



# Analysis of the Relationship between Physical Activity and the Factors Related to Weight Management of Bariatric Surgery Patients

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## Abstract

**Background:** We aimed to analyze the relationship between physical activity and the factors related to the weight management of bariatric surgery patients.

**Methods:** This descriptive-correlational study was conducted on 87 participants, who underwent bariatric surgery in Cyprus between May and Oct 2020. The International Physical Activity Questionnaire and a questionnaire on socio-demographic and obesity characteristics were used to collect data.

**Results:** Mean age of the participants was  $34.7 \pm 8.43$  and 65.5% were female. A statistically significant difference was found between physical activity levels and weight loss ( $P=0.021$ ). Post-bariatric surgery physical activity level was low active for 65.5% of the participants. There was a statistically significant difference between the MET scores of the participants according to their gender, and the scores of men were higher than women (2256.9; 1110.9 respectively). Although most of the participants in the study were females, women lost less weight than males (45.5; 54.2 respectively).

**Conclusion:** Being female, married, and having chronic diseases caused less weight loss after bariatric surgery. As the physical activity levels of the patients increased, their weight loss increased. In line with these results, people undergone bariatric surgery and are at risk of regaining weight should be followed closely after surgery and appropriate physical activities should be planned.

**Keywords:** Physical activity; Weight control; Bariatric surgery; Patient following

## Introduction

Obesity is a chronic multifactorial disorder of excess lipid accumulation in adipose tissue and ectopic sites, such as skeletal muscle and liver. It is generally caused by environmental factors and genetic predisposition (1). Diet and physical exercise are the primary treatment methods for obesity, and drug therapy is used if the first two methods are unsuccessful within the first six months.

There is increasing evidence that bariatric surgery is a more effective treatment for morbidly obese patients who cannot lose weight despite all these practices (2). Bariatric surgery is a surgical intervention that improves the quality of life and decreases mortality by reducing obesity and associated chronic diseases (2,3). This surgical method decreases the risk of new health problems associ-



ated with obesity. (4). Roux-en-Y gastric bypass, sleeve gastrectomy, adjustable gastric banding, and biliopancreatic diversion are among the bariatric surgical procedures (5,6).

Multidisciplinary teams play a key role to prevent or treat complications that may occur after bariatric surgery. To obtain successful surgical outcomes during the postoperative period, health professionals should inform the patients about the effects of physical activity and the reduction of sedentary behavior on weight management. Several factors influence regaining weight after the surgery, including depression, eating disorders, urge to eat, inability to adapt to the new lifestyle, and lack of exercise (3,7–9).

Physical activity before and after bariatric surgery has a positive impact on weight loss and body composition (10). Although there is no specific guideline for physical activity in bariatric surgery in the literature, it is recommended to start physical activity in the preoperative period (11–13). A combination of 20 min of aerobic exercise and resistance training 3 or 4 d a week, together with dietary restriction before bariatric surgery, will reduce the risk of surgical complications, accelerate recovery and increase cardiorespiratory fitness (11,13,14). The American Society for Metabolic and Bariatric Surgery (ASMBS) recommends an average of 30 min of moderate-intensity exercise daily after surgery and making it a routine of daily life.

Bariatric surgery is the most effective method of the last century for patients to lose weight. Most of the weight loss occurs within six months after bariatric surgery and weight stabilization takes place in the first two years (15). Moreover, according to a meta-analysis study, bariatric surgery significantly improves physical activity up to 3 yr after surgery (16). On the other hand, weight regain is an unexpected and undesirable situation for patients after bariatric surgery (17). Patients' non-compliance with the recommendations regarding lifestyle changes leads to weight regain (18). Furthermore, 30% to 50% of the patients regain weight in the first 18 to 24 months after the surgery (19). It is a fact that increasing physical activity is very important in terms of main-

taining the lost weight, not regaining it, and minimizing the formation of skin deformations in the body while losing weight (20). Following the surgery, patients are followed up for a long period. During the postoperative follow-up period, physical activity status, barriers to exercise, and other factors that influence weight loss should be evaluated carefully. Revealing the physical activity trends and other factors that are effective in weight loss after bariatric surgery will be effective in developing individualized weight management strategies for patient.

We aimed to analyze the relationship between physical activity and the factors related to weight management of bariatric surgery patients. The findings of this study may be used as primary data to plan interventions for effective weight management and physical activity by the health professionals, who are responsible for the care and treatment of patients undergoing bariatric surgery.

#### *Research questions include the followings*

1. What are the physical activity levels of individuals undergoing bariatric surgery?
2. Is there a relationship between physical activity and weight loss in individuals undergone bariatric surgery?

## **Methods**

### *Study Design and Setting*

This study was conducted in the descriptive correlational design, in a public hospital in North Cyprus between May and Oct 2020.

### *Participants*

Overall, 144 individuals who underwent Bariatric Surgery between May and Oct 2020, when the study was conducted, came for control. Overall, 38 of these patients were not included in the study because they had an operation within the first 3 months. Of the 106 patients who met the inclusion criteria, 87 agreed to participate in the study voluntarily and constituted the sample of the study (n=87). An average of 82% of the re-

search population has been reached. The average age of the participants was  $34.7 \pm 8.43$  year. 65.5% of participants were female, 51.7% were married, 52.9% were a bachelor's degree and above, and 69% had no chronic diseases.

### ***Inclusion Criteria***

The study was conducted with volunteering patients above the age of 18 yr undergone bariatric surgery and were at least 3 months after the operation and had no communication problems.

### ***Exclusion Criteria***

Those with diseases that prevent physical activity and those with eating disorders were not included in the study.

### ***Data Collection Tools***

Questionnaire sociodemographic and obesity characteristics, and the International Physical Activity Questionnaire-Short form were used to collect data on the physical activity level of the patients.

### ***Questionnaire on Sociodemographic Characteristics***

This questionnaire included questions on age, gender, marital status, education level, the state of having a chronic illness, duration after surgery, regular exercise status, and barriers to exercise. Also, pre-operative and post-operative weights were collected from the participants to calculate the BMI difference and weight loss values.

### ***International Physical Activity Questionnaire-Short Form (IPAQ-SF)***

Craig et al. evaluated physical activity performed by the patient in the last seven days (21). The validity and reliability of the Turkish version were performed by Öztürk (22). The questionnaire was composed of seven questions on duration (minutes) and frequency (days) spent on, sitting, walking, and engaging in vigorous and moderate activities. The energy required for the activities was calculated with the MET-minute score. The IPAQ-SF was developed as an outcome to measure levels of physical activity for comparisons

across international populations. The IPAQ-SF measures energy expenditure per week (METs-1 min<sup>-1</sup> week) and can give a continuous or categorical score rating of an individual's weekly PA level; low (<600 METs-1 min<sup>-1</sup> week), moderate ( $\geq 600$ –2999 METs-1 min<sup>-1</sup> week) and high PA levels ( $\geq 3000$  METs-1 min<sup>-1</sup> week). The IPAQ-SF contains four items that assess sedentary activities, walking activities, moderate-intensity activities, and vigorous-intensity activities (21).

### ***Ethical Considerations***

Permission was obtained from the ethics committee of the hospital where the study was conducted (YTK.1.01 (EK005/20)). In addition, a voluntary informed consent form prepared in accordance with the principles of the Declaration of Helsinki was used to obtain written informed consent.

### ***Data Analysis***

Collected data were analyzed by using SPSS ver. 15.0 (Inc., Chicago, IL, USA). Kolmogorov-Smirnov was used to evaluate the normality of the variables. Categorical variables were evaluated with the Chi-Square test. The difference between the groups was compared with the Independent Samples t-Test and One-way-ANOVA. Statistical significance was set at 0.05.

## **Results**

Table 1 shows some characteristics of the participants related to bariatric surgery. It had been 12 months or more since the operation of 69% of the participants. Furthermore, 73.6% of participants underwent sleeve gastrectomy, 74.7% of the participants were morbid obese in the pre-operative period and 60.9% were exercising regularly. The physical activity level for 65.5% of the participants was low and 59.8% did not have barriers to exercise. The mean BMI difference and weight loss before and after the surgery were  $17.24 \pm 5.78$  and  $48.5 \pm 17$ , respectively.

**Table 1:** Some Characteristics of the Participants Related to Bariatric Surgery

<i>Variables</i>	<i>Number</i>	<i>Percentage</i>
Duration after operation		
3- 6 months	6	6.9
6 -12 months	21	24.1
More than 12 months	60	69
Type of bariatric surgery		
Sleeve gastrectomy	64	73.6
Gastric Bypass	18	20.7
Adjustable gastric banding	5	5.7
Preoperative BMI		
18.5-24.9 (healthy weight)	0	0
25-25.9 (overweight)	0	0
30-39.9 (Obese )	22	25.3
40 and above (Morbid Obese)	65	74.7
Postoperative BMI		
18.5-24.9 (healthy weight)	27	31
25-29.9 (overweight)	28	32.2
30-39.9 (Obese )	32	36.8
40 and above (Morbid Obese)	0	0
Physical Activity Level		
Low (<600 MET-min/week)	57	65.5
Moderate (600-3000 MET-min/week)	21	24.1
High (>3000 MET-min/week)	9	10.3
Regular exercise		
No	34	39.1
Yes	53	60.9
Barriers to exercise		
No barriers	52	59.8
Time constraints	20	23
Fatigue	8	9.2
Other	7	7.9
	Min-Max	Mean (SD)
BMI difference	5.3-36.3	17.24 (5.78)
Kg difference	16-100	48.50(17.0)

\*IPAQ( International Physical Activity Questionnaire) was used to determine physical activity level.

Table 2 presents the findings on the relationship between the MET scores of the participants and some of their characteristics. There was a statistically significant difference between the MET scores of the participants according to their gender, and the scores of men were higher than women ( $2256.93 \pm 2037.72$ ;  $1110.85 \pm 1306.61$

respectively). No statistically significant difference was found between the MET scores and age ( $P=0.059$ ), marital status ( $P=0.645$ ), education level ( $P=0.313$ ), chronic disease ( $P=0.339$ ), duration after the operation ( $P=0.158$ ), type of bariatric surgery ( $P=0.891$ ), preoperative BMI ( $P=0.174$ ), and postoperative BMI ( $P=0.059$ ).

**Table 2:** Relationship between MET Scores of The Participants and Some of Their Characteristics

<i>Variables</i>	<i>N</i>	<i>MET Score</i>		<i>Test Sta- tistics</i>	<i>P*</i>	<i>η<sup>2</sup></i>
		<i>M</i>	<i>SD</i>			
<b>Age group</b>						
35 yr and below	50	1703.79	1793.81	1.415 <sup>a</sup>	0.161	0.023
Above 35 yr	33	1182.48	1433.20			
<b>Gender</b>						
Female	57	1110.85	1306.61	-3.187 <sup>a</sup>	0.002	0.107
Male	30	2256.93	2037.72			
<b>Marital status</b>						
Married	45	1421.37	1844.14	-.485 <sup>a</sup>	0.629	0.003
Single	42	1596.79	1494.15			
<b>Education</b>						
High school and below	41	1223.90	1834.41	-1.412 <sup>a</sup>	0.139	0.026
Bachelor's degree and above	46	1757.53	1498.62			
<b>Chronic disease</b>						
Yes	27	1293.72	1211.80	-.791 <sup>a</sup>	0.431	0.007
No	60	1601.60	1849.84			
<b>Duration after operation</b>						
3- 6 months	6	3199.00	3140.08	2.302 <sup>b</sup>	0.316	0.081
6 -12 months	21	1190.38	969.27			
More than 12 months	60	1447.24	1616.92			
<b>Type of bariatric surgery</b>						
Sleeve gastrectomy	64	1605.46	1748.99	2.185 <sup>b</sup>	0.335	0.011
Gastric Bypass	18	1177.72	1559.36			
Adjustable gastric banding	5	1415.60	1136.99			
<b>Preoperative BMI</b>						
30-39.9 (Obese )	22	1054.45	1035.42	-1.471 <sup>a</sup>	0.145	0.025
40 and above (Morbid Obese)	65	1658.90	1825.68			
<b>Postoperative BMI</b>						
18.5-24.9 (healthy weight)	27	1080.89	980.07	2.991 <sup>b</sup>	0.224	0.059
25-29.9 (overweight)	28	2069.30	2125.08			
30-39.9 (Obese )	32	1371.94	1612.40			

<sup>a</sup>. Independent Samples t-Test, <sup>b</sup>chi-square test,  $\eta^2$ : effect size

Table 3 shows the relationship between some of the characteristics of the participants and their weight loss. Weight loss was lower for female participants ( $45.5 \pm 14.2$ ) than the males ( $54.2 \pm 20.3$ ) ( $P=0.022$ ). Besides, the weight loss of single participants ( $52.5 \pm 19.7$ ) was higher than married participants ( $44.8 \pm 13.2$ ) ( $P=0.032$ ). Additionally, weight loss was lower for the participants with chronic diseases ( $42.9 \pm 12.3$ ) than the participants without chronic diseases ( $51.0 \pm 18.3$ )

( $P=0.038$ ). Finally, there was a statistically significant difference between physical activity levels and weight loss ( $P=0.021$ ). Mann-Whitney U test to find the source of difference revealed that the difference stemmed from the 'highly active' group, whose weight loss ( $63.22 \pm 2.7$ ) was significantly higher than other groups. No statistically significant difference was found between weight loss and age ( $P=0.078$ ), an education level ( $P=0.973$ ), and barriers to exercise ( $P=0.055$ ).

**Table 3:** Distribution of Participants' Characteristics Associated with Weight Loss

<i>Factors</i>		<i>Weight Loss M (<math>\pm</math>SD)</i>	<i>Test</i>	<i>P</i>	<i><math>\eta^2</math></i>
<b>Age group</b>	n				
35 yr and below	54	51.0(18.4)	1.786 <sup>a</sup>	0.078	0.036
Above 35 yr	33	44.4(13.8)			
<b>Gender</b>					
Female	57	45.5(14.2)	-2.324 <sup>a</sup>	0.022	0.060
Male	30	54.2(20.3)			
<b>Marital status</b>					
Married	45	44.8(13.2)	-2.176 <sup>a</sup>	0.032	0.053
Single	42	52.5 (19.7)			
<b>Education</b>					
High school and below	41	48.4(16.8)	-0.034 <sup>a</sup>	0.973	0.000
Bachelor's degree and above	46	48.6 (17.3)			
<b>Barriers to exercise</b>					
Yes	35	44.26(15.45)	1.943	0.055	0.043
No	52	51.37(17.5)			
<b>Chronic disease</b>					
Yes	27	42.9(12.3)	-2.109 a	0.038	0.050
No	60	51.0(18.3)			
<b>Physical activity level*</b>					
Low active	57	47.1(15.6)			
Moderate active	21	46.1(15.8)	4.588 b	0.101	0.088
High active	9	63.2(22.7)			

\*: IPAQ was used to determine physical activity level

<sup>a</sup>. Independent Samples t-Test; <sup>b</sup>Kruskal-Wallis

## Discussion

This study analyzed the relationship between physical activity level and weight management of bariatric surgery patients. As a result of the study, a statistically significant difference was found between physical activity levels and weight loss ( $P=0.021$ ). In other words, increased physical activity after bariatric surgery accelerated weight loss. Although 59.8% of the participants stated that they had no disability to exercise, the physical activity level of 65.5% was low active. The percentage of physically low active female participants was higher than males (80.7% and 19.3%, respectively). Weight loss was lower for female participants ( $45.5\pm 14.2$ ) than the males ( $54.2\pm 20.3$ ) ( $P= 0.022$ ). These results reveal the

contribution of physical activity to weight management after bariatric surgery. Physical activities should be regulated and followed closely, especially in the postoperative period of the female.

The mean age of the participants was  $34.7\pm 8.43$ , most were female. According to WHO, the global prevalence of obesity was 13% in 2016 and 15% of the female and 11% of the male population were obese. Turkish Health Survey prepared by the Turkish Statistical Institute (TUIK) in 2019 found that the prevalence of obesity in people over the age of 15 yr was 21.1%. TUIK reported that 24.8% of the female and 17.3% of the male population in Turkey were obese. Parallel to our findings, obese patients in another study on patients that underwent bariatric surgery were mostly female with higher education levels and morbid obesity (23).



Patient adherence during the postoperative period is crucial to maintaining weight control. Only 60% of the participants in this study regularly performed physical exercise whereas others had barriers to exercise, including time constraints (23%) and fatigue (9.2%). A study on patients that underwent bariatric surgery found that time constraint was the most frequent barrier to exercise (24). Participants in the same study also noted fatigue as a barrier to exercise. Barriers to exercise in our study were similar to those in the literature. Physical activity and exercise lead to improvements in body composition, bone mineral density, and muscle strength. Due to this reason, discharge education should underline the importance of physical exercise and patients should be regularly evaluated in terms of physical activity levels during their follow-up (25).

Gender is considered an important factor influencing physical activity levels. This study found that the percentage of physically low active female participants was higher than males. Studies on the physical activity levels of university students found that the physical activity levels of male students were significantly higher than female students (19,26). Married and obese participants had higher BMI and lower physical activity levels (27). In another study on weight loss of men and women, after aerobic exercise for 16 months, men lost more weight than women (28,29). The WHO states that physical inactivity is higher in women and young girls than in men. The reasons for this are stated as not being able to go to physical activity centers due to economic reasons, and allocating limited time to physical activity due to their workload at home and caregiver roles. Cultural factors limit the participation of women in some activities (30). In this sense, our findings are parallel to the findings in the literature. Based on the findings, female patients, who have lower physical activity and a higher prevalence of obesity, should be closely monitored during the postoperative period.

The level of physical activity is vital for weight control. Increasing energy consumption leads to a 4.2% loss in BMI one year after bariatric surgery and prevents regaining weight in the first

two years. Besides, it increases the quality of life by improving the psycho-social conditions of the patients (25). In our study, there was a statistically significant relationship between physical activity levels and weight loss, and weight loss was higher for the physically active participants ( $63.22 \pm 2.7$ ). Similarly, Herman et al. and Amundsen et al. reported that an increase in physical activity levels helped weight loss (31, 32). Bariatric patients that reported more than 200 min of exercise a week had greater weight loss than those who did less than 90 min a week (33). On the other hand, a meta-analysis found no impact of physical exercise on enhancing weight loss in bariatric patients but noted that the variation in the protocols used made it early to reach a definite conclusion (34).

Physical level activity for 2/3 of the participants in our study was low active. Similarly, the physical activity levels of the participants that would receive bariatric surgery in the study of Bond et al. were low (35). Activity levels of bariatric surgery patients, evaluated by a team of a dietician, psychologists, and physiotherapists in the study of Nova et al., improved from inactive to moderate or sufficiently active. The physical activity levels of bariatric surgery patients that received exercise training before the surgery improved one year after the surgery (36). Bariatric surgery patients should start physical exercise before the surgery to better adhere to physical activity requirements during the postoperative period (9,25). A pre-operative exercise program should take the existing level of physical activity, functional capacity, and body composition of the patients into consideration (13).

## **Limitation**

One of the limitations of this study is that the physical activity levels of the participants were measured with subjective measurement tools. To evaluate and categorize the self-reports of the participants, a measurement tool that conducts validity and reliability studies in many international languages and Turkish was used. In addition to these, it is recommended to use devices

that provide objective measurements of physical activity levels in future studies. Another limitation is that most of the participants are women.

## Conclusion

Being female, married, and having chronic diseases caused less weight loss after bariatric surgery. As the physical activity levels of the patients increased, their weight loss increased. It is recommended that people undergone bariatric surgery and are at risk of regaining weight should be followed closely after surgery and appropriate physical activities should be planned.

## Journalism Ethics 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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## Conflicts of interest

The authors declare that there is no conflict of interest.

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