ORIGINAL ARTICLE

Effect of Aerobic Training Program on Obesity and Insulin Resistance in Young Women with Polycystic Ovary Syndrome

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ABSTRACT

OBJECTIVE: Polycystic Ovary Syndrome (PCOS) is the most common endocrinopathy in women of reproductive age characterized by the presence of polycystic ovaries, menstrual dysfunction and biochemical or clinical hyperandrogenism. Lifestyle modification is important in treatment of obese and overweight women with PCOS. This study was performed to evaluate the benefit of aerobic exercise training on obesity and insulin resistance in young women with PCOS.

MATERIALS AND METHODS: Twenty obese PCOS patients aged 15-30 underwent a 12-week aerobic training program. Anthropometric parameters (weight, height, maximum oxygen consumption, waist circumference, waist to hip ratio and body fat percentage), metabolic and hormonal profiles (glucose and insulin) were assessed and compared at the baseline and after the 12-week training program.

RESULTS: After a 12-week aerobic training program body weight decreased from 76.9 ± 11.69 to 74.01 ± 11.82 Kg, body fat percentage decreased from 37.01% ± 4.16 to 35.57% ± 4.13 and waist circumference decreased from 86.4 ± 8.75 to 82.29 ± 6.59 cm ($P < 0.05$). There was also a significant increase in V02max, from 34.77 ± 1.86 to 35.87 ± 1.94 ($P = 0.006$). Changes in fasting glucose, fasting insulin, and insulin resistance were not significant.

CONCLUSION: Aerobic training program improves anthropometric parameters, and metabolic and hormonal profiles in young women with PCOS .

KEY WORDS: Polycystic Ovary Syndrome (PCOS), Obesity, Insulin resistance, Aerobic training.

INTRODUCTION

Polycystic ovary syndrome (PCOS) is the most common endocrine disorder in women, characterized by chronic anovulation, polycystic ovaries and hyperandrogenism (1, 2). PCOS affects about 5-10% of women of childbearing ages (3). Insulin resistance has a pivotal role in the pathophysiology of this syndrome and obesity, specifically central obesity has strong correlation with it. Weight loss can improve endocrine and metabolic disorders such as glucose intolerance in PCOS (4). It is usually recommended to lose weight up to a body mass index of less than 30 Kg/m² in obese women with PCOS before initiating

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pharmacologic treatment (5). With gradual decrease in body weight and abdominal fat, insulin sensitivity increases and ovulation restores in overweight or obese women with PCOS (6,7). Weight loss also improves fertility in PCOS (8,9).

Some researches in obese PCOS patients showed that patients engaged in endurance and resistance exercise with nutrition consultations attained better oxygen consumption and loss of body fat compared to women that only received nutrition recommendations. However, there was no significant difference between the hormone levels except for insulin and the amount of weight loss in the two groups (10,11). This study was performed to determine the effect of a 12-week aerobic training program on obesity and insulin resistance in women with PCOS .

MATERIALS AND METHODS

The subjects in this clinical trial study included 20 PCOS patients aged 15-30 who referred to the Endocrine Clinic of Ghaem at University Hospital of Mashhad, Iran. PCOS was diagnosed in accordance with Rotterdam consensus diagnostic criteria. The patients had no medical history for coronary artery disease, diabetes, hypertension, renal insufficiency and thyroid disease. The patients were informed by written and verbal consent about the nature and purpose of the study, and possible risks they may confront during the study. The research was approved by the Ethics Committee of Mashad University of Medical Sciences.

Blood sampling for glucose (Selectra E, Man company kits) and insulin (IRMA, Immunotech, Beckman coulter company-Czech R.) was performed for all the subjects on the third day of menstrual cycle after a 12-hour fasting and 24 hours abstinence from strenuous physical activity.

The anthropometric parameters including weight, height, maximum oxygen consumption, waist circumference, waist to hip ratio and body fat percentage (Seca 220, Germany) were measured and recorded. To determine the maximum oxygen consumption, the Queen College Step Test was applied and maximum oxygen consumption was calculated in ml/min /Kg. Insulin resistance was calculated using the homeostasis model assessment of insulin resistance formula (HOMA-IR). After a 12-week training program, the same tests and measurements were repeated.

The training course included 3 sessions per week, each lasting 45-60 minutes which took place at the Health Training Clinic of Champions in Mashhad. The first 5-7 minutes in each session was for warm-up, the next 30-45 minutes for exercise and the last 5-7 minutes for cooling down. Warm up exercises included walking and stretching the muscles. Actual training would then start by pedaling on an exercise bike with a speed that was previously determined for each patient. Each participant pedaled in 3 sessions, each lasted 8 minutes. Between sessions, the participants had 5-7 minutes active resting period. At the end of each one, slow walking and stretching exercises were performed to return the body to the initial state. Exercise intensity was determined by the ratio of reserved maximum heart rate obtained from this formula:

HRRMax = HRmax – HRrest

Statistical Test

To determine a normal distribution, Kolmogorov-Smirnoff's statistical test was applied. The statistical T-student test was also used to determine the difference between the means before and after the training program in the dependant group. P value less than 0.05 was considered significant .

RESULTS

20 PCOS women (aged 15-30 years) entered the study. Mean BMI of the patients was 29.25 ± 2.88 Kg/m2.

After a 12-week aerobic training program, body weight decreased from 76.9 ± 11.69 to 74.01 ± 11.82 Kg (P = 0.00). Also body fat

percentage decreased from 37.01% ± 4.16 to 35.57% ± 4.13 (P = 0.00) and waist circumference decreased from 86.4 ± 8.75 to 82.29 ± 6.59 cm (P = 0.005). There was also significant increase in V02max from 34.77 ± 1.86 to 35. 87 ± 1.94 (P = 0.006**)**

Mean body mass index (BMI) of patients also decreased but insignificantly (from 29.25 ± 2.88 to 28.65 ± 3.37 Kg/m2 (P = 0.053)

The mean blood glucose after training program did not show a significant reduction. The mean plasma insulin level of the patients after training program increased insignificantly.

The mean insulin resistance increased from 1.49 ± 0.35 to 1.77 ± 0.78 umol/square liter which was not statistically significant (P > 0.05).

Table 1 shows the effect of the 12-week training program on anthropometric parameters (body weight, body mass index, waist to hip ratio, waist circumference and percentage of body fat) and maximum oxygen consumption in obese women with polycystic ovary syndrome.

Table 2 shows the effect of the 12-week training program on the metabolic and hormonal profiles (blood glucose, insulin, insulin resistance) in subjects .

DISCUSSION

This study revealed a significant reduction in body weight, percentage of body fat, waist circumference and an increase in V02max after a 12-week aerobic training program in PCOS women .

Body weight of these patients decreased significantly. The same finding was observed in the researches of Noakes, Clifton et al., Euberto Pagotto et al., S. Palomba et al. and Francisco Orio. (12,13,14 and 15) .

Reduction in mean BMI of patients after training program was not statistically significant. This finding is similar to the results of Harpal S. Rando et al .but in contrast with the findings of Carlo Vigorito, Euberto Pagotto, Francisco Orio and Palomba. (11, 12,13,14 and 16). The possible explanation is the difference in the initial BMI of the patients and the population of the study. BMI of PCOS patients differs widely from one country to another. PCOS patients from countries other than the United State have a tendency for being slimmer. Mean BMI of PCOS patients is 28 Kg/m^2 in Finland (16), 31 Kg/m^2 in Germany (17) and 29 Kg/m^2 in Italy (18). While in the United States, the BMI of patients with PCOS ranged from 35 to 38 Kg/m^2 (22,21). As a result, researches that evaluated the effect of physical activity on the BMI of PCOS patients reported different findings. The greater the initial BMI of the patients, the greater the results can be affected (17).

The mean waist circumference of all patients after the 12-week training program decreased significantly. Similar findings were seen in similar studies (10,11,14,15 and 18) .

The body fat percentage in the patients revealed a statistically significant reduction

Table 1- The effect of the 12-week aerobic training program on anthropometric parameters and VO2max

Variable	Group	Mean ± SD	*P* Value
Body weight (Kg)	Before training	76.9 ± 11.69	0.00
	After training	74.01 ± 11.82	
BMI (Kg/m2)	Before training	29.25 ± 2.88	0.053
	After training	28.65 ± 3.37	
WHR	Before training	0.80 ± 0.058	0.574
	After training	0.79±0.035	
Percentage of body fat	Before training	37.01 ± 4.16	0.00
	After training	35.57 ± 4.13	
VO2max	Before training	34.77 ± 1.86	0.006
	After training	35.87 ± 1.94	

Table 2- The effect of the 12-week aerobic training program on metabolic and hormonal profiles

Variable	Group	Mean ± SD	*P* Value
Blood glucose (mg/dl)	Before training	88.82 ± 9.28	0.062
	After training	84.18 ± 8.89	
Plasma insulin (uU/ml)	Before training	6.87 ± 1.70	0.059
	After training	8.84 ± 4.28	
Insulin resistance	Before training	1.49 ± 0.35	0.148
	After training	1.77 ± 0.78	

but waist to hip ratio (WHR) decreased insignificantly. Similar results also were observed in other studies (11, 14, 15 and 18). The cause may be the fact that by exercise, hip and waist circumferences reduce proportionally in patients, therefore, WHR change may be insignificant. We know also that waist circumference is more associated to visceral fat content than WHR (19).

The mean plasma insulin level of the patients after training program increased insignificantly. This corresponded to the results of Harpal S. Rando's study, but in contrast with the findings of many other studies (10,11,12 and 13).

Maximum oxygen consumption (V02max) revealed a significant increase. The same result was found in the studies by Harpal Rando, Bruner, Chad and Chizen, Carlo Vigorito and Francisco Orio (10,11,12 and 16). Increase in VO2max after training program is the result of improvement of oxidative phosphorylation capacity of muscles, stroke volume of the heart and oxygen content of blood. The mean blood glucose after training program did not show a significant reduction. This finding is in contrast to the results of similar investigations (11,12,13 and 14).

The mean insulin resistance increased from 1.49 ± 0.35 to 1.77 ± 0.78 umol/square liter which was not statistically significant (P > 0.05). These findings did not correspond with the findings of many studies (11,14,15 and 16).

Resistance exercise decrease insulin resistance by increasing muscle mass and glucose transporters, and aerobic exercise enhances glucose disposal through increases in skeletal muscle capillarization, blood flow, and hexokinase and glycogen synthase activities. In our study, no improvement in insulin resistance was observed. The following factors could be responsible for these differences :

1. The initial insulin resistance level plays an important role on the amount of effect that physical activity will have on it. In this study, the patients had an initially low insulin resistance (HOMA-IR = 1.49 ± 0.35), while in most of the other studies mentioned above, initial insulin resistance was more than 4 micro mol/square liter.
2. Insulin resistance with regards to age, BMI and race shows significant difference.
3. The duration of training plays an important role on the parameters of insulin sensitivity.
4. The statistical sample of this research was less, compared to the other researches mentioned.
5. The indirect assessment of insulin resistance (HOMA) used, may not have been sensitive enough to detect additional exercise effects, and a more sensitive assessment (hyperinsulinemic-euglycemic clamp) may have been appropriate.

Therefore, aerobic training program can lead to a significant improvement in cardiorespiratory capacities (V02max) and obesity indices (body weight, body fat percentage and waist circumference) in women with PCOS. A training program is a simple treatment option in patients with PCOS alongside other treatments. Further research is necessary before the results of this study can be applied to a larger population of women with PCOS .

CONCLUSION

Aerobic training program improves cardiorespiratory capacities (V02max) and obesity indices (body weight, body fat percentage and waist circumference) in women with PCOS .

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