



Effects of Aerobic-Anaerobic Exercise on Social Avoidance, Positive and Negative Affects, and Self-Consciousness of Obese Women

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Abstract

Background: We aimed to investigate the effects of aerobic-anaerobic exercise on social avoidance, positive and negative emotions, and self-awareness in obese women as well as provide some basis for guiding them to increase their physical exercise and promote physical and mental health.

Methods: Sixty obese women (body mass index ≥ 23 kg/m²) who volunteered to participate in the experiment were selected in Tianjin, China in 2022, and divided into control group and observation group with 30 people in each group. The control group received normal physical training, whereas the observation group received a uniform diet and an aerobic-anaerobic exercise intervention based on normal physical training that lasted for 12 weeks. The changes in the two groups before and after the intervention were compared.

Results: After intervention, the body fat rate and fat weight of obese women in the observation group were significantly decreased, the lean body weight and muscle weight were significantly increased, and the improvement of body composition index was better than those in the control group was ($P < 0.05$). The obese women in the observation group showed lower scores in negative affect and higher scores in positive affect ($P < 0.05$). The obese women in the observation group showed higher scores in comfort, health assessment, satisfaction of body parts, overweight, gregariousness, anxiety, physical appearance and properties, intelligence, school situation, and behavior, while the observation group received lower scores in social avoidance and social distress.

Conclusion: Aerobic-anaerobic exercise has a better role in strengthening the physical exercise and physical and mental development of obese women.

Keywords: Aerobic-anaerobic exercise; Obese women; Social avoidance; Self-consciousness

Introduction

Obesity occurs when the human body stores too much fat and energy, manifested by the increasing volume and number of fat cells. Obesity is a metabolic disease with a variety of pathogenic and influencing factors (1, 2). After a comprehensive analysis of the body mass index (BMI)

and body weight of patients based on international standards is conducted, skin fold thickness, physical content, hip-to-waist ratio, hip-to-waist circumference ratio, and waist circumference should be considered to confirm whether they are obese. Obesity will cause an unpleasant ap-



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pearance, fat, and swelling, and more importantly, cause serious psychological and physical diseases, especially among obese women, whose social and psychological behavior is more severely affected by the condition. Most of them will suffer from anxiety and depression, social avoidance, poor partnership, obvious inferiority complex, lack of self-confidence, and low self-consciousness, all of which will seriously affect their personal development. This problem has attracted close attention in the medical, psychology, and education circles.

Given the large-scale prevalence of obesity, intervention methods have emerged one after another. These methods can be roughly divided into exercise intervention, surgical intervention, traditional Chinese medicine acupuncture, dieting, and drugs. Thus far, the most effective, reasonable, and scientific intervention method for obesity is exercise intervention. Square dancing exercise for overweight and obese women can significantly reduce their body fat and blood fat (3). Su et al. (4) demonstrated that obese adolescents who perform eight weeks of resistance exercise could increase their body muscle content and reduce body fat content and BMI. Aerobic exercise for obese college students could relieve their negative emotions, such as anxiety and depression, and improve their procrastination behavior (5). Wang et al. (6) pointed out that shuttlecock kicking has a positive effect on the self-image factors and social avoidance of obese women. Anaerobic and aerobic exercise for obese female college students could improve their self-awareness and enthusiasm in social activities (7). Traditional aerobic exercise and weight loss methods generally have a slow effect and relatively long process and result in less muscle mass, which is not conducive to long-term adherence and the comprehensive health of obese patients. However, the single anaerobic exercise process is relatively short but the load is heavy, resulting in certain risks for women with relatively weak constitutions and is relatively boring and difficult to control.

Aerobic-anaerobic exercise is an innovative exercise mode that combines these two exercises to make effectively up for the deficiency of each

method. The aerobic-anaerobic exercise mode can consume body fat through aerobic exercise and improve the cardiovascular endurance of the body. Anaerobic exercise alone can also improve the basic metabolism level of the body, increase body muscle content, effectively shorten the weight loss cycle, and prevent and control the rebound, making it a highly scientific and quick effective method for patients with poor perseverance of weight loss. Meanwhile, aerobic-anaerobic exercise can also promote the participation of obese women in collective activities and improve their self-consciousness and self-confidence. Such mode of exercise could significantly improve the problem of concentric obesity, relieve anxiety, depression, and other negative emotions, and improve self-image and social skills (8). Pourranjbar et al. (9) stated that aerobic-anaerobic exercise has a positive effect on improving the self-consciousness level of obese adolescents, besides; it has a significant effect on improving social avoidance and distress in obese patients (10).

Currently, conventional exercise intervention is effective but slightly boring, such that obese women have low enthusiasm for continuing to participate in exercise. Thus, it is urgent to explore an intervention method suitable for obese women. We performed a randomized controlled trial to investigate the effects of aerobic-anaerobic exercise on social avoidance, positive and negative emotions, and self-awareness in obese women. The goal was to provide some basis for guiding these women to enhance their physical exercise and promote their physical and mental health.

Methods

Research objects

Sixty obese women ($BMI \geq 23 \text{ kg/m}^2$) who volunteered to participate in the experiment were selected in Tianjin, China in 2022, and randomly divided into control group and observation group with 30 people in each group. The control group received normal physical train-

ing, whereas the observation group received a uniform diet and an aerobic-anaerobic exercise intervention based on normal physical training that lasted for 12 weeks. The obese women in the control group were in the age range of 18–22 years (average age: $[20.15 \pm 0.36]$), stood $[163.29 \pm 1.38]$ cm tall, and weighed $[74.69 \pm 3.52]$ kg. Those in the observation group were in the age range of 18–22 years (average age: $[20.23 \pm 0.41]$), stood $[163.35 \pm 1.32]$ cm tall, and weighed $[74.75 \pm 3.48]$ kg.

All the participants signed the informed consent form, and this study was approved by the Ethics Committee of Tianjin University of Technology (Approval TJUT.2022.326).

No significant difference was observed in age, height, weight, and other general information between these two groups at $P > 0.05$, excluding those patients who were unable to attend sports or had skeletal, muscle, and joint disease, severe cardiovascular disease, asthma, and diabetes.

Experimental method

Obese women in the control group received normal physical training, whereas those in the observation group received a uniform diet and an aerobic-anaerobic exercise intervention based on normal physical training that lasted for 12 weeks.

Setting up a survey team

According to the needs of the experiment, the survey team comprised six people who received professional training and would guide and supervise the content of each exercise. They were also responsible for the questionnaire distribution and index measurement before and after the experiment.

Exercise program

Anaerobic exercise includes many kinds of exercises, such as body weight-bearing resistance training and high-intensity running training. The data indicated that there is currently no authoritative classification standard for anaerobic exercise. In this study, anaerobic exercise was defined as body resistance training, and the specific exercise

methods and intensity were as follows: anaerobic exercise load of 8–12 (at maximum), heart rate control with aerobic load intensity of 120–150/min (mainly moderate intensity), exercise frequency of 80 min/time 3 times/week, and 12 weeks intervention time. Exercise content: 1) jogging for 10 min. 2) ~40 min anaerobic strength training, mainly including three groups of barbell bench presses (8–12 times/group). 3) Three groups of squatting with weights (8–12 times/group). 4) Three groups of rowing equipment training (8 times/group) and three groups of frog jumping with weights (15 times/group). 5) Bicycle exercise for 30 min.

Diet and physical activity control

To avoid the influence of physical activity, diet, and other factors, all patients received a uniform diet. All meals had a balanced variety of foods. They should be eaten in the same canteen. The patients were not allowed to participate in any major physical activities except for gymnastics and the exercises mentioned in this study.

Evaluation indexes

Body composition

Muscle mass; fat mass, body fat rate, and lean body mass were measured before and after intervention using a body composition-measuring instrument (X-SCAN PLUS II, Beijing Xinruikang Scientific & Technical Corporation). During the measurement process, patients were required to take off their shoes, socks, coat, and any metal objects on their person, stand on the measuring instrument, put their hands on both sides of their body, refrain from talking with others, and keep quiet.

Multidimensional Body Self-image Relations Questionnaire (MBSRQ)

MBSRQ has 69 items in total that reflect two tendencies, namely, cognitive and evaluation behavioral tendencies, which respectively represent health tendency, health and appearance. Items included are self-classification of body weight, overweight, satisfaction of body part, disease tendency, health tendency, health assessment,

comfort tendency, comfort assessment, appearance tendency, and appearance assessment. A five-level scoring method, from 5 (completely agree) to 1 (completely disagree), was used for evaluation, and the questionnaire had good reliability and validity.

Social Avoidance and Distress scale (SAD)

The SAD scale contains a total of 28 items to evaluate social avoidance emotions and behaviors of individuals, of which 14 items are used to evaluate social distress and the other 14 to evaluate social avoidance in a “yes/no” way. Social distress is the emotional reaction of annoyance, pain, and discomfort when individuals participate in social communication. Social avoidance is a social reluctance or dislike to communicate with others and a preference to be alone.

Positive and Negative Affect Scale (PANAS)

PANAS includes 20 items in total, of which 10 items are used to evaluate negative emotions and the other 10 to evaluate positive emotions. A five-level scoring method was used for evaluation, where the higher the score of the negative emotion scale, the more pain and confusion for patients. By contrast, the higher the score of the positive emotion scale the more attentiveness and energy from the patients.

Feeling of Inadequacy Scale (FIS)

FIS includes 36 items in total used to measure personal social anxiety, self-sensitivity, sense of inferiority, and defect. A seven-level scoring method was used to perform an overall evaluation on individual inferiority level. The general scale also contained five aspects of inferiority, such as fitness, appearance, self-respect, learning ability, and social confidence. The total score was the sum of the scores of all dimensions, where the stronger the sense of inferiority of patients, the higher the score.

Piers-Harris Self-consciousness Scale (SCS)

The SCS scale consists of 80 items, including six dimensions, such as happiness and satisfaction,

social fit, anxiety, physical appearance and attributes, intelligence and school situation, and behavior. The total score is the sum of the scores of each dimension, where the higher the score of each dimension, the higher the level of self-awareness.

Statistical analysis

The data were analyzed using SPSS 22.0 (IBM Corp., Armonk, NY, USA). The measurement data (following normal distribution) were described in $(\bar{x} \pm s)$, and pairwise *t*-test (inter-group comparison) or *t*-test (inter-group comparison) was carried out. $P < 0.05$ indicates statistical significance.

Results

Changes in body composition of the two groups before and after intervention

The control group did not show any statistically significant differences in body composition before and after intervention ($P > 0.05$). After intervention, the body fat rate and fat weight of the obese people in the observation group were significantly decreased while lean body weight and muscle weight were significantly increased. The changes in body composition of the observation group were better than those of the control group were ($P < 0.05$) (Table 1).

MBSRQ scores of the two groups before and after intervention

The control group did not show any statistically significant differences in their MBSRQ scores before and after intervention ($P > 0.05$). After intervention, the scores of comfort tendency, health assessment, body part satisfaction, and overweight in the observation group were significantly increased, and the scores of each item in the questionnaire in the observation group were higher than those in the control group ($P < 0.05$) (Table 2).

Table 1: Changes in body composition of the two groups before and after intervention ($\bar{x} \pm s$)

Variable	Control group (n=30)		Observation group (n=30)	
	Before	After	Before	After
Fat rate (%)	38.86±2.59	38.89±2.62 ^c	38.78±2.63	36.11±2.74 ^{ab}
Fat weight (kg)	28.58±2.85	28.69±2.93 ^c	28.62±2.81	25.11±2.65 ^{ab}
Lean body weight (kg)	44.08±3.06	44.11±3.05 ^c	44.05±3.03	45.18±3.12 ^{ab}
Muscle weight (kg)	29.11±3.02	29.15±2.87 ^c	29.06±3.09	32.97±3.16 ^{ab}

Note: Compared with this situation, before the intervention, ^a $P < 0.05$. Compared with the control group, ^b $P < 0.05$. Compared with this situation, before the treatment, ^c $P > 0.05$.

Table 2: MBSRQ scores of the two groups before and after intervention (score, $\bar{x} \pm s$)

Variable	Control group (n=30)		Observation group (n=30)	
	Before	After	Before	After
Appearance evaluation	3.39±0.45	3.36±0.42 ^c	3.37±0.51	3.53±0.52
Appearance tendency	3.05±0.42	3.02±0.40 ^c	3.06±0.38	3.08±0.39
Comfort evaluation	3.42±0.68	3.53±0.59 ^c	3.39±0.65	3.59±0.56
Comfort tendency	3.62±0.53	3.65±0.49 ^c	3.50±0.49	3.87±0.52 ^{ab}
Health evaluation	3.68±0.43	3.73±0.38 ^c	3.65±0.39	4.06±0.45 ^{ab}
Health tendency	3.42±0.38	3.45±0.39 ^c	3.40±0.36	3.49±0.41
Disease tendency	3.41±0.57	3.36±0.56 ^c	3.42±0.52	3.31±0.45
Body part satisfaction	3.80±0.43	3.81±0.41 ^c	3.76±0.41	3.96±0.43 ^{ab}
Overweight	2.01±0.32	2.06±0.26 ^c	1.96±0.31	2.45±0.65 ^{ab}
Self-classification	2.54±0.32	2.56±0.29 ^c	2.55±0.30	2.59±0.33

Note: Compared with this situation, before the intervention, ^a $P < 0.05$. Compared with the control group, ^b $P < 0.05$. Compared with this situation, before the treatment, ^c $P > 0.05$.

Comparison of the SAD scores of the two groups before and after intervention

The control group did not show any statistically significant differences in the SAD scores before and after intervention ($P > 0.05$). After interven-

tion, the SAD scores in the observation group were significantly decreased and significantly better than those in the control group were ($P < 0.05$) (Table 3).

Table 3: SAD scores of the two groups before and after intervention (score, $\bar{x} \pm s$)

Variable	Control group (n=30)		Observation group (n=30)	
	Before	After	Before	After
Social avoidance	2.45±0.46	2.43±0.39 ^c	2.46±0.36	2.30±0.27 ^{ab}
Social distress	2.53±0.42	2.54±0.38 ^c	2.55±0.39	2.32±0.26 ^{ab}

Note: Compared with this situation, before the intervention, ^a $P < 0.05$. Compared with the control group, ^b $P < 0.05$. Compared with this situation, before the treatment, ^c $P > 0.05$.

Comparison of PANAS scores of the two groups before and after intervention

The control group did not show any statistically significant differences in the PANAS scores before and after intervention ($P > 0.05$). After intervention, the scores of negative emotions in the

observation group were significantly decreased while those of positive emotions were significantly increased. The PANAS scores in the observation group were significantly better than those in the control group were after intervention ($P < 0.05$) (Table 4).

Table 4: Comparison of PANAS scores of the two groups before and after intervention (score, $\bar{x} \pm s$)

Variable	Control group (n=30)		Observation group (n=30)	
	Before	After	Before	After
Positive emotions	19.06±3.56	19.15±3.62 ^{ac}	19.08±3.65	23.59±3.75 ^{ab}
Negative emotions	22.65±4.23	22.62±4.21 ^{ac}	22.68±4.29	19.65±4.16 ^{ab}

Note: Compared with this situation, before the intervention, ^a*P*<0.05. Compared with the control group, ^b*P*<0.05. Compared with this situation, before the treatment, ^c*P*>0.05

Comparison of FIS scores of the two groups before and after intervention

The control group did not show any statistically significant differences in the FIS scores before and after intervention (*P*>0.05). After intervention, the scores of physical fitness, appearance,

self-respect, learning ability, social confidence, and total scores in the observation group were significantly decreased, and the FIS scores in the observation group were better than those in the control group (*P*<0.05) (Table 5).

Table 5: Comparison of FIS scores of the two groups before and after intervention (score, $\bar{x} \pm s$)

Variable	Control group (n=30)		Observation group (n=30)	
	Before	After	Before	After
Physical fitness	13.98±3.16	13.94±3.19 ^c	13.95±3.21	12.85±3.12 ^{ab}
Appearance	15.32±4.16	15.27±3.89 ^c	15.36±4.08	14.05±3.16 ^{ab}
Self-respect	16.33±3.54	16.28±3.62 ^c	16.35±3.64	14.20±3.75 ^{ab}
Learning ability	18.06±4.51	17.89±4.42 ^c	18.01±4.46	15.32±3.63 ^{ab}
Social confidence	31.54±5.64	31.28±5.42 ^c	31.51±5.58	29.48±4.26 ^{ab}
Total score	95.21±8.54	95.14±8.43 ^c	95.26±8.62	86.39±7.62 ^{ab}

Note: Compared with this situation, before the intervention, ^a*P*<0.05. Compared with the control group, ^b*P*<0.05. Compared with this situation, before the treatment, ^c*P*>0.05.

Comparison of SCS scores of the two groups before and after intervention

The control group did not show any statistically significant differences in the SCS scores before and after intervention (*P*>0.05). After intervention, the scores of social integration, anxiety,

physical appearance and attributes, intelligence and school situation, behavior, and total scores in the observation group were significantly increased, and the scores of SCS in the observation group were better than those in the control group (*P*<0.05) (Table 6).

Table 6: Comparison of SCS scores of the two groups before and after intervention (score, $\bar{x} \pm s$)

Variable	Control group (n=30)		Observation group (n=30)	
	Before	After	Before	After
Happiness and contentment	7.81±1.54	7.89±2.15 ^c	7.85±1.46	8.03±2.10
Social integration	8.11±1.46	8.26±1.35 ^c	8.15±1.57	9.51±2.10 ^{ab}
Anxiety	8.25±2.69	8.31±2.6 ^{ac}	8.32±2.54	9.69±2.67 ^{ab}
Physical appearance and attributes	8.35±3.65	8.54±3.5 ^{ac}	8.39±3.71	9.86±3.62 ^{ab}
Intelligence and school attributes	10.65±3.19	10.78±3.32 ^c	10.62±3.15	12.59±3.41 ^{ab}
Behavior	10.23±2.16	10.35±2.13 ^c	10.29±2.14	13.54±3.26 ^{ab}
Total scores	51.25±7.66	52.53±7.32 ^c	51.34±7.74	59.32±7.89 ^{ab}

Note: Compared with this situation, before the intervention, ^a*P*<0.05. Compared with the control group, ^b*P*<0.05. Compared with this situation, before the treatment, ^c*P*>0.05.

Discussions

Table 1 shows that the scores of body fat rate and fat weight of obese women in the observation group were significantly lower than those in the control group were after intervention and the scores of lean body weight and muscle weight were significantly higher than those in the control group were. These findings indicate that aerobic-anaerobic exercise can effectively improve the body composition of obese women, which is similar to another report (11). This might be attributed to fat weight and fat rate being used as indicators to evaluate the physical health risk and degree of obesity, with fat weight as the total amount of all fat tissues in the body of a person. Both aerobic and aerobic-anaerobic exercise can effectively reduce the body fat rate and body weight of obese adolescents, but the effects of resistance exercise and aerobic exercise are more significant (12). Anaerobic exercise could improve the body composition of obese women by promoting muscle protein synthesis and increasing lean body weight and muscle content. Compared with fat tissue, muscle has a higher basal metabolic rate and fat consumption and thus improves the body composition of obese women. Lean body weight is also known as fat-free body weight, which mainly refers to the weight of human bones and muscles (13). In this study, classic resistance exercises such as bench press and squat could effectively stimulate muscle fibers, constantly repair and break muscle fibers, promote the continuous synthesis and growth of muscle proteins, increase the cross-sectional area of muscles, increase muscle volume and mass, and eventually increase lean body weight. Therefore, aerobic-anaerobic exercise can improve the overall composition of the body.

Table 2 shows that the scores of comfort tendency, health evaluation, body part satisfaction, and overweight in the MBSRQ of the observation group were higher than those of the control group were after intervention, indicating that aerobic-anaerobic exercise can effectively improve

the self-image factors of obese women. This result agrees with the findings of Cui et al. (14). This is mainly because body image is the subjective feelings of individuals, including the perception of their physical properties, emotions, imagination, and consciousness. In addition, body image is the concept that always changes with the physical experience, environment, and state of mind, making it a psychological phenomenon that is acquired and completed during the growth and development of an individual. In short, body image affects our psychology, self-confidence, social behavior, self-esteem, self-concept, and behavioral disorders (15-16). In this study, aerobic-anaerobic exercise can remove extra fat on the body surface and in the body and lead to a better body shape. Meanwhile, long-term training is also good for the harmonious development of joints, bones, and muscles and can better help improve bad posture, thus enhancing the satisfaction of obese women with their situation and improving the levels of their self-image factors.

Tables 3-5 show that SAD scores, negative emotion scores, and the scores of physical energy, appearance, self-respect, learning ability, and social confidence in FIS of the observation group were significantly lower than those of the control group after intervention, and the positive emotion scores of the observation group were significantly higher than those of the control group. These results indicate that aerobic-anaerobic exercise can effectively improve the social avoidance and positive and negative emotions of obese women. This finding agrees with Zhou et al. (17), who noted that the college stage is an important stage of personal development, acceptance of education, and social activities. Since obese women are not satisfied with their body image, they will develop an inferiority complex, avoidance, or fear of social interaction, which will lower their confidence, gradually reduce their opportunity to exercise and learn social skills, and decrease their social and learning ability (18). In this study, aerobic-anaerobic exercise can not only improve body shape, physical fitness, and aesthetic perception but also help form better self-image and

cultivate self-personality so that obese women can better integrate into a new collective environment, form healthy values and mentality, and improve communication skills.

Table 6 shows that the scores of social integration, anxiety, physical appearance and attributes, intelligence and social situation, behavior, and total scores in the SCS of the observation group after intervention were significantly higher than those of the control group, indicating that aerobic-anaerobic exercise can effectively improve the self-consciousness of obese women. This result agrees with the findings of Kayan et al. (19). In this study, aerobic-anaerobic exercise can better reduce the body fat content of obese women, enhance their self-confidence so they can easily do physical exercise and have a sense of achievement, and then improve their enthusiasm for exercise or body activities and be recognized by their classmates. Therefore, aerobic-anaerobic exercise can effectively improve the self-consciousness level of obese women.

Conclusions

Aerobic-anaerobic exercise can effectively improve the body composition and body shape of obese women, improve their self-image and self-consciousness level, reduce social avoidance and distress, and achieve the purpose of improving self-esteem, self-confidence, and social ability, all of which have a good effect on promoting their physical and mental development.

Journalism Ethical considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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