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The effect of eight weeks combined training with and without pomegranate juice on metabolic syndrome indices in overweight middle-aged women

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Extended Abstract

Introduction

The prevalence of metabolic syndrome has expanded as the presence of several metabolic risk factors associated with overweight (dyslipidemia, high blood pressure, increased blood sugar, and insulin resistance), which leads to health problems and imposes various costs on society. In the new definitions of metabolic syndrome, overweight has been introduced as a mandatory criterion for its development. On the other hand, the role of regular exercise as a strategy for reducing excess weight and improving body composition is obvious. Exercise improves insulin resistance and improves metabolic status and obesity-related diseases.

In addition to exercise, one of the non-drug methods of dealing with metabolic syndrome risk factors is consuming pomegranates. Pomegranates are anti-cancer, anti-inflammatory, and antioxidant, and they help treat bacterial cardiovascular diseases. Pomegranate juice contains 11% sugar, 1.5% pectin, water, ascorbic acid, phenolic compounds, and other compounds. On the other hand, the presence of various antioxidants such as tannins, anthocyanins, flavonoids, and polyphenols in pomegranate fruit is one of the most important reasons for its medicinal properties.

As women age, their physical activity levels decrease. On the other hand, different socio-cultural and economic situations, dietary habits, multiple pregnancies, and hormonal changes put women at greater risk of developing cardiovascular diseases than other people. Therefore, lifestyle changes are one of the methods of treating and modifying metabolic syndrome risk factors, which includes maintaining a healthy weight and reducing excess weight, increasing physical activity, and adopting appropriate eating habits and a healthy lifestyle. The aim of the present study was to determine and compare the effects of eight weeks of combined exercise with and without pomegranate juice consumption on metabolic syndrome indicators in overweight middle-aged women.

Method

The aim of this study was to investigate the effect of eight weeks combined exercise with and without pomegranate juice on metabolic syndrome indices in overweight middle-aged women. The statistical sample of this quasi-experimental study was 30 middle-aged (40 – 50 years old) women in Mashhad, Iran. These women randomly divided into 3 equal groups (control, combined exercise with pomegranate juice consumption, and combined exercise without pomegranate juice consumption). The combined exercise and pomegranate concentrate group, along with daily exercise, consumed 50 grams of pomegranate concentrate in two 25-gram servings after lunch and dinner each day. At the beginning of each week, pomegranate concentrate was made available to the subjects in 350-gram bottles in a week's supply. At the end of each week, the bottles consumed were collected and their consumption was calculated. The pomegranate concentrate was

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obtained from Razavi Food Products Company. The analysis of pomegranate concentrate was conducted by the research center's reference laboratory.

The combined training program included simultaneous aerobic and resistance training in one session, with aerobic training first followed by resistance training. The training was performed for 8 weeks, 3 sessions per week, at noon each day. The aerobic training program included running, which was performed for 16 minutes in the first week of training at 65% of heart rate reserve. Gradually, the time and intensity of the training increased, reaching 30 minutes in the eighth week at 80-85% of heart rate reserve. The time was increased by 2 minutes every week and the intensity by 5% every two weeks. Also, a 10-15-minute warm-up with flexibility and stretching exercises was performed at the beginning, and a 5-10-minute cool-down with gentle running, walking, and stretching exercises was performed. The resistance training program also included three sessions per week, which was performed after aerobic training for approximately 30 minutes at an intensity of 60-70% of one repetition maximum. Resistance training was circular (in 3 cycles, each cycle had 10 stations and 15 repetitions at each station). The activity time at each station was about 30 seconds and the rest time between stations was limited to moving from one station to the next. The rest time between cycles was considered to be 120 seconds. A ten-minute cool-down was performed at the end of the workout with a variety of stretching movements. The training stations included, respectively, chest press, knee extension (front of thigh), seated rowing, overhead press, knee bend (squat), elbow extension (back of arm), back push, heel lift (calf), elbow bend (front of thigh), and sit-ups. In the first and second weeks, 60%; in the third week, 65%; and in the fourth week, 70% of one repetition maximum was performed in each movement at each station. After that, the values of one repetition maximum of the muscle groups were determined again and the subjects continued training with 60-70% of one repetition maximum.

In order to determine the baseline levels of factors, a 10 ml blood sample was taken after an eight-hour overnight fast. Insulin resistance was obtained through the HOMA-IR index and based on the product of fasting glucose concentration (mmol/liter) and fasting insulin concentration (microunits/mL) divided by 22.5. Fasting blood sugar was measured using a Hitachi 902 device made in Japan and a Glucose kit made in Iran by Pars Azmoun. Insulin was measured using a cobas e411 device and a Roche kit made in Germany by the ECL method. Glycosylated hemoglobin was measured by the electrochemiluminescence method using a Roche kit made in Germany by the Elecsys 2010 device. Plasma lipoproteins were measured directly using commercial kits from Pars Azmoun Iran.

The normal distribution of the data was examined using the Kolmogorov-Smirnov test. To examine the differences between groups, the analysis of variance test and the LSD post hoc test were used. To examine the differences within groups, the dependent t-test was used. All calculations were performed using SPSS 22 software, and the significance level was set at $p \leq 0.05$.

Results

There were significant differences between the groups in blood sugar, glycosylated hemoglobin, insulin resistance, low-density lipoprotein, and high-density lipoprotein. Blood sugar, glycosylated hemoglobin, insulin resistance, and low-density lipoprotein decreased in all three groups; however, there was a significant decrease in the exercise group with and without pomegranate juice consumption. High-density lipoprotein increased significantly in both exercise groups.

Discussion and Conclusion

Exercise increases glucose uptake by muscles, which is dependent on functional changes in insulin signaling and is associated with increased GLUT4 protein content. In two situations, during physical activity (in the absence of insulin) and two to three hours after a meal (in the presence of insulin), glucose consumption by muscles increases. Repeated contractions have an insulin-like effect. These repeated contractions increase the number of GLUT4 and increase the permeability of the membrane to glucose. Also, during contraction, muscle fibers have a relatively long period of low glycogen concentration. On the other hand, after physical activity, muscle cells try to restore their glycogen stores, and for this reason, after activity, blood glucose concentration remains low for several hours. Among the mechanisms that can increase insulin action after aerobic exercise are increased insulin receptor signaling, increased glucose transporter protein expression, increased glycogen synthase and hexokinase activity, decreased release and increased clearance of free fatty acids, increased glucose release from the blood to the muscle due to increased muscle capillaries, and changes in muscle composition to increase glucose uptake.

Exercise increases lipoprotein lipase activity. Increased lipoprotein lipase increases the catabolism of triglyceride-rich lipoproteins; therefore, low-density lipoprotein levels decrease with exercise. Enzymes such as hepatic lipoprotein lipase, triglyceride, and cholesteryl ester carrier protein play important roles in changing high-density lipoprotein concentrations. Lipoprotein lipase is the most important factor in changing high-density lipoprotein concentrations through the hydrolysis of plasma triglycerides. Changes in triglycerides can also be attributed to the response of lipoprotein lipase to exercise. Lipoprotein lipase is one of the enzymes that regulate lipoproteins and break down triglycerides in triglyceride-rich

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lipoproteins. On the other hand, studies show that after regular aerobic exercise, the liver lipase enzyme is reduced and inhibited. Therefore, the formation of triglycerides in low-density lipoprotein is reduced. **The results showed that a combined training period with and without pomegranate juice consumption improved blood sugar, glycosylated hemoglobin, insulin resistance, low-density lipoprotein, and high-density lipoprotein.**

Keywords: Pomegranate Juice, Combined Training, Glycated Hemoglobin, Plasma Lipoproteins, Insulin Resistance.

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