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Optimising weight loss outcomes in bariatric surgery patients: the role of physical activity

Abstract heading

Background: The effect of physical activity on weight loss outcomes post bariatric surgery is not well understood. This study sets out to determine if there is a correlation between physical activity levels of patients and their percentage excess weight loss following bariatric surgery.
Methods: Using the bariatric clinic's database, 261 participants were identified who underwent bariatric surgery between June 2008 and June 2009. The World Health Organisation's Global Physical Activity Questionnaire (GPAQ) was used to assess and quantify physical activity levels. In accordance with the GPAQ guidelines, metabolic equivalent (MET) minutes and total physical activity levels were calculated. Percentage excess weight loss values found in the clinic database were collected during the participants' follow-up visits.
Results: A total of 125 patients participated in the study. The study population was mainly female (258; 98.8%), with a Caucasian predominance (148; 56.7%). Surgeries included: laparoscopic band (110; 42.1%); Roux-en-Y gastric bypass (94; 36%); and sleeve (20; 7.6%). When stratified into low, medium and high physical activity levels, all three groups showed an increasing mean percentage excess weight loss over the six-month postoperative period, from 17.99-20.02% at one month to 35.93-40.67% at six months. However, there was no correlation between the physical activity levels or the MET-minutes and the percentage excess weight loss in the study group on the whole or when stratified by surgery type.
Conclusion: Our cross-sectional study failed to demonstrate a correlation between physical activity levels and percentage excess weight loss in post-bariatric surgery patients. Further prospective studies that consider factors such as percentage fat loss, lean body mass values, preoperative physical activity levels and caloric intake are recommended to gain a better understanding of the role physical activity plays in weight loss outcomes in postoperative bariatric patients.

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Introduction

Studies by the Center for Disease Control and the National Center for Health Statistics indicate that approximately 127 million Americans are overweight, of which approximately 60 million are obese and nine million are morbidly obese.[1] Similarly, obesity is a major public health problem in Ireland. The prevalence of obesity in 18- to 64-year-old adults has increased greatly in the past 20 years – from 8% to 26% in men, and from 13% to 21% in women.[2]
Established weight loss strategies, such as dietary and behavioural modification and exercise, are increasingly being accompanied by medical and/or surgical intervention.[3] Currently, lifestyle-based weight loss programmes are the cornerstone of treatment for obesity, providing a mean weight loss of 5-10% in most individuals.[4] However, it has been repeatedly shown that this weight is usually regained over time, and sometimes the regained weight exceeds that initially lost.[5-7]
The range of co-morbidities associated with obesity involves almost every organ system and includes hypertension, insulin resistance and raised serum cholesterol levels.[7,8] Individuals of excessive body weight must be encouraged to lose weight and engage in healthy behavioural changes to decrease their risk of developing

obesity-related morbidities. Bariatric surgery is rapidly becoming a mainstay of treatment for obese (body mass index (BMI) >30kg/m^2) and morbidly obese (BMI >40kg/m^2) individuals with significant comorbidities, such as hypertension, diabetes or sleep apnoea, and for those who fail to lose weight using non-surgical approaches.[9]
There has been a dramatic increase in the number of bariatric surgeries performed in the United States, from 4,925 operations in 1990 to 70,256 operations in 2002.[10] In Ireland, there are currently two Health Service Executive (HSE)-funded centres that perform bariatric surgery, St Columcille's Hospital in Loughlinstown in Dublin and University Hospital Galway, each of which performs roughly 100 surgeries per year.[11,12,13]
Weight loss outcomes in bariatric surgery are thought to be mainly due to either restrictive or restrictive and malabsorptive processes. Among the most popular bariatric procedures in practice today are the adjustable laparoscopic banding and Roux-en-Y gastric bypass procedures. The former is a restrictive procedure where a silicone band is placed around the fundus of the stomach to restrict the volume of the stomach, and thus the amount that can be consumed in one meal. The Roux-en-Y gastric bypass procedure restricts the size of the stomach, but also bypasses a significant part of the small intestine to promote weight loss by malabsorption.[9]
The effect of physical activity on weight loss outcome when combined with bariatric surgery has not been widely considered in a research setting. This cross-sectional study aims to determine the correlation, if any, between physical activity levels of postoperative bariatric patients and their excess weight loss outcomes.

Methods

Participants

Participants aged 18 to 79 years who underwent a bariatric intervention at the University of Texas Houston Institute between June 2008 and June 2009 were included in the study. Participant information and medical data were obtained from the bariatric clinic online database. The eligible population consisted of 261 patient records who were at least six months postoperative to allow for sufficient time for postoperative and follow-up assessments.

Physical activity assessment

The second version of the Global Physical Activity Questionnaire (GPAQ), developed by the World Health Organisation, was used in the telephone survey to collect information regarding the physical activity level of the participants.[14] The GPAQ questionnaire is composed of 16 questions divided into four sections: activity at work; travelling to and from places; recreational activities; and, sedentary activity. The sections are further categorised into vigorous work, moderate work, travel, vigorous recreation, moderate recreation and sitting.
The metabolic equivalent (MET) was used as the measure of physical activity. MET is the ratio of a person's working metabolic rate to his/her resting metabolic rate. One MET is defined as the energy equivalent of sitting quietly, which is 1kcal/kg/hr. MET can also be defined in terms of the oxygen cost of sitting quietly, which has an oxygen uptake of 3.5ml/kg/min. MET values are applied to the participants' activity intensity during work, transportation and recreation. The Physical Activity Guidelines Advisory Committee estimated that vigorous activity at work or recreation is equivalent to eight METs, and moderate activity at work or recreation is four METs.[14] The different types of activities are grouped together to generate a MET value for each type of activity. The total physical activity (TPA) score was calculated by combining the total MET-minutes at work, transportation and recreation.
Based on responses, participants were classified into three categories as defined by the GPAQ analysis framework:

1. High activity level: person participates in: (1) vigorous-intensity activity at least three days a week and achieves a minimum of 1,500 MET-minutes per week; or, (2) at least seven days of any combination of walking and moderate- or vigorous-intensity activities and achieves a minimum of 3,000 MET-minutes per week.
2. Moderate activity level: a person does not meet the criteria for a high activity level, but meets the criteria of: (1) three or more days of vigorous-intensity activity for at least 20 minutes per day; (2) five or more days of moderate-intensity activity or walking for at least 30 minutes per day; or, (3) five or more days of any combination of walking and moderate- or vigorous-intensity activities achieving a minimum of 600 MET-minutes per week.
3. Low activity level: person does not meet criteria for high or moderate activity levels.

Physical and biochemical assessments

All physical and biochemical information was gathered from the Memorial Hermann Bariatric Clinic online databases. Weight loss and percentage excess weight loss (%EWL) were recorded for all patients at one, three, six, nine and 12 months postoperatively. The total excess weight was calculated based on each individual's ideal body weight as per the National Institute of Health's guidelines. In this study, %EWL represents weight loss as a fraction of total excess weight.

Statistical analysis

Analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Mac, version 18.

Results

Using the bariatric clinic database, 261 records were identified for 242 patients. Of these patients, 113 could not be reached, one had passed away and three refused to participate (**Figure 1**). Of the 125 who accepted the study invitation, 100 were female (80%), and 87 were Caucasian (69.6%). Bariatric surgical interventions were performed in all participants, of whom 57 underwent laparotomy band procedures (45.6%), 55 underwent Roux-en-Y gastric bypass procedures (44%), and 13 underwent sleeve procedures (10.4%).
Using the GPAQ, the general physical activity level of each participant was gauged. In the months following surgical intervention, 30 patients (24.0%) had high activity levels, 38 patients (30.4%) had moderate activity levels and 57 patients (45.6%) had low activity levels.
All three patient groups experienced a greater %EWL by six months

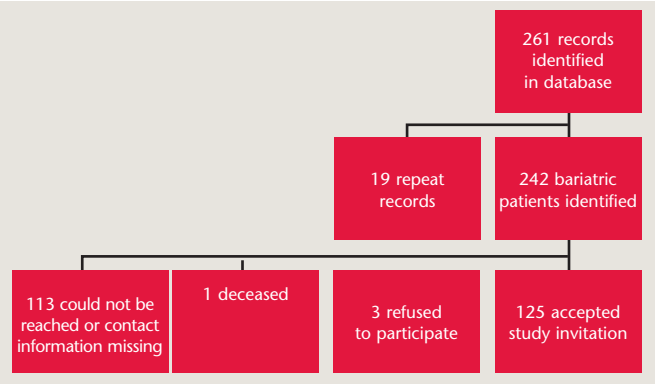

FIGURE 1: A flow chart showing the breakdown of the 261 records identified on the bariatric clinic database.

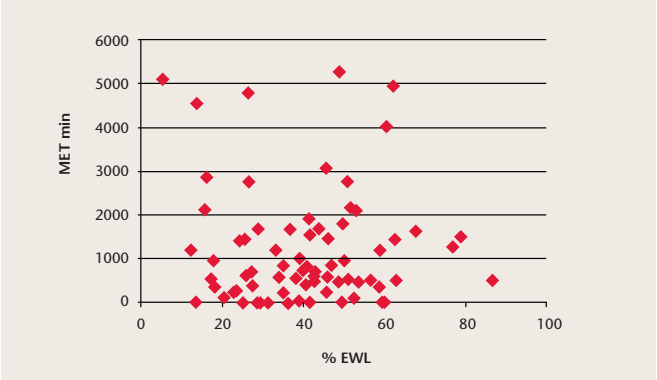

FIGURE 2: Correlation between metabolic equivalent minutes (MET-minutes) and percentage excess weight loss (%EWL) at six months post bariatric intervention; r=-0.04.

Table 1: Percentage excess weight loss (%EWL) at one, three and six months after bariatric surgical intervention in patients with low, moderate or high activity levels.

Months post operation	%EWL (95% CI)		
	Low activity level [n=57]	Moderate activity level [n=38]	High activity level [n=30]
1	20.02 (15.63-24.41)	19.07 (14.218-23.92)	17.99 (14.73-21.25)
3	29.29 (26.15-32.43)	27.14 (22.02-32.26)	27.34 (23.07-31.61)
6	40.67 (35.78-45.56)	35.93 (30.73-41.14)	39.40 (33.40-45.40)

%EWL: percentage excess weight loss.

than by one month post operation (**Table 1**). While the increase in %EWL from one to six months post operation was significant in all three groups, there was no significant difference in weight loss in terms of %EWL among the three groups at any time point.

Without considering the type of bariatric procedure performed, no correlation was observed between the level of physical activity and the %EWL (r=-0.04; **Figure 2**). No correlation was observed even after the stratification of patients by type of bariatric intervention. In particular, no relationship between MET-minutes and %EWL was observed in either laparotomy band patients (r=-0.14; **Figure 3**) or Roux-en-Y gastric bypass patients (r=0.16; **Figure 4**).

Discussion

Data from this investigation indicate that all patient groups experienced significant weight loss six months after bariatric surgery irrespective of physical activity level (**Table 1**). Using data from all 125 participants, no correlation was found between activity level and weight loss at six months post surgery (r=-0.04; **Figure 2**). The lack of correlation of physical activity and weight loss in the post-surgical patient persisted irrespective of the surgery type, whether a laparotomy band (r=-0.14) or Roux-en-Y gastric bypass procedure was performed (r=0.16).

These results are consistent with another study that demonstrated no difference in weight loss between exercise and non-exercise groups following a duodenal switch procedure – a malabsorptive bariatric procedure that re-routes the small intestine.[9] However, during the 18-month follow-up, it was noted that the exercise group experienced a 28% greater loss of fat mass and an 8% greater gain in lean body mass than the non-exercise group. Another study investigated the physical activity level and weight loss outcomes in 199 Roux-en-Y gastric bypass patients, and found that at one year post operation, greater changes in the physical activity level correlated with better weight loss outcomes.[15,16] Those who did not increase their activity levels from the pre- to postoperative period, even if highly active, did not experience significant weight loss.

To assess the role of physical activity in the %EWL of bariatric patients postoperatively, the GPAQ questionnaire was used to assess the activity levels of the study participants. This questionnaire was selected because of its validity and adaptability.[17] Gauging the activity level by duration and intensity, and categorising the four domains of work, commuting, recreation and sitting, allowed for a logical and comprehensive estimate of an individual's activity level. In addition, unrestrictive, open-ended questions allowed participants to take into consideration the wide array of activities in which an individual may participate in a typical week. A recent study of more than 2,500 individuals from diverse sociocultural, educational and economic backgrounds in nine countries showed that GPAQ provides reproducible data and is a suitable instrument for assessing physical activity.[17]

This study has several limitations. The sample size was small because of the inability to contact 113 patients due to missing or inaccurate contact information and the restriction of the study to one centre.

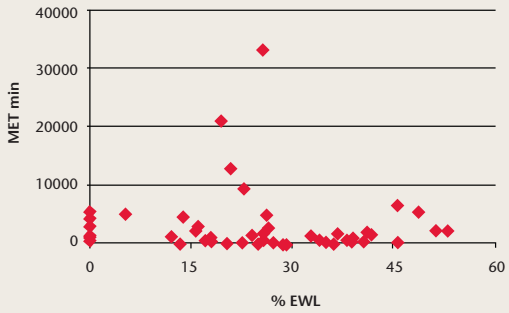

FIGURE 3: Correlation between MET-minutes and %EWL at six months post laparotomy band intervention; r=-0.14.

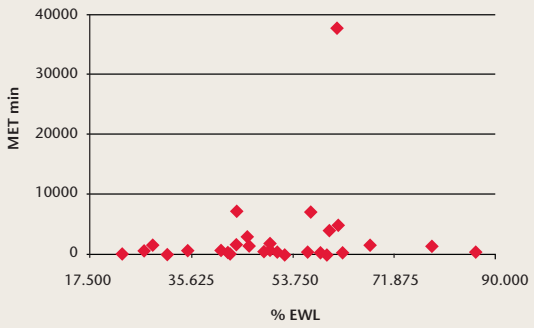

FIGURE 4: Correlation between MET-minutes and %EWL six months after Roux-en-Y gastric bypass surgery; r=0.16.

Having followed only 125 patients reduces the power of this investigation. Furthermore, the use of a questionnaire for assessment of a major aspect of this study is subject to self-report bias – as bariatric patients are regularly monitored for weight loss, diet and exercise and thus may give answers that they feel are expected of them – and recall bias.[18] Finally, no data was available on the preoperative activity levels of our study participants, so change in activity levels pre and post surgical intervention could not be studied.

Future studies concerning weight loss and exercise in post-intervention bariatric patients should be of a prospective design and consider the change in physical activity level and measurements of lean body mass and fat loss, rather than focusing solely on post-intervention activity levels and percentage weight loss. Elucidation of the role of exercise, among other factors, in weight loss after surgical intervention may inform management guidelines regarding the bariatric patient.

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