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International Journal of Current Research
Vol. 10, Issue, 06, pp.70842-70847, June, 2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

AEROBIC EXERCISES AND WEIGHT LOSS AFTER BARIATRIC SURGERY: (SYSTEMATIC REVIEW)

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ARTICLE INFO

Article History:
Received 09th March, 2018
Received in revised form
26th April, 2018
Accepted 29th May, 2018
Published online 30th June, 2018

Key words:
Aerobic Exercises,
Bariatric Surgery
Weight loss Surgery
Obesity
Systematic Review.

ABSTRACT

Background: The use of Aerobic exercises and weight loss in the post bariatric surgery patients is new, and thus the scientific evidence for its effectiveness needs to be evaluated through a systematic review. **Objective:** To provide updated evidence-based guidance for Aerobic exercises effects on losing weight of post bariatric surgery patients**. Data sources:** Pub Med (Medline), Ovid, Physiotherapy Evidence Database (Pedro) ,Google scholar website, Cochrane Central Register of Controlled Trials, Electron library of Cairo University, Science direct website were searched from their earliest records up to August. **Data extraction:** Template was created to systematically code the demographic, methodological, and miscellaneous variables of each RCT. The Physiotherapy Evidence Database (PEDro) scale was used to evaluate the study quality. **Data synthesis:** Three studies included 108 participants in total. Best evidence synthesis was applied to summarize the outcomes, which were weight loss, physical fitness, blood pressure and anthropometric measures. **Conclusions :** However researches on Aerobic exercises is still preliminary , the available data demonstrated the efficacy of Aerobic exercises as a new modality on rehabilitation of weight loss in post bariatric surgery patients with immediate and long term effect on improving physical fitness. Further studies are still needed, especially those involving both physiological and functional evaluations and to cover further domain on weight loss.

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***Citation: Aya Salah Eldin Fouad Rostom, Dr. Mohamed Mahmoud Abd El Khalek Khalaf, Assis. Prof. Dr. NaglaaAbd El- Moneim Morad. and Dr. Walid Ahmed Ibrahim Aboue lnaga*, 2018.** "Aerobic exercises and weight loss after bariatric surgery: (systematic review)", *International Journal of Current Research*, 10, (06), 70842-70847.

INTRODUCTION

A systematic review (SR) is literature reviews that focus on a single question that tries to identify, appraise, select and synthesize all high quality research evidence relevant to that question. Systematic reviews of high-quality evidence across all type of study are crucial to evidence based medicine. An understanding of systematic reviews and how to implement them in practice is becoming mandatory for all professionals involved in the delivery of health care. Systematic reviews are not limited to medicine but are quite common in other sciences (Dicenso, 2009). A systematic review uses an objective and transparent approach for research synthesis, with the aim of minimizing bias. While many systematic reviews are based on an explicit quantitative meta-analysis of available data, there are also qualitative reviews which adhere to the standards for qualitative and quantitative research in systematic reviews (Thomas *et al*., 2004). Morbid obesity is a major contributor to a wide variety of disease states including diabetes mellitus, coronary artery disease, and sleep apnea. Obesity, generally defined as a body mass index (BMI) greater than 30 kg/m2, increases the risk of all-cause death (Wandell *et al*., 2009). Obesity is one of the main public health problems in the world, being considering a disease which worries due to social, psychological and metabolic issues. It is linked to the development of co morbidities that may even lead to death. Individuals with body mass index (BMI) above 40 m / kg² are considered obese grade 3, severe or morbid. In this degree, increase the risk of developing cardiovascular diseases, diabetes, some cancers, high blood pressure, breathing difficulties, disorders on the loco motor system and dyslipidemia beyond psychopathological disorders such as depression and binge eating (Livhits *et al*., 2010). The number

of bariatric surgery procedures has increased significantly over the past few decades, not only in the USA but also worldwide (Buchwald, 2003). Severe obesity (defined as BMI of ≥40 kg/m2) is a significant public health problem in the United States. According to a national survey conducted in the year 2007–2008, nearly 6% of US adults are severely obese (Flegal *et al*., 2008). Severe obesity is associated with a number of major co morbidities and markedly lessens life expectancy (Fontaine *et al*., 2003; Must *et al*., 1999). Studies in non-bariatric-surgery patients and data from the National Weight Control Registry have suggested that individuals may need to expend ≥2,000 kcal/week in moderate- intensity exercise in order to lose and/or maintain weight loss. Whether bariatric surgery patients, many of whom are severely obese even after weight loss, can exercise at this level is not clear (Wing, 2001; Jakicic *et al*., 2003). According to a case–control study in which bariatric surgery patients were compared with sex- and weight matched controls, only 30% of the former group reported expending ≥1,500 kcal/week in exercise compared to 70% of the latter group (Klem *et al*., 2000). Similarly, according to another case–control study in which bariatric surgery patients who had lost a large amount of weight were compared with subjects who had lost a similar amount of weight through nonsurgical means, approximately 30% of the former group reported expending at least ≥2,000 kcal/week in physical activity compared to about 60% of the latter group (Bond *et al*., 2009).

There is evidence to support the effectiveness of weight loss and reduction of co-morbidities associated with RYGB in the short term, but there are limited data on long-term weight loss with RYGB (Sjostrom *et al*., 2007). Due to the high prevalence of overweight (BMI between 25 and 30 kg/m2) and obesity, interventions such as diet and exercise to promote weight loss have become increasingly important to reduce morbidity in the general population. The benefits of exercise include increasing energy expenditure and lean body mass while contributing to fat loss, reducing obesity-related complications, and improving self-esteem and depression. Exercise also improves cardiopulmonary fitness, which may reduce mortality from cardiovascular disease (Hainer *et al*., 2008). Failure to lose a significant amount of weight as well as weight regain have typically been attributed to poor adherence to postoperative modifications such as limiting caloric intake and increasing energy expenditure.

Most research has focused on examining the patient's eating behaviors after surgery (such as dietary adherence and eating disorders), whereas questions remain with respect to the impact of physical activity on long-term weight loss and the contribution of one's physical capabilities to long-term surgical outcomes (Sarwer *et al*., 2015). Exercise has been postulated to improve weight loss after bariatric surgery. However, even moderate physical activity is often difficult for morbidly obese patients due to co morbidities such as osteoarthritis and asthma. Patients who have undergone bariatric surgery are forced to make dietary changes due to the restrictive and/or mal absorptive changes of the operation. The role of physical activity in contributing to weight loss is less clear, as patients are already forced to significantly decrease their caloric intake. Recommendations regarding physical activity are more difficult to enforce. It is critical to evaluate whether exercise improves weight loss outcomes to determine if this modality should be mandated as part of the standard postoperative guidelines (Livhits *et al*., 2010).

MATERIALS AND METHODS

Subjects

Search strategy: This review included studies that examined the effect of Aerobic exercises on weight loss in post bariatric surgery patients. Literature search was performed independently by the three authors using an electronic inclusive literature search of Pub Med (Medline) , Ovid ,Physiotherapy Evidence Database (Pedro) ,Google scholar website, Cochrane Central Register of Controlled Trials, Electron library of Cairo University, Science direct website databases from their earliest records to August 2017, using a number of key words: Aerobic exercises-Bariatric surgery – weight loss surgery - Obesity - Physical Therapy Modalities. These key words were used individually and/or were combined. All references from the selected articles were also cross-checked by the authors to identify relevant studies that may have been missed in the search. The reviewers also used the Science Citation Index (Science Direct) to conduct forward citation tracking of any eligible studies found, in order to identify additional articles relevant for the review.

Study selection: The titles and abstracts collected by the above mentioned search strategy, were initially screened against the inclusion and exclusion criteria for identification of the relevant trials. When the title and abstract did not indicate clearly if an article should be included, the complete article would be read to determine its suitability.

Eligibility criteria: The inclusion criteria for studies to be included in this systematic review were as follows: Published English studies with full text articles of Randomized controlled trials (RCTs) that were showing the effect of aerobic exercise on decreasing weight after bariatric surgery. Types of Participants: the review included Participants aged from 20-50 years. Types of Interventions: This review included studies which demonstrated the effects of aerobic exercise in management of obesity following bariatric surgery with reported findings for analysis of its effectiveness. Types of Outcome Measures: Systematic review of effect of aerobic exercise on decreasing weight after bariatric surgery. Primary outcomes: weight reduction. Secondary outcomes: Anthropometric measurements, VO2max, Physical fitness, Blood pressure, Insulin, Plasma glucose. Lipid profile, Effect of bariatric surgery on physical fitness, Effect of exercise program in morbidly obese patient after bariatric surgery, Remission of type 2 diabetes, Dynamic and static muscle strength , Functional capacity and Life style modification. Studies were excluded if the research was unpublished studies, Study design other than RCT (e.g. case report, controlled trials, cohort study), Studies that measured outcomes not related to the scope of our study, Not related articles and Studies published in language other than English.

Data-extraction and management: Data from all the included studies was summarized in the following format that includes: participants' characteristics (number in each group, target population, diagnosis, numbers in each diagnostic subgroup, and ages), intervention used, control used, research design and level of evidence for the study, and outcomes of interest. Key details of each study were extracted using the specific data extraction format. The format includes: Study design, The characteristics of participants.

The characteristics of interventions including types of exercise, intensity, duration, modality, number of session per week, total duration (wks) and any additional care, Details of outcome measures and risk of bias including randomization, blinding, attrition and reporting.

Assessment of methodological quality: The review authors independently assess risk of bias of included studies, based on Cochrane Handbook for Systematic Reviews of Interventions (Higgins and Green, 2008). All the included studies were scored on their methodological rigor with the Physiotherapy. Evidence Database (Pedro) scale (Pedro, 2010). Appendix. The PEDRO scale examines 11aspects of the quality of methodology. The Pedro scale considers two aspects of trial quality, namely the "believability" (or "internal validity") of the trial and whether the trial contains sufficient statistical information to make it interpretable. It does not rate the "meaningfulness" (or "generalisability" or "external validity") of the trial, or the size of the treatment effect. The scale is used to rate studies from 0–11 according to following 11 methodological criteria: specified eligibility criteria, random allocation, concealed allocation, baseline comparability, blinded subjects, blinded therapists, blinded assessors, adequate follow-up, and intention-to-treat analysis, between group comparisons, and point estimates and variability. Each item was scored as 1(yes) or 0(no).

The studies were ranked as 'high quality' if their score is more than or equal 7, studies with a score of 5 or 6 were considered of 'moderate quality' and those with a score of 4 or less were deemed of 'poor quality PEDro scores were not used as inclusion/exclusion criteria, but rather as a basis for data-analysis and to discuss the strengths and weaknesses of studies. The first item on the Pedro scale (the item on eligibility criteria) is related to external validity, so it does not reflect the dimensions of quality assessed by the Pedro scale. This item is not used to calculate the method score (which is why the 11 item scale gives a score out of 10). According to the Pedro guidelines, a positive answer to each of the criteria 2 to 11 will yield one point, obtaining a Pedro score of 0 to 10. The PEDRO scale has been shown to have moderate interrater reliability (intraclass coefficient for the total score is 0.56, 95% confidence interval 0.47–0.65) (Maher *et al*., 2013). Papers that had a Pedro score of seven or higher, would be considered 'high quality', those with a Pedro score of five or six would be considered 'moderate quality', and those with a Pedro score of four or less would be considered 'poor quality'. The more the number of scores of the aspects evaluating the quality of the study, the more quality of the study (Moseley *et al*., 2002).

Data synthesis and analysis: After extracting data from each study included in the systematic review, data was compared and the findings were represented either quantitivity, qualitivity or both according to the homogeneity between studies. Meta-analysis is a quantitative method employing statistical techniques, to combine and summarize the results of studies that address the same question without major differences in its inclusion or exclusion criteria of the participants, mode of administration, doses, and duration of the intervention as well as the comparison intervention, and the outcomes assessed and the methods of their assessment. Studies were clinically, methodologically and statistically homogenous before combining its results .So, Meta-analysis was done to three studies as they are homogenous and descriptive analysis was done to two studies as they are heterogonous. Confidence interval (Cl) is defined as "the range of scores within which the true score for a variable is estimated to lie within a specified probability (e.g: 90 percent. 95 percent.99 percent) (Jewell, 2008)". Effect sizes with 95%Cls were calculated if raw data were available in the studies. The effect sizes give easy understanding of how big the treatment effect is and the clinical significance of these statistically. Significant treatment effects can also be justified. The effect size was "the difference between the means of outcome measures of the participants and control group". If there was no control group, the difference of the pre and post-treatment means would be used as the participants were acting as their own controls. If heterogeneity is present, results of the studies will not be apple to be combined but will be summarized as descriptive analysis (Herbert, 2000).

RESULTS

Flow of studies through the review: Only three studies met the inclusion criteria. Randomized controlled trials were made on the topic. The main reasons for exclusion of the other studies were: The other study doesn't meet the inclusion criteria. They did not meet the inclusion and exclusion criteria. The other studies not randomized control trials. They were non-intervention studies. They were narrative reviews.

Description of Studies: The data extracted from the 3 studies are summarized in Table (2). There were 108 participants in the 3 studies. They were post bariatric surgery patients their average age ranged from 20 to 50 years.

Methodological quality and level of evidence: The mean PEDro score of all studies was (range6-7) Table (3). (1 study with score8, 2 studies with scores 7), indicating that the quality of the RCTs included in this research was high to moderate. All studies were randomized; all studies had dropout rate and reported between-group difference, 100% group similarity at baseline and point estimate and variability. 33% of studies did not perform blinding of participant and therapist (100%), concealed allocation (0%), and blinding of assessor (100%). The level of evidence of eight studies out of the nine (88%) was 1b this means that the majority of the included studies had Good level of evidence for the recommendation to consider. The scoring of each study with the Physiotherapy Evidence Database (PEDro) scale is listed in Table 3. The scores of the all studies included in the study ranges from six to seven, the more the number of scores of the aspects evaluating the quality of the study, the more quality of the study**.**

Interventions: The intervention method, dose, duration and intensity varied across the studies. One study used Expanding ≥ 2.000kcal/week in moderate-intensity aerobic exercise at 60–70% of maximal oxygen consumption (VO2max) (Shah *et al*., 2011), second study used Exercise program before and 4 months after the operation (Stegen *et al*., 2011) and the third study used Conventional diabetes therapy with focus on weight loss by lifestyle change vs. laparoscopic adjustable gastric banding with conventional diabetes care (Dixon *et al*., 2008). The interventions mentioned in the previous literatures ranged to 36 sessions in frequency. The time of aerobic exercises application in each session was 20 minute on all reviewed studies.

Table 1. The three selected studies for this systematic review:

Study	Title
Shah *et al*., 2011	High-Volume Exercise Program in Obese Bariatric Surgery Patients: A Randomized, Controlled Trial
Stegen *et al*., 2011	Physical Fitness in Morbidly Obese Patients: Effect of Gastric Bypass Surgery and Exercise Training
Dixon *et al*., 2008	Adjustable Gastric Banding and Conventional Therapy for Type 2 Diabetes: A Randomized Controlled Trial

Table 2. Data extraction sheet

Study	Study design	Population	Age Range (X—)	Eligibility criteria	Intervention	Outcomes	Results
Shah *et al*., 2011	RCT double	33 obese post bariatric surgery patients	18- 65 years Mean age= 31.5	obese post bariatric surgery patients	- Expanding ≥ 2.000kcal/week in moderate-intensity aerobic exercise) Dosage 12 weeks	-physical activity -oxygen consumption - weight	VO2max (ml/kg/min) using a graded maximal exercise test on a treadmill and was supervised by a physician who monitored a 12-lead ECG.
Stegen *et al*., 2011	Pilot single	15 Morbidly obese patient with GB surgery	35-45years Mean age= 37.5	Morbidly obese patient with GB surgery	exercise program after GB Dosage 12 weeks (36sessions)	- dynamic and static muscle strength - aerobic capacity	Anthropometrical characteristics were measured, and an extensive assessment of physical fitness (strength, aerobic, and functional capacity).
Dixon *et al*., 2008	RCT double	60 Patients with Type 2 diabetes and AGB surgery	40-50 years Mean age= 42	Patients with Type 2 diabetes and AGB	Surgical Program: In addition to all aspects of the conventional-therapy program Dosage 2 years and 10 000 steps per day and 200 minutes per week	- type 2 diabetes -weight loss	Weight, blood pressure, anthropometric measures, and biochemical data (levels of fasting plasma glucose, glycated hemoglobin [HbA1c], C-peptide, and serum insulin, and a lipid profile)

RCT- randomized control trail.GB-gastric bypass.AGB- adjustable gastric banding.

Table 3. PEDro scores and level of evidence for included studies (n=3)

Criteria	Shah *et al*., 2011	Stegen *et al*., 2011	Dixon *et al*., 2008
1-Specified eligibility criteriaa	Yes	Yes	Yes
2-Random allocation of participants	Yes	Yes	Yes
3-Concealed allocation	Yes	Yes	Yes
4-Similar prognosis at baseline	Yes	Yes	Yes
5-Blinded participant	Yes	Yes	No
6-Blinded therapists	No	No	No
7-Blinded assessors	No	No	No
8-More than 85% follow-up for at least one key outcome	Yes	Yes	Yes
9-'Intention to treat' analysis	Yes	No	Yes
10-Between group statistical analysis for at least one key outcome	Yes	Yes	Yes
11-Point estimates of variability for at least one key outcome	Yes	Yes	Yes
PEDro score	8/10	7/10	7/10

Outcome Measures: Studies also differed in the type of outcome measures one study used Energy expended during moderate physical activity to measure VO2max (ml/kg/min) using a graded maximal exercise test on a treadmill and was supervised by a physician who monitored a 12-lead ECG (Shah *et al*., 2011) second study used exercise program after gastric bypass "GB+E," "the trained patients to measure decrease in body weight, BMI and waist circumference (Stegen *et al*., 2011) and the third study used Surgical Program In addition to all aspects of the conventional-therapy program to measure remission of type 2 diabetes through greater weight loss (Dixon *et al*., 2008).

Effect of aerobic exercises: Shah *et al.* (2011) found significant improvement in some quality-of-life scales. Changes in weight, energy and macronutrient intake, resting energy expenditure (REE) fasting lipids and glucose, and fasting and postprandial insulin concentrations were not different between the two groups. Stegen *et al*. (2011) found decrease in dynamic and static muscle strength and no improvement of aerobic capacity. - In contrast, an intensive exercise program could prevent the decrease and even induced an increase in strength of most muscle groups- Together with an improvement in aerobic capacity, functional capacity increased significantly. Both groups evolved equally with regard to body composition (decrease in fat mass and fat-free mass). (Dixon *et al*., 2008) found Participants randomized to surgical therapy were more likely to achieve remission of type 2 diabetes through greater weight loss. These results need to be confirmed in a larger, more diverse population and have long-term efficacy assessed.

DISCUSSION

Aerobic exercises are probably beneficial for weight loss of post bariatric surgery patients. The main objective of this review was to critically evaluate articles that demonstrate this assumption. As we selected only the randomized trials to meet the highest standard of evidence, a stiff conclusion cannot be achieved through this review with three studies. Furthermore, there was large clinical heterogeneity presented across the studies. Combining all outcome measures of all studies, aerobic exercise intervention generally demonstrated strong effects in improving weight loss in post bariatric surgery patients, comprising improvements in weight loss, physical fitness (strength, aerobic, and functional capacity) in addition to reductions in blood glucose, and improvements in Anthropometrical characteristics and body compositions .It helps in improvement of functional performance and in mobility when comparing with conventional therapy or controls . It was demonstrated that strategy such as exercise that helps to maintain REE may be useful in preventing weight regain. To help preserve LBM and thus REE, >60 g of protein intake per day is recommended in bariatric surgery patients (Shah *et al*., 2011).The exercise goals would be met by most of the subjects in the HVEP group and that it would lead to improvement in fitness in these subjects compared to the controls. The secondary outcome goals were weight loss, co morbidities, and health-related QOL. Nevertheless, bariatric surgery patients who engage in an exercise training program may be able to achieve similar weight loss without markedly reducing their energy intake compared to patients who are just dieting (Shah *et al*., 2011). It was demonstrated that loss in FFM should not be more than 22% of total weight loss because of its function in resting metabolic rate, maintenance of functional capacity as the body ages, thermoregulation, oxidative capacity of the body, and weight management. Exercise training can attenuate muscle atrophy or can even maintain FFM during weight loss in diet studies, but the value of a standardized exercise program after bariatric surgery, or specifically after gastric bypass surgery, has not been investigated. We now show that a 3×/week combined aerobic and resistance exercise program could not prevent the loss in FFM (Stegen *et al*., 2011). It has been reported that weight loss alone can improve metabolic flexibility, but recent diet studies showed that only weight loss combined with exercise can improve aerobic capacity, mitochondrial content, and electron chain transport activity in skeletal muscle of sedentary obese subjects (Stegen *et al*., 2011). It was demonstrated that Early and intensive treatment of type 2diabetes is known to improve health outcomes and quality of life. Weight control comprises perhaps the most important aspect of type 2diabetes management, with weight loss reducing morbidity and mortality. Recent evidence indicates that improvement in blood glucose control is related to degree of weight loss (Dixon *et al*., 2008). Lifestyle modification programs were individually structured to reduce energy intake, to reduce intake of fat (_30%) and saturated fats, and to encourage intake of low glycemic index and high-fiber foods. Physical activity advice encouraged 10 000 steps per day and 200 minutes per week of structured activity, including moderate intensity aerobic activity and resistance exercise. Lifestyle was the primary approach to weight loss, but very low calorie diets and medications were discussed with all patients and used after consultation with the dietitian or general physician if the patient expressed a desire to use additional measures (Dixon *et al*., 2008). From the previous studies it could be included that there is few studies support the effect of exercises therapy on the primary outcome such as weight loss in post operative obese patients and there are some evidence support its effects on secondary outcomes as remission of type2 diabetes, Anthropometric measurements, VO2max, Physical fitness, Blood pressure and Functional capacity. Evidence based medicine is needed to improve quality of health care. A body of evidence regarding safety, effectiveness, appropriate indications, cost-effectiveness, and other attributes of medical care are demanded (Manchikanti, 2008).

Conclusion

Available data from three reviewed studies demonstrated the efficacy of aerobic exercises as anew modality in reduction of weight loss in post bariatric surgery patients with immediate and long term effect on physical fitness including strength, aerobic, and functional capacity.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

Bond DS, Phelan S, Wolfe LG, Evans RK, Meador JG, Kellum JM, Maher JW. and Wing RR. 2009. B: "Becoming physically active after bariatric surgery is associated with improved weight loss and health-related quality of life."Obesity (Silver Spring)., 17(1):78-83.

Buchwald H. and Williams SE. 2003. "Bariatric surgery worldwide." *Obes Surg.,* 14(9): 1157-1164.

Dicenso A, Bayley L. and Haynes RB. 2009." Accessing pre-appraised evidence: fine-tuning the 5S model into a 6S model." *Evid Based Nurs*., 12(4):99-101.

.Dixon JB, O'Brien PE, Playfair J, Chapman L, Schachter LM, Skinner S, Proietto J, Bailey M, Anderson M 2008. Adjustable gastric banding and conventional therapy for type 2 diabetes: a randomized controlled trial;Jan 23;299(3):316-323

Flegal KM, Carroll MD, Curtin LR. and Ogden CL. 2008. "Prevalence and trends in obesity among US adults, 1999-2008." *JAMA*., 303(3):235-241.

Fontaine KR, Redden DT, Wang C, Westfall AO. and Allison DB. 2003. "Years of life lost due to obesity." *JAMA*., 289(2):187-193.

Hainer V, Toplak H. and Mitrakou A. 2008. "Treatment modalities of obesity: what fits whom?" *Diabetes Care*., 31 (2):269-277.

Herbert R. 2000. "How to Estimate Treatment Effects from Reports of Clinical Trials: Continuous outcomes." *Aust J Physiother*., 46(3):229-235.

Jakicic JM, Marcus BH, Gallagher KI, Napolitano M. and Lang W. 2003. "Effect of exercise duration and intensity on weight loss in overweight, sedentary women: a randomized trial." JAMA., 290(10):1323-1330.

Jewell D. 2008. "Evidence-Based Physical Therapy Practice" In: Jones And Bartlett learning books "Guide To Evidence-Based Physical Therapy Practice." 2nd (ed). USA; 5-84.

Klem ML, Wing RR, Chang CC, Lang W, McGuire MT, Sugerman HJ, Hutchison SL, Makovich AL. and Hill JO. 2000. "A case-control study of successful maintenance of a substantial weight loss: individuals who lost weight through surgery versus those who lost weight through non-surgical means." *Int J Obes Relat Metab Disord.,* 24(5):573-579.

Livhits M, Mercado C, and Yermilov I, Dutson E, Mehran A, Ko CY. and Gibbons MM. 2010. "Exercise following bariatric surgery: systematic review."*Obes Surg*., 20(5):657-665.

Maher CG, Sherrington C, Herbert RD, Moseley AM. and Elkins M. 2003. "Reliability of the PEDro Scale for Rating of Randomized Controlled Trials". *Phys Ther*., 83(8):713-721.

Manchikanti L. 2008. "Evidence Based Medicine Systematic Reviews, and Guidelines in Interventional Pain Management, Part I: lntroduction and General Considerations." *Pain Physician*., 11(2):161-186.

Moseley AM, Herbert RD, Sherrington C. and Maher CG. 2002. "Evidence for Physiotherapy Practice: A Survey of the Physiotherapy Evidence Database. (PEDro)." *Aust J Physiother*., 48(1):43-49.

Must A, Spadano J, Coakley EH, Field AE, Colditz G. and Dietz WH. 1999. "The disease burden associated with overweight and obesity."*JAMA*., 282(16):1523-1529.

Sarwer DB, Wadden TA. and Fabricatore AN. 2005. "Psychosocial and behavioral aspects of bariatric surgery." *Obes Res.,* 13(4):639-648.

Shah M, Snell PG, Rao S, Adams-Huet B, Quittner C, Livingston EH and Garg A 2011. High-volume exercise program in obese bariatric surgery patients: a randomized, controlled trial; Sep; 19(9):1826-1834.

Sjostrom L, Narbro K, Sjostrom CD, Karason K, Larsson B, Wedel H, Lystig T, Sullivan M, Bouchard C, Carlsson B, Bengtsson C, Dahlgren S, Gummesson A, Jacobson P, Karlsson J, Lindroos AK, Lönroth H, Näslund I, Olbers T, Stenlöf K, Torgerson J, Agren G. and Carlsson LM. 2007. "Effects of bariatric surgery on mortality in Swedish obese subjects." *N Engl J Med*., 357(8):741-752.

Stegen S, Derave W, Calders P, Laethem CV. and Pattyn P. 2011. "Physical Fitness in Morbidly Obese Patients: Effect of Gastric Bypass Surgery and Training." *Obes Surg*., 21(6):61-70.

Thomas J, Harden A, Oakley A, Oliver S, Sutcliffe K, Rees R, Brunton G. and Kavanagh J. 2004."integrating Qualitative Research with Trials in Systematic Reviews". *BMJ*., 328(7446) :1010-1012.

Wandell PE, Carlsson AC. and Theobald H. 2009. "The association between BMI value and long-term mortality." *Int J Obes (Lond).,* 33(5):577-582.

Wing RR. and Hill JO. 2001. "Successful weight loss maintenance." *Annu Rev Nutr*., 21(5):323-341.

Appendix (1)

Physiotherapy Evidence Database (Pedro) scale

Criteria	No	Yes
eligibility criteria were specified		
subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated in the order in which treatments were received)		
allocation was concealed		
the groups were similar at baseline regarding the most important prognostic indicators		
there was blinding of all subjects		
there was blinding of all therapists who administered the therapy		
there was blinding of all assessors who measured at least one key outcome		
measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups		
all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by "intention to treat"		
the results of between-group statistical comparisons are reported for at least one key outcome		
the study provides both point measures and measures of variability for at least one key outcome		

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