Efficacy of Aerobic Training Program on Weight Reduction after Gastric Banding (A Randomized, Controlled Trial)

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ABSTRACT

The purpose of this study was to determine if differences on weight reduction existed between a group of 20 morbid obese female patients (Study Group) who had undergone Gastric Banding (GB) and who received Aerobic training program and other group of 20 obese patients (Control Group) had undergone GB only. Methods: data were obtained for each patient from history about the presence of any functional, social or economic problems and psychological status; determination body mass index (BMI), serum cholesterol and triglycerides level were done after six weeks postoperative (pre- exercise) and at six months postoperative. The physical therapy program began, six weeks post operative for experimental group. Including aerobic exercises performed on the stationary bicycle, for 40 min, 3 sessions per week for 6 months Results: showed a statistically significant decrease in BMI, total serum cholesterol and triglycerides in both groups, with a higher rate of reduction in experimental group. Conclusion: these results suggested that aerobic training program had a significant effect on weight reduction after Gastric Banding (GB) than Gastric Banding (GB) only.

Key words: *Gastric Banding, Aerobic training program, BMI, Morbid obesity.*

INTRODUCTION

Obesity is an increasingly significant health problem. Over 4 decades, the prevalence of obesity (BMI 30 Kg/m2) has increased from 13% to 31% in adults concurrent increases occurred in adolescents and children. Obesity is especially common in developed country[19].

Women have a higher prevalence of obesity than men do in most developed countries. Obesity affects many aspects of woman's health by increasing risk for heart diseases, diabetes, breast cancer, and infertility[28].

Obesity is strictly defined as an excessive accumulation of body fat. The BMI has become the most commonly accepted measurement. A BMI exceeding 25 is considered overweight, while obesity is defined as a BMI of 30 or more. A BMI of 35 or more with serious morbid condition, or BMI of 40 or more, is considered morbid obesity[13].

Sever obesity is associated with a large number of problems that gave rise to the term (morbid obesity[24].

Weight management means the adoption of healthfull and sustainable eating and exercise behaviors indicated for disease risk and improved feelings of energy and well-being[1].

On the other hand, surgery is considered the treatment of choice for well informed and well motivated severely obese (BMI 40 or 35 with comorbidities). Typically, people who seek surgery have exhausted the more conservative weight less options without satisfactory results. Surgical treatment of obesity is based on two techniques gastric – restricting technique (gastric band, stapling, and ballon) and gastric restricting and malabsorptive technique (Gastric hypass)[7].

Furthermore, Gastric banding is an excellent procedure that will provide as much weight control as needed to correct or prevent most complications of obesity, provided that the patient makes more effort to understand the operation and work with it. Most patients are able to eat all types of food without vomiting, provided the food is well chewed and the pouch is not forcefully overfilled[10].

The inflatable band is placed around the upper part of the stomach to create a smaller stomach pouch. This restricts the amount of food that can be consumed at one time and increases the time taken for the stomach to empty. The patient achieves sustained weight loss by limiting food intake, reducing appetite, and slowing digestion[2].

Fortunately, physical activity has been shown to aid in the prevention, maintenance and treatment of obesity through increased energy expenditure[8].

Therefore exercise produces improvements in plasma lipid profiles, insulin sensitivity, Blood pressure and mode[26].

[22]reported that, regular aerobic exercise, even without dietary restriction, brings about favorable changes in body mass and body composition.

So, the aim of this study is to assess the effect of aerobic training program on reduction of body weight following gastroplasty among adult obese females.

SUBJECTS, MATERIAL AND METHODS

Subjects:

Forty female patients who underwent Gastric Banding (GB) laproscopic procedure, were included in the study, they were selected from Educational Ahmed Maher Hospital. These subjects were divided randomly and equally into two groups, Group (A) (Study group): received aerobic training program following Gastric Banding for 6 months (3 sessions per week).while Group (B) (Control group): underwent Gastric Banding only.

Inclusion criteria; All the forty patients were females only, Their ages were ranged from 25-45 years old, had a body mass index (BMI) of more than 40 (morbid obesity), were conscious and ambulant, received the same necessary required drugs, had the same surgical technique done by the same surgeon, and began the training program immediately after discharge.

Exclusion criteria, Patients excluded if they were: Smokers, Alcohols drinkers or any substance abuse, Osteoarthritic patients, Cardiac patients, Diabetic patients those who had previous surgical procedures in L.L which may affect the study, those who missed two successive sessions, and Athletic females.

Ethical consideration

The experimental protocol was explained in details for each patient before the initial assessment and informed written consent were obtained from all participants. The trial protocol was approved by the meeting of the department of surgery, faculty of physical therapy, Cairo University. There was no harm inflicted on the patients. On the contrary, all had benefited from the final results of the study.

Material and Methods:

[A] Measurement procedures:

1- Initial Evaluation Procedures:

- Each subject was examined medically in order to exclude any abnormal medical problems which previously mentioned.
- Each subject's history was taken in previously prepared Questionnaire to collect information about:

a) The presence of any functional, social or economic problems.

b) Psychological status.

- The purpose of training program was explained for each subject.

2- Measurement of Height and Weight:

Weight was determined, height was measured, then the body mass index was calculated where: Body mass index (BMI) = body weight (Kg)/ height (m)2 (Ogden et al., 2002).

3- Estimation of Lipid Profile:

After fasting for at least 12 hours, 3mL venous blood was extracted from dorsal hand vein and allowed to clot at 37oC in the water bath, then serum was separated using a centrifuge for estimation of serum triglycerides and cholesterol level.

Measurements were taken as following:

Six weeks postoperative (pre-exercise).

Six months postoperative.

[B] Therapeutic procedures:

1- Postoperative care and follow up :(for both groups):

- The patient may be prescribed a liquid-only diet, followed by mushy foods and then solids.
- Gradual walking up to one mile per day was started from first day postoperative.

2- Program of aerobic training: (for study group):

Exercises performed on the electronic bicycle ergo meter as the following stages:

First stage (warming up):

Consisted of 5 minutes warming up in the form of pedaling at speed of 60 revolutions per min without load.

Second stage (active stage):

Consisted of:

- Duration: 30 minutes.

- Mode: pedaling at speed of 60 revolution per min with;
- Load: adjusted load to achieve 60% of the predictive age maximal heart rate which was calculated by the following equation:

Maximal heart rate = 220-age in years

Moderate work load = 60% of maximal heart rate

The heart rate was measured through pulsometer attached to the patient's ear.

Third stage (cooling down):

Consisted of 5 minutes cooling down in the form of pedaling at speed of 60 revolutions per min without load[30].

Duration and frequency: 3 sessions per week for 6 months post operatively will begin after discharge[30].

Statistical Analyses

Statistical analyses were performed using a personal computer running SPSS 16.0 (SPSS, Inc. Chicago, IL) for Windows 7 (Microsoft, Inc., Redmond, WA). Paired Student t tests were used to compare between pre and post values in each group (Within group comparison). Two-tailed unpaired Student t tests were used to compare between results of both groups (between groups comparison). Statistical significance was defined at the 5% ($P < .05$) level.

RESULTS

Statistical analysis of data by using analysis of no variance was performed to detect the significance level, mean and standard deviation for the effect of Gastric banding only and Gastric banding + aerobics on BMI, serum cholesterol and triglycerides of these subjects.

The results were presented as follow:

Data presented in table (1) show that the post value of body mass index was lower than their corresponding pre values in both groups; it is worth mention that the BMI post values were 40.75% lower than that of pre values in group A and 13.33% lower than that of pre values in group B. Moreover, the body mass index of gastric bypass + aerobics treated patients was lower than that of gastric bypass treated patients by 28.97%.

Table (1): Statistical analysis for BMI (pre and post values) in each group.

Item	Groups				Groups	
	Gastric bypass+ aerobics Group (A)		Gastric bypass Group (B)		Gastric bypass+ aerobics Group (A)	Gastric bypass Group (B)
	Pre	post	pre	Post	post	Post
Mean	57.38	34.03	57.22	43.89	34.03	43.89
S.D	5.04	3.4	4.98	4.2	3.4	4.2
M.D	23.35		9.33		9.86	
Improvement %	40.75%		13.33%		28.97	
t-Value	49.83		23.29		9.83	
P-Value	<0.0001		<0.0001		<0.0001	
Significance	significant		significant		Significant	

Level of significance at P <0.05, SD = Standard Deviation, MD= Means Difference,
P-Value = probability value, t -value = paired t-test

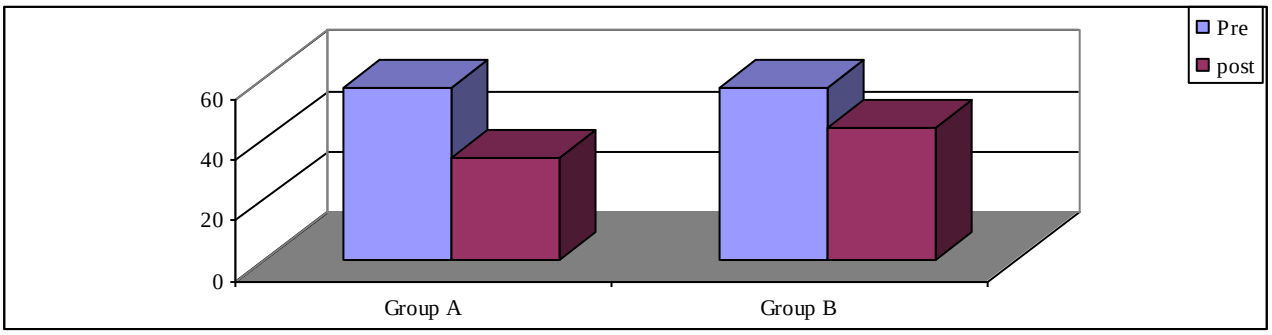

Fig. (1) Pre and post values of body mass index of both groups.

Table (2) and Fig. (2), show comparison between pre and post values of Triglycerides in each group. Table (2) denotes that the (gastric bypass+ aerobics) have a significant lessening effect on triglycerides; the post values of triglycerides were 35.37% of the pre value., further more, the T.G. were decreased by 21.60%in the gastroplasty group. The triglycerides of the gastric bypass + aerobics treated patients were 20.75% that of patients treated with gastric bypass.

Table (2): Statistical analysis for triglycerides (pre and post values) in each group.

Item	Groups				Groups	
	Gastric bypass+ aerobics Group (A)		Gastric bypass Group (B)		Gastric bypass+ aerobics Group (A)	Gastric bypass Group (B)
	Pre	post	pre	Post	Post	Post
Mean	170.03	110.22	169.78	133.1	110.22	133.1
S.D	12.15	15.24	10.86	6.09	15.24	6.09
M.D	59.81		36.68		22.88	
Improvement %	35.37%		21.60%		20.75%	
t-Value	29.71		23.74		6.99	
P-Value	<0.0001		<0.0001		<0.0001	
Significance	Significant		Significant		Significant	

Level of significance at P <0.05, SD = Standard Deviation, MD= Means Difference
P-Value = probability value, t-Value = Paired t-test

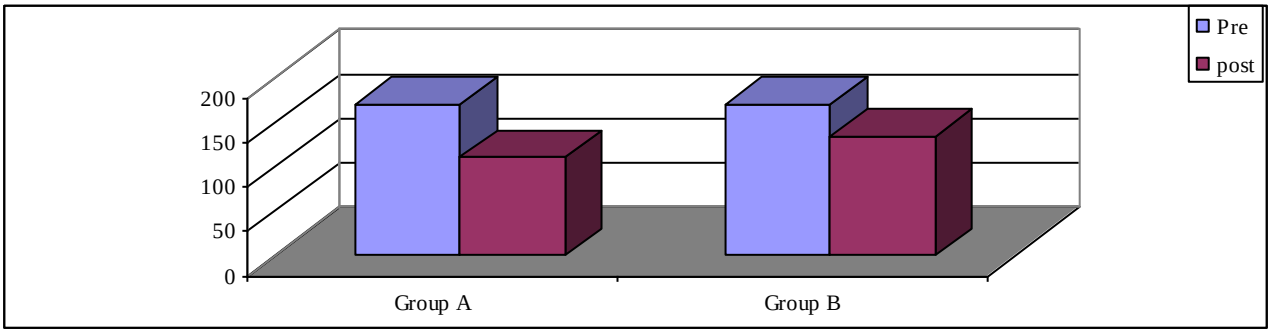

Fig. (2): Pre and post values of triglycerides of both groups.

Table (3) and Fig. (3), show comparison between pre and post values of total cholestrerol in each group. Table (3) identifies a significant decreasing effect of gastric bypass + aerobics on total cholesterol. The post value of cholesterol was lower than the respective pre values by 26.11%, also there was a significant decrement effect of gastric bypass only on total cholesterol which was decreased by 12.65% in group B. On comparison with that of gastric bypass treated patients; the total cholesterol of gastric bypass + aerobis treated patients was lowered by 12.60%.

Table (3): Statistical analysis for cholesterol (pre and post values) in each group.

Item	Groups				Groups	
	Gastric bypass+ aerobics Group (A)		Gastric bypass Group (B)		Gastric bypass+ aerobics Group (A)	Gastric bypass Group (B)
	Pre	post	pre	Post	Post	Post
Mean	260.89	192.75	261.02	228	260.89	228
S.D	16.69	29.61	19.93	14.31	29.61	14.31
M.D	68.14		33.02		31.6	
Improvement %	26.11%		12.65%		12.60%	
t-Value	9.26		14.06		4.3	
P-Value	<0.0001		<0.0001		0.000	
Significance	significant		significant		Significant	

Level of significance at P <0.05, SD = Standard Deviation, MD= Means Difference
P-Value = probability value, t-Value = Paired t-test

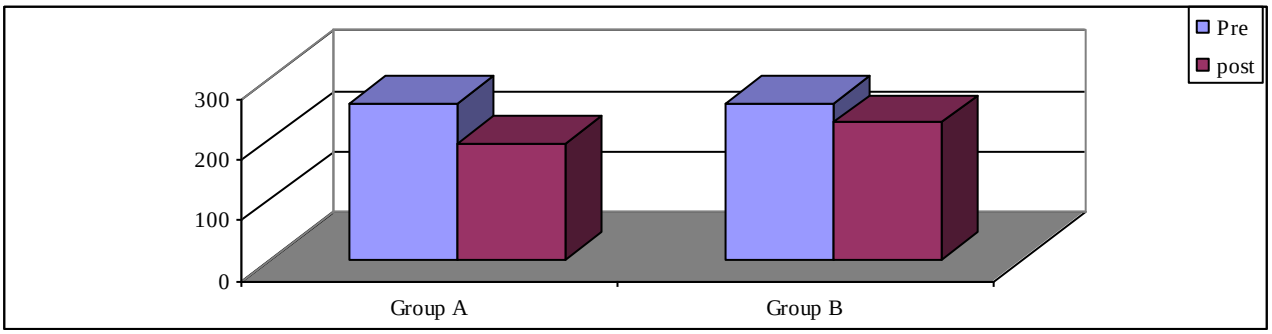

Fig. (3): Pre and post values of cholesterol of both groups.

DISCUSSION

The aim of this work was to determine the effect of aerobic training program on reduction of body weight following gastric banding among adult obese females.

The results obtained in the present study indicated that both (gastric banding + aerobics) and (gastric banding) groups induced significant reduction in BMI, serum cholesterol and triglycerides but this reduction was higher in gastric banding + aerobics group (study group) than gastric banding group (control group).

In the present study forty patients underwent gastric banding and showed significant reduction in BMI and serum cholesterol and triglycerides, these results were supported by:[27] they reported a 43 to 48% loss of excess weight for the gastric banding. Substantial weight loss generally occurs for 18 to 24 months after surgery; some regain of weight was common about two to five years after surgery. With improved conditions such as sleep apnea, diabetes, high blood pressure, and hyper-cholesterol. Many patients reported an improvement in mood and other aspects of psychosocial functioning after surgery.

The effectiveness of GB to lose excess weight was noticed in a series of 60 gastric banding operations. The operative treatment results in a reduction to within 40 percent of ideal weight in 80 percent of patients between 12 and 18 months after surgery[27].

[12]noticed that the results from conservative therapeutic tools such as dietary intervention, exercise regimens, behavioural modification and even pharmacological adjuncts remain disappointing, with most patients either failing to lose weight or, for those able to lose weight, experiencing total weight regain within a few years. Furthermore, such conservative measures do not sustain improvement in obesity-related co-morbidities. In contrast, bariatric surgery for the severely obese has resulted in an overall 61% weight reduction across all procedures and has been shown to eliminate or significantly ameliorate many of the obesity-related co-morbidities.

On the other hand,[17] reported on 201 patients who underwent gastric banding and

who were followed for a minimum of 2 years. More than 50% of patients who maintained an intact staple line had durable weight loss of 75% to 100% of excess weight. And of all weight-related pathologic conditions existing before the operation, 83% were either cured or improved.

Moreover, The study of[19] over 70 patients with mean BMI ± 49.1 underwent GB showed median weight loss at 1 year was 48% excess weight loss (EWL) with complete resolution of associated co-morbidities and the only complication was that 30-50% patients vomit once or more a week.

According to[6] in a study of five hundred fifteen subjects who had GB were followed with yearly conventional lipid profiles for up to 4 years and showed favorable changes in fasting triglycerides (TG), high-density lipoprotein-cholesterol (HDL-C), and total cholesterol (TC) and all improvements were maintained up to 4 years and concluded that improvement with weight loss is related to the decrease in fasting glucose, improvement in insulin sensitivity, and the extent of weight lost. Improvement in dyslipidemia is sustained with long-term weight loss.

[3]had an agreement with the results of this study as they reported that over their study on 30 patients with BMI 42.4 treated by GB, hyperlipidemia observed in 8 patients with 4 patients showed normal levels, 2 lowered levels and 2 unchanged values post operatively.

As it was mentioned before the forty patients underwent GB. So, the higher rate of reduction in BMI and lipid profile in the study group was attributed to the effect of aerobic training program and these results were supported by many investigators as:

[9]who take biopsies of abdominal subcutaneous tissue before and immediately after two hours of exercises on ergometric bicycle to investigate the effect of long lasting boat of exercise on the lipolytic β- and antilioplytic and α-2 adrenergic receptors and the antiliopolytic effect of insulin in obese subjects, they concluded that, after exercises, spontaneous lipolysis was significantly increased compared to the level before exercise. For the effect of insulin on lipolysis, there was no significant difference before and after exercises, the main finding of this study is the presence of significant exercise induced increase in β- adrenergic lipolytic effect in adipocytes obese subjects.

Fortunately,[14] had investigated the effect of eight months randomized trial involving different amounts and intensities of exercise among overweight men and women with dyslipidemia. They found that low amounts of exercise at moderate or high intensity are associated with potentially beneficial changes in plasma lipid profile. However, higher levels of high intensity exercise resulted in more pronounced changes in lipoprotein and were required to increase the high density lipoprotein cholesterol level, without significant weight loss.

It was concluded that the highest amount of weekly exercise training, even with minimal weight change had widespread beneficial effects on lipid profile. They related such improvement to the amount of activity and not to the intensity of exercise training[14].

[11]reported that aerobic exercise on obese women led to loss of weight and decreased in body mass index because exercise training is a major modifiable component of total daily energy expenditure.

It was found that after 8 weeks of aerobic exercise, there was significant decrease in body mass index. This was explained as cycle ergometer leading to increase energy expenditure[18].

Total daily energy expenditure can be divided into several component: resting metabolic rate, which account for approximately 60-70% of 24 hour energy expenditure; the energy cost of feeding approximately 10% of 24 hour energy expenditure; and the thermal effect of physical activity or exercise, which is most variable component and may vary from 15% of 24 hour energy expenditure in sedentary people to even 400% in professional cyclists under extreme circumstances[18].

Many of the improvements in lipid profile variables and insulin sensitivity that are associated with habitual exercise are also seen after a single session of exercise. This finding could indicates that the short term effects of exercise on insulin signaling in muscle are a

fundamental mechanism underlying many of the observed changes in the lipid profile[25].

Despite the plethora of observations of exercise induced changes in the lipoprotein profile, there is limited understanding of the underlying mechanisms. Exercise conditioning is associated with an increase in lipoprotein lipase activity in adipose tissue and muscles. According to[26] Increased lipoprotein lipase activities lower LDL and chylomicron triglyceride levels and enhance clearance of cholesterol-rich LDL and chylomicron remnant. LDL, and triglycerides are exchanged for cholesterol ester in LDL, and HDL, a process mediated by cholestryl ester transfer protein, and the triglycerides in HDL, and LDL is then hydrolyzed by lipases, causing a decrease in the size of the particles. Exercise and weight loss also reduce the level of cholestryl ester transfer protein perhaps because a fraction of this protein is made in adipose tissue.

On the other hand,[31] showed a decrease in body mass index and abdominal fat by training on a cycle ergometer for 3 days/week for 6 weeks because there was decrease in total amount of stored calories. This decrease in energy stores is obviously the results of a negative energy balance so that exercise produces decrease in energy intake leading to a reduction in weight.

[20]studies have demonstrated that cycling can be an effective form of exercise for weight loss and weight control. Also, improvements were seen in cardiovascular function with a reduction in total body weight and percentage of body fat.

It is now fairly-well recognized that aerobic exercise training can increase HDL cholesterol levels if the exercise stimulus is sufficient[4]. Furthermore, it had been also suggested that the HDL-raising effect of aerobic exercise training could be largely explained by the concomitant loss of body mass or fat. Therefore, among high risk overweight dyslipidemic patients with insulin resistance, hyperinsulinemia, hypertriglyce-ridemia, and low HDL cholesterol levels, the net increase in the daily energy expenditure produced by regular aerobic exercise may eventually induce mobilization of body fat and weight loss. In turn this ay ultimately reduce the amount of abdominal fat, improve insulin action, lower triglycerides level and increase plasma HDL level.

Moreover, [(5)]found that exercise on obese women causes a long term weight loss and decrease body mass index. They revealed that this loss, due to regular physical activity that enhance fat oxidation and partially prevent the age related increase in central body fatness.

On the other hand, The literature supported that for the goal of weight loss exercise should be of a low to moderate intensity for a long duration (45 min). generally, 3 days per week is recommended[23].

[2]and[16] demonstrated that three months of aerobic exercise training was able to improve the lipid profile by reducing the level of cholesterol, triglycerides, LDL and associated with increase of HDL level.

It was stated that during exercise the adrenal medullae release epinephrine and norepinephrine as a result of sympathetic stimulation these two hormones directly activate hormone sensitive triglyceride lipase that is present in the fat cells and this causes rapid break down of triglycerides and mobilization of fatty acids. Sometimes the free fatty acids concentration in the blood rises as much as 8 folds and the use of these fatty acids by the muscles for energy is increased[15].

Also the results of the study revealed no side effects reported by any patient in (gastroplasty+aerobics) group during and after treatment period. On conclusion, the present study revealed that aerobic training program has an effect on weight reduction after gastroplasty in obese females.

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الملخص العربي

استجابة فاعلية تحزيم المعدة لبرنامج تدريب هوائي مقترح

يهدف هذا البحث إلى قياس مدى استجابة فاعلية تحزيم المعدة لبرنامج تدريب هوائي مقترح وقد تم إجراء هذا البحث على أربعين مريضة بالسمنة المفرطة من اللاتي قد أجريت لهن عملية تحزيم المعدة. وقد قسمت عينة البحث إلى مجموعتين متساويتين: المجموعة الأولى: مجموعة الاختبار ، والمجموعة الثانية : المجموعة الضابطة. حيث أن المجموعة الأولى "مجموعة الاختبار" تحتوي هذه المجموعة على عشرين مريضة تم تطبيق برنامج التدريب الهوائي المختار والمكون من تمرينات هوائية على العجلة الثابتة لمدة 40 دقيقة، ثلاث جلسات أسبوعياً، بعد ستة أسابيع من الجراحة لهن ولمدة ستة أشهر، والمجموعة الثانية "المجموعة الضابطة" وتحتوي هذه المجموعة على عشرين مريضة واللاتي لم يمارسن التدريب الهوائي بعد الجراحة. تم التقييم كالآتي: قياس الوزن والطول وحساب نسبة الوزن إلى مربع الطول وقياس نسبة الكوليسترول والدهون الثلاثية بالدم بعد ستة أسابيع من الجراحة وبعد ستة اشهر، وذلك للمجموعتين. أظهرت النتائج وجود فروق ذات دلالات إحصائية عالية ووجود تحسن واضح في مجموعة الاختبار بالمقارنة بالمجموعة الضابطة في نسبة الوزن إلى مربع الطول والكوليسترول والدهون الثلاثية بالدم فبدت أقل في مجموعة الاختبار عنها في المجموعة الضابطة ، ولذلك فإن لبرنامج التدريب الهوائي تأثير على إنقاص الوزن بعد عملية تحزيم المعدة .

الكلمات الدالة: (تحزيم المعدة – برنامج التدريب الهوائي – نسبة الوزن إلى مربع الطول – السمنة المفرطة) .