Effect of Exercise on Basal Metabolic Rate (BMR) and Anthropometric Variables in Women with Anorexia Nervosa

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Abstract: Anorexia Nervosa is a very serious eating disorder that usually young girls, between ages 12-20 experience. Girls which have such high expectations placed on them to be thin are the ones that are most likely to experience Anorexia Nervosa. However a few researches have studied the effect of exercise in young thin women with anorexia nervosa. The aim of this study was to investigate whether walking exercise can positively effect on BMR and anthropometric variables in young thin women. Twenty thin (BMI <20) women with age 22.00 ± 1.50 years volunteered to participate in this study. They were randomly assigned to exercise (n=10) and control (n=10) groups. Before and after the training program both groups had BMR and anthropometric measurements. Each walking session was 30 min walking at 50-75% of maximal heart rate, 3 days per week, for 2 months. Percent body fat, fat mass and lean mass changes in response to training were significant in the exercise group (all p=0.000). Also BMR in exercise group significantly increased (p= 0.022). This study demonstrated that walking exercise improved the Anorexia Nervosa in young thin women. If done on a regular basis, this type of training can be efficient, safe way of reducing this illness.

Key words: Anorexia Nervosa %Walking Exercise %Thin women.

INTRODUCTION

Dieting and thinness has become a new obsession in Western culture in the past 30 years. While, there is nothing wrong with maintaining a healthy lifestyle and losing a few extra pounds, there is a growing trend in North America and Europe of women resorting to extreme measures in order to lose weight [1]. One of the ever-growing forms of "dieting" is anorexia. Anorexia is a severe and chronic eating disorder characterized by self-imposed starvation. Anorexia nervosa, commonly referred to as anorexia, is an eating disorder in which the sufferer refuses to maintain a healthy weight. Through starvation, an anorexic will continuously lose weight, eventually causing severe physical and emotional turmoil [2]. An anorexic will have a body weight that is, on average, 15% lower than the expected weight for their age and height. Although our culture’s idealization of thinness plays a powerful role in the development of anorexia, there are other contributing factors, including genetics, individual personality traits and family environment. Anorexia is most common in adolescent girls and young women, with a typical age of onset between the ages of 13 and 20 [3]. While the physical and emotional consequences of anorexia can be devastating, the good news is that it’s a treatable condition. With the right treatment team, people with anorexia can and do get better. They can regain their health, learn to eat normally again and develop healthier attitudes about food and their bodies. The first priority in anorexia treatment is to address and stabilize any serious health issues. A second component of anorexia therapy is nutritional counseling. In nutritional counseling, a nutritionist or dietician teaches the patient about healthy eating, proper nutrition and balanced meals. The nutritionist also helps the person develop and follow meal plans that include enough calories to reach or maintain a normal, healthy weight [4, 5]. Many times the person with anorexia doesn't think they need any treatment. Even if they do, anorexia is a long-term challenge that may last a lifetime. People remain vulnerable to relapse when going through stressful periods of their lives. Anorexia is life threatening, but there is support and effective treatment for anorexia out there. Without treatment, about 20% of chronic anorexics will die. However, treatment for anorexia is highly effective and can help to overcome the disorder and lead a happy and fulfilling life. In fact, only 2% of treated anorexics succumb to the illness [6, 7].
Active living such moderate exercise is helpful. Evidence in the literature links physical activity increased the appetite in thin women with anorexia nervosa. The goal of exercise was to burn calories. Moreover, exercise induced amenorrhea in people with anorexia and those recovering from the disorder. People of all ages who are active have a better image of themselves than those who are not active [8]. The most easily accessible form of exercise is walking. It may not involve high loading, but it is accessible to majority of all women. Moreover, weight-bearing exercise is also recommended due to the positive stimulus of the mechanical pull of the muscles. Although walking and other types of regular exercise can provide many other health benefits, these potential benefits need to be weighed against the risk of fractures, delayed weight gain and exercise-induced amenorrhea in people with anorexia and those recovering from the disorder [9]. However, few researches have studied the effect of exercise in young thin women with anorexia nervosa. The aim of this study was to investigate whether walking exercise can positively effect BMR and anthropometric variables in young thin women.

**MATERIAL AND METHODS**

Subjects were recruited through various advertising strategies, such as posters in physicians offices daycare centers and drugstore. A formal interview was used to make the diagnosis anorexia nervosa in these subjects. Twenty thin women between the ages of 20-25 years volunteered to participate in this study. Then they were randomly assigned to exercise (n=10) and control (n=10) groups. This study was approved by local Committee of Ethics. Written informed consent for all procedures was obtained from all participants prior to entering the study. The criteria for the invitation were being willing to participate, clinically healthy (no cardiovascular, musculoskeletal, respiratory, or other chronic diseases that might limit training or testing), no menstrual irregularities, not using medication and sedentary life style (no regular sports activities for at least 2 years), nonsmoking and no apparent occupational or leisure time responsibilities that impede their participation. The following measurements were made at baseline prior to the start of the exercise program and at after completion of the 2-month training program.

**Anthropometric Measurement:** Body weight and height were recorded and body mass index (BMI) was calculated as weight (kg) divided by height (m) squared.

DXA (Lunar DPX-L, software version 1.31, USA) was used to measure each subject's fat mass, percentage body fat and lean mass. The DXA scans were performed in the Orthopaedic Diagnostic Centre at the National University Hospital, Guilan. In addition, all subjects were weighed every week. A physician recognized the commonly coexisting psychiatric conditions such as both cognitive behavioral psychotherapy and interpersonal psychotherapy in our subjects every two week.

**Basal Metabolic Rate (BMR):** Caloric expenditure was calculated based on the weight of the subject via the Harris-Benedict formula based on total body weight (BMR = 655 + (9.6 X wt in kg) + (1.8 X ht in cm) - (4.7 X age in years)). To minimize any affect that dietary composition might have on the measured metabolic variables, the initiation of the study all subjects were instructed on the American Health Association (AHA) diet by registered dietitian. We gave a diet program with equal caloric to exercise group, that it was about 1400 kcal a day to them. The composition of this diet was 50-55% carbohydrate, 15-20% protein, <30% fat [10]. The subjects were asked to maintain this diet composition throughout the study's duration (2mo). Compliance was monitored by review of 7-day food records taken every week.

**Exercise Program:** The program included warming-up phase for 5 minutes of stretching exercises, 30 minutes walking at 50-75% of maximum heart rate and cooling-down phase for 5 minutes of stretching, three times a week for 2 months. Stretching exercises were performed for the arms, leg, back and stomach. A target heart rate range between 50-75% of age adjusted maximum heart rate intensity was calculated by each walker from her age and walking supine resting heart rate. Heart rate was measured with an electronic heart rate meter (Sport Tester PE, Polar Electro, Oy, Finland) [11]. The exercise program was accompanied by music. All sessions were supervised by a professional exercise physiologist leader.

**Statistical Analysis:** The data were analyzed using the SPSS statistical package (SPSS 13 for Windows; SPSS, Chicago, USA). Mean and standard deviation (SD) was used as descriptive statistic. Student's t-test was used for normally distributed variables. Unpaired t-test was used to assess the change in BMI, body weight, basal metabolism rate before and after the exercise intervention. The final level of significance was accepted as $p<0.05$ for all comparisons.
Table 1: Changes in Anthropometric variables and Basal metabolism in pre and post test exercise(X ±SD)

<table>
<thead>
<tr>
<th>variable</th>
<th>Thin(Exe)</th>
<th></th>
<th>Thin(Con)</th>
<th></th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre</td>
<td>post</td>
<td></td>
<td>pre</td>
<td>post</td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>21.10± 1.73</td>
<td>-</td>
<td>21.90±1.29</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.90± 7.56</td>
<td>-</td>
<td>162.70±6.65</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>45.88 ± 5.33</td>
<td>46.43±5.18</td>
<td>46.49±5.21</td>
<td>46.31±5.21</td>
<td>0.000*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>17.73±1.05</td>
<td>17.89±1.49</td>
<td>17.51±1.05</td>
<td>17.24±0.98</td>
<td>0.000*</td>
</tr>
<tr>
<td>Lean mass (kg)</td>
<td>33.54± 3.72</td>
<td>34.53±3.97</td>
<td>34.93±4.31</td>
<td>33.67±4.57</td>
<td>0.000*</td>
</tr>
<tr>
<td>Fat mass (kg)</td>
<td>9.86±1.85</td>
<td>9.21±2.14</td>
<td>10.38±1.92</td>
<td>10.51±1.90</td>
<td>0.000*</td>
</tr>
<tr>
<td>% Body fat</td>
<td>21.82± 3.13</td>
<td>20.13±3.60</td>
<td>22.35±2.86</td>
<td>22.43±4.20</td>
<td>0.000*</td>
</tr>
<tr>
<td>BMR(Kcal)</td>
<td>1238.50±2.11</td>
<td>1412.20±1.10</td>
<td>1211.90±3.01</td>
<td>1201.30±2.20</td>
<td>0.022*</td>
</tr>
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*Significant at the 0.05 level.  *Exe=Experimental  *Con=Control

RESULTS

Twenty subjects (100%) completed the training program. No major change in menstrual status was observed during the study. Table 1 shows the physical characteristics of the study subjects (pre, post study), there were no significant differences in mean age, height, BMI between the two groups at the first. Percent body fat, fat mass and lean mass changes in response to training were significant in the two groups. The lean mass in both groups were significantly increased but the present body fat, fat mass were significantly decreased (p<0.05). Furthermore, BMR also in exercise group significantly increased (p<0.05).

DISCUSSION

This is the first study to asses the effect of exercise on young girls who had anorexia nervosa. Two months of walking exercise showed efficacy in slowing or stopping anorexia and recovering from the disorder. This difference may be due to the younger age of subjects in our study and the nature of the mechanical load. This study finding revealed that 2 months walking exercise was of sufficient duration and intensity to result in significant improvements in the all components of body composition in obese exercise group. The increase in body weight in exercise group accounts for the responses of body weight to walking exercise compare with the control group. This is may be du to that walking exercise increased caloric expenditure in exercise group and that is why BMR also increased in exercise group. Indeed the appetite in exercise group increased [12]. In our case a simple 30 minutes of walking exercise at the range of 50-75% maximum heart rate was enough to decreasing the fat mass and increasing in lean body weight. Researchers showed that weight bearing and muscle contractions generate stress on lean body necessary to prevent lose weight. Although overall fat mass does necessary for thin women, so does overall lean mass. “Lean mass” means muscle."Lean mass," the researchers conclude, "is the major determinant of body size, providing further evidence that body size is adapted to the dynamic load imposed by muscle force rather than passive loading" by fat [13]. This issue is desirable for women with anorexia nervosa because they do not like have any fat mass in their body.

While, several reports have suggested a relationship between involvement in regular exercise activity and the presence of eating disorders or eating-disordered characteristics, other research has demonstrated no such association [14]. Methodological difficulties and interpretive differences among researchers contributing to these disparate findings are reviewed. Conventional wisdom at the time advocated for complete activity restriction and "bed rest." Rosenblum et al [15] reported that the psychological impact of exercise in patients with anorexia nervosa is complex and exercise may have a negative impact on their health. The relationship between exercise patterns and possible risk for eating disorders was examined by Richert et al. [16] in a survey of undergraduates using the Eating Attitudes Test (EAT). Reported hours of jogging per week correlated positively and significantly with total EAT scores and with scores on the “Dieting” factor. The Dieting factor also showed significant correlations with number of activities and total hours of activities. Subjects with EAT scores at or above 30 showed a significantly higher mean number of hours of jogging per week than subjects with EAT scores less than 30. Total EAT scores and each of the three factor scores showed a significant positive correlation with exercising alone. Overall levels of activity and hours spent in
activities other than jogging did not relate to total EAT scores nor differentiate between the high and low EAT score groups. The apparent preference for jogging among those possibly at risk for eating disorders is discussed in terms of socio cultural and dynamic factors associated with eating disorders. Wolf et al. [17] investigated the relationship between exercise involvement and eating-disordered characteristics in 159 “exerciser” and 129 “non exerciser” male and female undergraduates. Women who were involved in regular exercise demonstrated more bulimic/anorectic eating attitudes and a greater drive for thinness than the women who were not involved in regular exercise. Further, results suggest that women involved in regular exercise who show disordered eating concerns do not manifest the personality characteristics associated with eating disorders that are shown among female non exercisers with similar levels of disordered eating concerns. This may be due to people who are active have a better image of themselves than those who are not active [18].

In conclusion, our data showed that moderate exercise, such as walking helpful once weight is restored. This exercise may increase appetite and slow continuing weight gain in a person recovering from anorexia. This study demonstrated that walking exercise improved the Anorexia Nervosa in young thin women. If done on a regular basis, this type of training can be efficient, safe way of reducing this illness.

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REFERENCES