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Original Article

Impacts of Comprehensive Exercise Therapy on the Management of Metabolic Disorders

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Keywords
Exercise therapy; Clinical protocol; Metabolic disorders; Obesity

Abstract

Background: Previous studies have reported a negative association between amount of physical activity and metabolic syndrome. There are strong associations between exercise therapy (ET) and reduced risk of metabolic disorders. The present case-control study was performed to assess the impact of comprehensive ET on the management of metabolic syndrome.

Methods: This case-control study was conducted on 66 patients with metabolic disorders between January 2014 and January of 2015. The participants' demographic variables, referral reasons, resting systolic and diastolic blood pressure, and drug history were recorded in the checklist. In addition, fasting blood sugar, serum lipids including triglycerides (TG), total cholesterol (TC), and high and low density lipoproteins (HDL and LDL) of the study participants were assessed. The ET program was comprised of 24 exercise sessions, scheduled over 8 weeks, and all tests were measured at the beginning and after completion of the ET protocol.

Results: The ET protocol significantly decreased body mass index (BMI) and mean subcutaneous fat thicknesses of quadriceps, triceps, and suprailiac among the participants.

Conclusion: The ET protocol had significant impacts on clinical characteristics of patients with metabolic disorders. It is suggested that multicentric studies with higher sample size be conducted in the future for the better assessment of ET protocol. Furthermore, the use of ET is recommended as part of the management protocol of patients with metabolic disorders and obesity.

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Introduction

Metabolic syndrome has been defined as abdominal obesity with abnormal serum level of lipids, high glucose level, and high blood pressure. A higher than normal level increase in body weight among patients with metabolic syndrome has been found to have a key role in the development of abdominal obesity.[1] Previous studies have reported a negative association between amount of physical activity and metabolic syndrome.[2-4] As an example, at least 150 minutes per week moderate activity is associated with decline in the metabolic syndrome prevalence.[1]

Although there are some methodological

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differences between similar studies in this field, most of them reported that physical exercise decreased the development of metabolic syndrome among patients. In most of the noted studies, which used exercise therapy (ET) as therapeutic modalities in metabolic syndrome, investigators reported that ET had additive and suitable therapeutic impacts on metabolic-related variables such as blood pressure, insulin resistance, and abdominal adiposity. There are strong associations between ET and reduced risk of diabetes mellitus (DM) type II development in accordance with a healthy body weight lowering diet.[5-7]

ET has been suggested as the most widely used therapeutic modality worldwide and might be provided as a single treatment or be part of a multimodal or multidisciplinary treatment program without considerable side effects. It seems that ET has a key role in therapeutic modalities in patients with chronic disorders such as metabolic syndrome. The present case-control study was performed to assess the impact of comprehensive ET on the management of metabolic syndrome.

Methods

The present case-control study was performed on 66 patients with metabolic disorders between January 2014 and January 2015. The study participants were referred from several hospital wards including internal medicine, surgery, orthopedics, rheumatology and neurosurgery, pain and physical medicine, and rehabilitation for receiving a regular exercise protocol as their medical management in the ET unit of the physical medicine and rehabilitation medicine department of Khatamolanbia Hospital, Iran. Among the patients, those who had acute musculoskeletal limitations, acute inflammation, uncontrolled metabolic disorders such as diabetes, unstable angina, uncontrolled hypertension, and joint related abnormalities with spinal neural root or peripheral nerve involvement, which would impact their physical exercises, were excluded from the study. The research ethical committee of Shahid Beheshti University of Medical Sciences, Iran, approved the study protocol, and all patients signed informed consent forms.

Medical history and physical examination findings of the study participants were recorded in the study checklist by a trained general physician and nurse. In addition to the above variables, data regarding the demographic variables (age, sex, height, and weight), reasons of referral to the clinic, resting systolic and diastolic blood pressure, and previous use of medication were gathered in the checklist. One blood sample was taken after 12-14 hours of fasting to measure fasting blood sugar, serum lipids including triglycerides (TG), and total cholesterol (TC) using enzymatic colorimetric methods. High-density lipoprotein (HDL) was determined after dextran sulfate magnesium chloride precipitation of non-HDL cholesterol; then, low-density lipoprotein (LDL) was calculated according to the Friedewald formula. All laboratory tests were measured at the beginning of the study and after receiving the ET protocol.

Exercise therapy program and follow-up: The ET program was comprised of 24 exercise sessions, scheduled over 8 weeks. Each session took 60-90 minutes and was performed in two stages consisting of aerobic training by an expert, and then, with ET equipment that was individualized to patients' characteristics, and distinct warmup, workout, and cooldown phases. The ET program was begun with a 10-20-minute warm up, followed by 20-40 minutes of workout, and terminated with a 10-minute cooldown. The type of exercise was either cycling using an ergo-meter, walking and running using a treadmill, or strength training exercise using equipment. The intensity of exercise was calculated, according to the determined risk, as ranging between 60% and 85% of the heart rate reserve (HRR).

Measurements of subcutaneous fat

thickness on triceps, quadriceps, and suprailiac regions were performed using a caliper (Mitutoyo, Andover, UK) according to standard protocols. The laboratory tests were reconducted at the end of the study for all patients who completed the ET program.

Statistical analysis: SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA) was used for data analysis. Qualitative variables were presented as frequency and percentage, and quantitative variables were presented as mean and standard deviation. Independent student t-test and chi-square test were used for comparing quantitative and qualitative variables between the two study groups. All P-values of less than 0.05 were assumed as significant results.

Results

In the present study, 66 patients with metabolic disorders were participated. Mean of age and body mass index (BMI) of the patients were 50.99 ± 8.17 years and 31.19 ± 5.31 kg/m^2. Mean BMI of patients with metabolic disorders had significantly decreased after the study period (33.77 ± 5.17 vs. 32.63 ± 5.17 kg/m^2; P < 0.001). Serum level of triglyceride had non-significantly decreased after the trial intervention among the study patients (161.26 ± 64.73 vs. 158.30 ± 47.34 mg/dl; P = 0.630). Moreover, serum level of cholesterol (224.43 ± 43.29 vs. 211.43 ± 47.55 mg/dl; P = 0.890), LD L (134.55 ± 36.66 vs. 117.07 ± 42.80 mg/dl; P = 0.780), and HDL (56.50 ± 11.40 vs. 55.60 ± 15.27 mg/dl; P = 0.070) had also decreased non-significantly after the intervention among the patients. Serum level of aspartate aminotransferase (AST) (28.16 ± 15.43 vs. 25.67 ± 20.21 mg/dl; P = 0.180) and alanine aminotransferase (ALT) (33.63 ± 30.22 vs. 28.67 ± 20.39 mg/dl; P = 0.250) had also decreased non-significantly after ET.

Mean of subcutaneous fat thicknesses of the quadriceps (59.87 ± 11.65 mm vs. 55.17 ± 10.40 mm; P ≤ 0.001) and triceps (41.17 ± 7.89 mm vs. 37.43 ± 7.69 mm; P ≤ 0.001) had significantly decreased after ET. Similar results were seen for subcutaneous fat thickness of the suprailiac region (58.66 ± 11.22 mm vs. 55.05 ± 10.32 mm; P ≤ 0.001). Abdominal (109.86 ± 11.55 mm vs. 107.27 ± 11.44 mm; P ≤ 0.001), waist (98.12 ± 13.06 mm vs. 95.27 ± 9.64 mm; P ≤ 0.001) and hip (114.26 ± 11.72 mm vs. 111.60 ± 11.05 mm; P ≤ 0.001) circumferences had significantly declined in response to ET (Table 1).

Table 1. Comparison of the study variables before and after the intervention among the participants

Study variable	Before the intervention	After the intervention	P*
BMI (kg/m^2)	33.77 ± 5.17	32.63 ± 5.17	< 0.001
Triglyceride (mg/dl)	161.26 ± 64.73	158.30 ± 47.34	0.630
Cholesterol (mg/dl)	224.43 ± 43.29	211.43 ± 47.55	0.890
LDL (mg/dl)	134.55 ± 36.66	117.07 ± 42.80	0.780
HDL (mg/dl)	56.50 ± 11.40	55.60 ± 15.27	0.070
AST (mg/dl)	28.16 ± 15.43	25.67 ± 20.21	0.180
ALT (mg/dl)	33.63 ± 30.22	28.67 ± 20.39	0.250
Quadriceps SC fat diameter	59.87 ± 11.65	55.17 ± 10.40	< 0.001
Triceps SC fat diameter	41.17 ± 7.89	37.43 ± 7.69	< 0.001
Suprailiac SC fat diameter	58.66 ± 11.22	55.05 ± 10.32	< 0.001
Abdominal circumference	109.86 ± 11.55	107.27 ± 11.44	< 0.001
Waist Circumference	98.02 ± 12.91	95.27 ± 11.47	< 0.001
Hip circumference	114.26 ± 11.72	111.60 ± 11.05	< 0.001

LDL: Low density lipoprotein; HDL: High density lipoprotein; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; SC: Subcutaneous
*Calculated with paired sample t-test

Discussion

Study findings showed that ET protocol as an intervention can have significant impacts on the study variables among patients with metabolic disorders and obesity. Exercise as a management procedure is used in therapeutic modalities and has been suggested for most patients with chronic disorders.[8,9]

ET, in most cases, is effective in medical therapeutic procedures, and in some cases, is added into the current medical management of patients with chronic disorders for outcome improvement.

The literature review showed that ET protocol, in most clinical trials, was used for patients with metabolic disorders and obese patients. Different epidemiological surveys suggested that ET can reduce the risk DM among the general population.[5,7] Most of the studies were mainly focused on the importance of ET in patients with DM. For instance, Sigal et al. studied the impact of aerobic and resistance exercise among patients with DM and found that although both exercise types reduced the HbA1c level, a combination of aerobic and resistance exercise had a larger reductive effect.[10] Investigators in similar studies reported that physical activity and ET protocol had huge impacts on patients with any weight.[11] Different studies showed that ET protocol without dietary intervention had only moderate impact on the body weight of patients.[12] Ross and Janssen found that, through 16 weeks of ET intervention, patients had achieved only 0.2 kg weekly weight loss.[12] Most longer term follow-up studies reported moderate effect on patients in terms of weight loss and some factors such as small ET doses, poor adherence, and even, potentially, dietary overcompensation.[13,14] Investigators reported that ET protocols must be accompanied with a diet, and ET alone had lower impacts on weight loss compared with diet alone among patients.[15,16] According to the American College of Sports Medicine guideline, it was suggested that the combination of ET and diet had more impact on weight loss in comparison with their separate use.[16] The abovementioned studies showed that ET protocol had significant impact on individuals with any body weight, and recent studies have suggested that a combination of ET and dietary intake interventions have more effective impacts than either one alone.

Conclusion

Findings of the present study showed that ET protocol had significant beneficial impact on the management of patients with metabolic disorders. Similar studies have reported that ET protocol had an important role in the primary and secondary prevention of metabolic disorders among patients. Moreover, significant health benefits of ET protocol are related to the suitable time, modality, and intensity of ET protocol. Moreover, ET characteristics must be individualized according to patients' characters.

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None

Conflict of Interest

Authors have no conflict of interest.

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