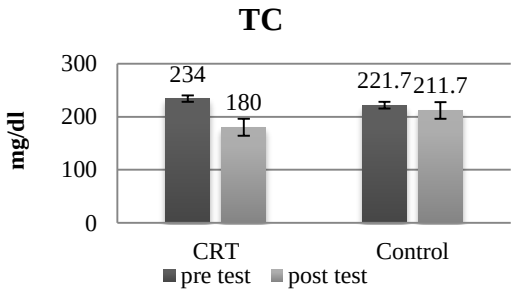
According to subsequent information of 8 weeks resistance training of two groups (Table 2), raise of FBS (0.021), HDL levels (P=0.019) and a reduction in cholesterol levels (P=0.010), Triglyceride (P=0.010), VLDL (P=0.019), BMI (P=0.003), WHR (P=0.001), BF% (P=0.019) has been occurred and no significant changes has been observed in LDL levels (P=0.293). These changes are not seen in the control group. Therefore, it can be concluded that circular resistive training has had a significant effect on reducing the total number of these. In resistance training group, FBS (0.014) HDL levels (P=0.003), cholesterol levels (P=0.002), Triglyceride (P=0.010), VLDL (P=0.010), LDL (0.015), BMI (P=0.001), WHR (P=0.001), BF% (P=0.032) have been seen.

TABLE 2. The comparison of inter group and between group

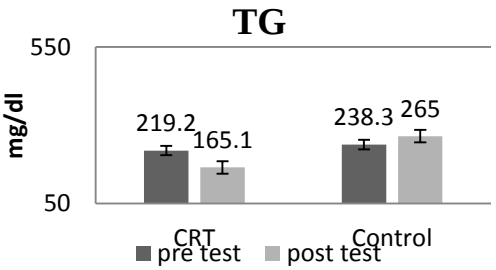
Dependent variable	Time	CRT group	Control group	*P* Value
Fasting Blood Sugar	Pre test	220.8±17.69	180.5±18.323	0.021
	Post test	138.7±6.727	185.2±6.327	
Cholesterol (mg/dl)	Pre test	234.00±8.21	221.700±8.44	0.010
	Post test	180.30±70.14	211.700±11621	
TG (mg/dl)	Pre test	27.942±188	29.843±2.227	0.010
	Post test	26.949±1.10	30.25±2.308	
HDL(mg/dl)	Pre test	1.1850±47.60	3.5207±49.80	0.042
	Post test	0.9043±50.80	2.5744±49.50	
LDL(mg/dl)	Pre test	139.360± 11.718	124.240±6.178	0.293
	Post test	99.6800± 6.066	109.140±7.848	
BMI (Kg/m²)	Pre test	1.188±27.942	2.227±29.843	003/0
	Post test	1.10±26.949	2.308± 30.25	
WHR	Pre test	0.0147±0.928	0.0144±0.9009	004/0
	Post test	0.0122±0.9009	0.149±0.9009	
%BF (%)	Pre test	2.494±34	4.0345±34.727	019/0
	Post test	1.885±33	3.949±34.40	



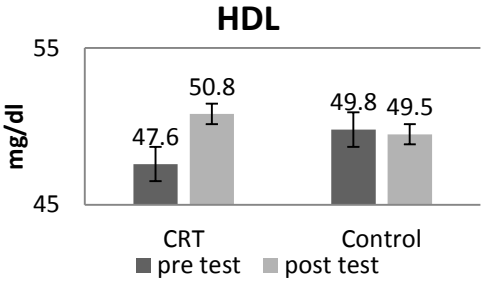
FBS inter group changes in per test and posttest P ≤0.05



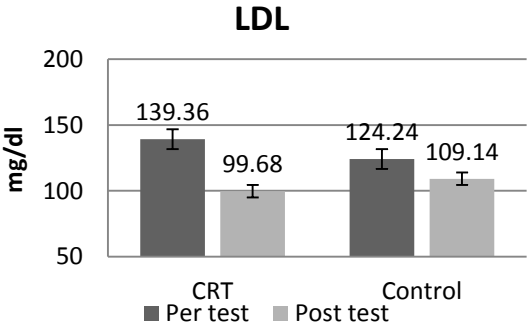
TC inter group changes in per test and post test P ≤0.05



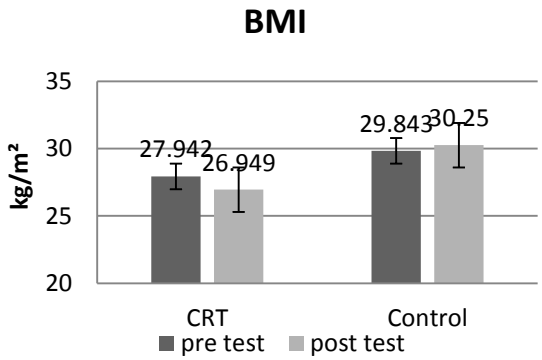
TG inter group changes in per test and posttest P ≤0.05



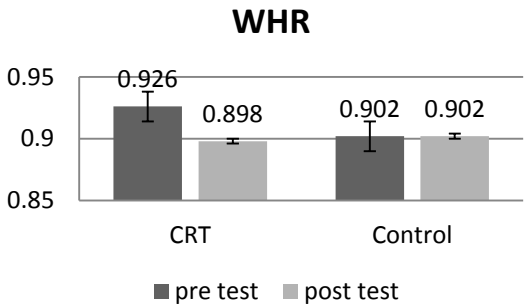
HDL inter group changes in per test and post test P ≤0.05



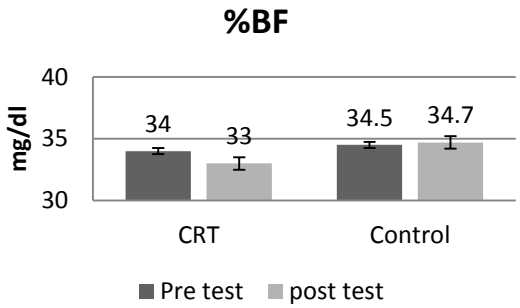
LDL inter group changes in per test and posttest P ≤0.05



BMI inter group changes in per test and posttest P ≤0.05



WHR inter group changes in per test and post test



BF% inter group changes in per test and post test

Discussion

This study has demonstrated that a supervised progressive high-intensity resistance training program performed 3 days/week for 2 months was safe and well tolerated by older patients with type 2 diabetes and was effective in improving metabolic syndrome and body composition . In the present study, authors studied the effect of 12 weeks Circuit resistance training on metabolic syndrome and body composition in women over age 50 with T2DM. After 12 weeks, significant difference between HDL levels (P=0.019), cholesterol levels (P=0.010), Triglyceride (P=0.010), VLDL (P=0.019), BMI (P=0.003), WHR (P=0.001), BF% (P=0.019) in two groups was observed. Here appears to be a linear dose–response relationship between activity levels and HDL cholesterol levels. significant increases in HDL and decreases in total cholesterol and triglycerides was seen, without an effect on LDL and it was in line with Wilson et al[23]. One of the complications of type 2 diabetes is high lipid levels in blood, Glycemic index and higher blood glucose levels are associated with low level of HDL[24] This is one of the common forms of dyslipidemia [25].

As mentioned resistance training lead to increase HDL in these patients and also recent studies have shown that the increase in Triglycerides, LDL, Cholesterol levels and HDL-lowering are the most important cardiovascular risk factors[26]. HDL is effective on LDL oxidation and cause to reduce cardiovascular risk factor. HDL can facilitate the decomposition of fat deposits and discharge Peripheral tissues from Cholesterol independently or convey very light lipoprotein to liver via Intermediary transaction[27]. It can be deduced from some literature that plasma HDL elevation can lead to weight loss and plasma triglyceride [29 ,28] that verifies the current research results. There was no significant effect on LDL levels in this study. LDL particle size may change in response to exercise. Chronic physical activity can effect on the concentration of total cholesterol in the plasma and its distribution in LDL and HDL. Cholesterol Concentration of the Plasma has a direct relationship with weight. Probably mechanism of cholesterol lowering in current study was losing weight following trainings the findings of current study are in agreement with Mougios, V. Improvements in body composition characteristics are suggested to be associated with beneficial changes in lipids and lipoproteins through mechanisms related to insulin resistance[30, 31].

In case of weight loss with exercise training subcutaneous fat will be observed[32]. It can be justified by means of adipocyte sensitiveness. This phenomenon's happening in respond unbound catecholamine to exercise training[33] . Metabolic subcutaneous fat plays an important role in regulating insulin sensitivity and other metabolic processes .[34] In other word the observed blood sugar reduction in this study can be the confirmation of the weight loss effect on insulin sensitiveness. In the same related research reported that 3%

Weight loss has led to a 31% decrease in insulin resistance [35] . After resistance training improvement of body composition and reducing fat mass in obese individuals

Conclusion

According to our results, CRT was an effective approach to improve FBS, lipid profile in women over age 50 with diabetes mellitus type 2. Moreover, CRT did have influence on LDL level. Also it has significant effect on body composition. Pursuant to the results in the current research and the nature of resistance training that is easier than aerobic exercise training for elderly people; it is suggested that utilize this model of training for glycemic control, lipid profile and body composition in elderly people.

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