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Weight Regain After Bariatric Surgery In Taif Region

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Abstract:

Background: The objective of this study is to assess and evaluate weight regain in patients submitted to bariatric surgery over a 2-year follow-up period. And Identify modifiable behaviors associated with weight regain after bariatric surgery. Getting a clear definition for weight regain after bariatric surgery association with clinical outcomes.
Methodology: The study was a cross-sectional study that was conducted in the Taif region for a duration of one year. The data collection tool used in this study was an electronic questionnaire sent to the patients. The questionnaire was designed to collect information on patient demographics, type of surgery, dietary and lifestyle habits, medical conditions, and weight management outcomes.
Results: we included 53 patients who underwent bariatric surgery, with 36 (67.9%) being male, with mean age of the patients was 39.64 years. the rate of weight gain after surgery appears to be relatively high, with 23 (43.4%) patients gaining more than 10 Kg, 15 (28.3%) patients gaining between 5-10 Kg, and only 15 (28.3%) patients gaining less than 5 Kg. it was found that those who followed a diet with clinical dietitian after surgery had a higher percentage of gaining > 10 kg compared to those who did not follow such a diet.
Conclusion: Weight regain following bariatric surgery is a common issue that requires ongoing management to avoid recurrence. In addition to highlighting the value of regular follow-up with a clinical dietitian and nutritional management in weight maintenance following surgery, this study offers insights into the factors linked with weight rebound after surgery.

Introduction:

Bariatric surgery promotes adequate reduction of excess body weight, with regained significant weight observed after five years, the postoperative time, labor activity stimulating eating out were the determining factors for the occurrence of weight regain [1]. This study investigated the prevalence of obesity in Saudi Arabia from a recent national level survey conducted by phone-interviews.

Prevalence of obesity in Saudi Arabia in national weighted (BMI ≥ 30) was 24.7%. This weighted prevalence of obesity is decreasing compared to 25.6% in 2018 and 28.7% in 2013. This finding is also lower than other Middle Eastern countries [2]. Bariatric surgeries are one of the reasons for the decline in obesity in Saudi Arabia [3]. The prevalence and clinical significance of weight regain after bariatric surgery remains largely unclear due to the lack of a standardized definition of significant weight regain. The development of a clinically relevant definition of weight regain requires a better understanding of its clinical significance.

There is little robust data on weight regain (WR) after bariatric surgery making it difficult to counsel patients regarding long-term outcomes of different bariatric procedures [4]. There are several mechanisms

by which bariatric surgery effectively modulates appetite which is thought to be a major factor in its success. However, a proportion of patients will experience clinically significant weight regain following bariatric surgery and the reasons for this are multifactorial [5]. A multidisciplinary approach consisting of behavioral modification, along with a secondary intervention such as use of an appetite suppressant, endoscopic plication or revision surgery may be utilized to give the patient the best chance of losing weight. The best practice perhaps therefore should be that patients seeking bariatric surgery are counseled on the likelihood of weight regain as well as informed of possible options should it occur [6].

Better understanding of the effectiveness and safety of dietary, behavioral, pharmacological, and surgical prevention and management strategies will assist in the selection of intervention/s to mitigate WR/IWL [7]. As the combination of such range of factors that contribute to WR/IWL are likely to be unique for each patient, applying such newly gained knowledge within a multidisciplinary team could be a step forward to individualized management plans tailored to patients in order to achieve resolution of WR/IWL [5]. The objective of this study is to assess and evaluate weight regain in patients submitted to bariatric surgery over a 2-year follow-up period. And Identify modifiable behaviors associated with weight regain after bariatric surgery. Getting a clear definition for weight regain after bariatric surgery association with clinical outcomes.

Methodology:

Location and Period:

The study was a cross-sectional study that was conducted in the Taif region for a duration of one year.

Sample Size and Sampling Technique:

The inclusion criteria were patients who underwent bariatric surgery and were between 20 and 70 years with both men and women included; the sample size in this study was 100-150. The participants to include in the study were purposively sampled in relation to the Judgement (or Purposive) Sampling strategy.

Data Collection:

For this study an electronic questionnaire was sent to the patients as the data collection tool. The questionnaire was developed to obtain data on patient demographics, surgical characteristics, dietary and lifestyle related habits, comorbidities, and weight control success. The questionnaire was pilot-tested on some of the patients and these results were not included in the analysis. Participants were given information about the study and requested consent to participate.

Ethical Considerations:

The study was in compliance with the declaration of Helsinki, and IRB approval was obtained prior to the onset of the study. Anonymity and secure storage of data guaranteed the privacy of the participants' information.

Statistical Analysis:

The results obtained from the online questionnaires have been processed using the Causal Analysis. Descriptive statistics – means, standard deviations, and percentages – were employed to describe the study sample and weight management outcomes. Chi-square tests and t-tests were applied for investigating the associations with respect to variables, and factors associated with weight regain following surgery, respectively. All the statistical analyses were performed using statistical program such as SPSS.

Results:

In this study, 53 patients who underwent bariatric surgery were included, with 36 (67.9%) being male and 17 (32.1%) being female. The mean age of the patients was 39.64 years, with a standard deviation of 9.86 years. The mean height was 167.07 cm, with a standard deviation of 8.88 cm, while the mean weight before bariatric surgery was 135.21 kg, with a standard deviation of 22.81 kg. The ideal body weight for the patients was 67.90 kg, with a standard deviation of 10.15 kg. The majority of patients (22.6%) were classified as having Obese 3 BMI index, followed by Obese 1 and Obese 2 with 17.0% each. Gastric sleeve was the most common type of bariatric surgery with 52 (98.1%) patients undergoing this procedure, while only 1 (1.9%) patient underwent bypass surgery. The patients lost an average of 42.26% of their initial body weight after bariatric surgery, with a standard deviation of 10.80%. The minimum weight reached by the patients was 77.25 kg, with a standard deviation of 15.80 kg. However, the patients also experienced weight regain after reaching their minimum weight, with an average weight gain percentage of 17.05% from their least weight, with a standard deviation of 13.08%. In terms of weight loss during the first year after surgery, the majority (75.5%) of patients lost more than 20 Kg, while 10 (18.9%) lost between 10-20 Kg and only 3 (5.7%) lost less than 10 Kg. However, the rate of weight gain after surgery appears to be relatively high, with 23 (43.4%) patients gaining more than 10 Kg, 15 (28.3%) patients gaining between 5-10 Kg, and only 15 (28.3%) patients gaining less than 5 Kg (Table 1).

Table 1: Demographic factors of the patients

		Count	Column N %
Gender	Male	36	67.9%
	Female	17	32.1%
Age	Mean (SD)	39.64	9.86
Height (cm)	Mean (SD)	167.07	8.88
Weight (Kg)	Mean (SD)	100.49	30.62
Ideal body weight	Mean (SD)	67.90	10.15
BMI index	Underweight	2	3.8%
	Normal	11	20.8%
	Overweight	10	18.9%
	Obese 1	9	17.0%
	Obses 2	9	17.0%
	Obese 3	12	22.6%
Type of bariatric surgery	gastric sleeve	52	98.1%
	bypass	1	1.9%
Weight before bariatric surgery	Mean (SD)	135.21	22.81
Minimum weight you reached	Mean (SD)	77.25	15.80
Weight loss percentage	Mean (SD)	42.26	10.80
Weight gain percentage from the least weight	Mean (SD)	17.05	13.08
Weight loss during the first year	Less than 10 Kg	3	5.7%
	10-20 Kg	10	18.9%
	> 20 Kg	40	75.5%
The rate of weight gain after surgery	< 5Kg	15	28.3%
	5-10	15	28.3%
	> 10 kg	23	43.4%

Of the 53 patients studied, 38 (71.7%) reported using medication, while 15 (28.3%) did not. The most common medical conditions reported were hypertension and diabetes, with 49 (92.5%) and 48 (90.6%) patients reporting these conditions, respectively. In terms of mental health, 45 (84.9%) patients reported

having depression, while 8 (15.1%) did not. Sleep apnea was reported by 47 (88.7%) patients, while 6 (11.3%) did not have this condition. Finally, 41 (77.4%) patients reported having orthopedic conditions, while 12 (22.6%) did not (Figure 1).

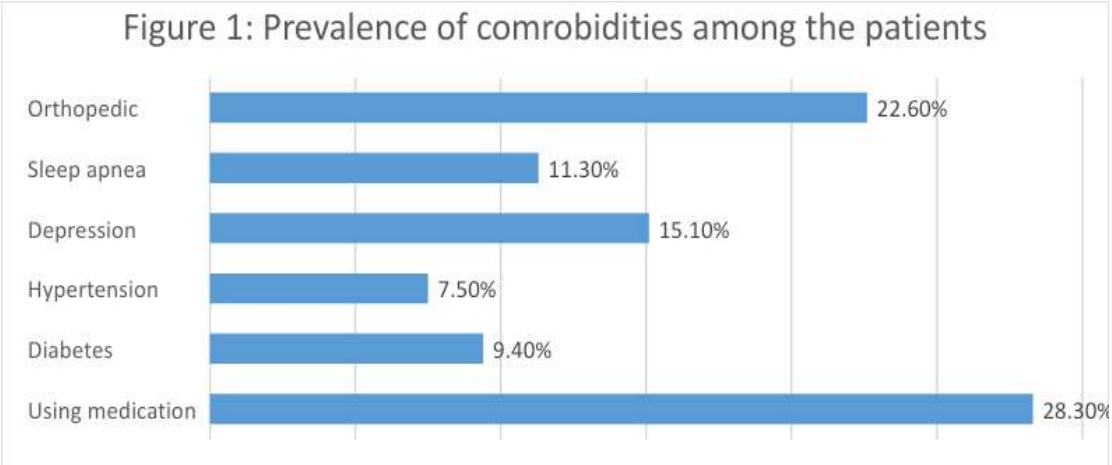

Table 2 provides information about the patients' diet and lifestyle behavior before and after bariatric surgery. Regarding the patients' adherence to a clinical diet before surgery, 36 (67.9%) patients reported not following a diet with clinical dietitian guidance. Of those who followed a diet before surgery, 18 (34.0%) reported losing weight with it. Regarding the patients' knowledge about a healthy diet and lifestyle before surgery, 28 (52.8%) reported not having information about it and 10 (18.9%) patients reported following a diet within the first year after surgery. In terms of clinical dietitian visits after surgery, 46 (86.8%) patients reported not visiting a clinical dietitian regularly after surgery (Table 2).

Table 2: The knowledge and practice of follow regular diet and visit to the clinical dietitian before and after the surgery

		Count	Column N %
Did you follow a diet with clinical dietitian?	No	36	67.9%
	Yes	17	32.1%
Did you lose weight when you followed a diet before surgery?	No	35	66.0%
	Yes	18	34.0%
Do you have information about healthy diety and healthy surgery (Food groups- Calories-Food label-Exercise)	No	28	52.8%
	Yes	25	47.2%
Did you follow a diet after the operation?	< 1 year	10	18.9%
	1 Year	13	24.5%
	> 1 year	30	56.6%
Did you regularly visit the clinical dietitian after operation?	No	46	86.8%
	Yes	7	13.2%

Regarding dietary habits, 24 (45.3%) patients reported not eating fast food, while 24 (45.3%) ate it twice a week. Similarly, 7 (13.2%) patients reported not eating sweets, while 27 (50.9%) ate them twice a week, and 19 (35.8%) ate them more than four times a week. In terms of unhealthy snacks, 16 (30.2%) patients reported not eating them, while 23 (43.4%) ate them twice a week, and 14 (26.4%) ate them more than four times a week. Regarding the consumption of healthy foods, 11 (20.8%) patients reported not eating fruit, and 7 (13.2%) patients reported not eating vegetables. In terms of milk and dairy products, 11 (20.8%)

patients reported not consuming them, while 33 (62.3%) consumed 2-3 servings per day, and 9 (17.0%) consumed more than three servings per day. Additionally, 45 (84.9%) patients reported consuming 3-5 servings of meat per day, while 4 (7.5%) consumed more than five servings per day. In terms of water consumption, most patients (34.0%) reported consuming 5-8 cups of water per day. Regarding meal frequency and timing, 27 (50.9%) patients reported eating all meals, while 1 (1.9%) patient reported eating only breakfast. In terms of snack frequency, 28 (52.8%) patients reported eating one snack per day, while 19 (35.8%) ate two snacks per day. Regarding exercise, 8 (15.1%) patients reported not doing any exercise, while 28 (52.8%) reported doing irregular exercise, and 13 (24.5%) reported doing regular exercise. Finally, 47 (88.7%) patients reported not being pregnant, while 6 (11.3%) reported being pregnant (Table 3).

Table 3: The frequency of consuming different dietary options

		Count	Column N %
Fast food	I do not eat	24	45.3%
	Twice a week	24	45.3%
	More than 4 times/week	5	9.4%
Sweets	I do not eat	7	13.2%
	Twice a week	27	50.9%
	More than 4 times/week	19	35.8%
Unhealthy snacks	I do not eat	16	30.2%
	Twice a week	23	43.4%
	More than 4 times/week	14	26.4%
Soft drinks	I do not eat	30	56.6%
	Twice a week	12	22.6%
	More than 4 times/week	11	20.8%
Sugar	I do not eat	12	22.6%
	2-4 TEASPOON PER DAY	31	58.5%
	More than 4 times/week	10	18.9%
Starch	I do not eat	4	7.5%
	4-6 serving /day	45	84.9%
	More than 6 serving/day	4	7.5%
Fruit	I do not eat	11	20.8%
	2-3 serving /day	38	71.7%
	More than 3 serving/day	4	7.5%
Vegetable	I do not eat	7	13.2%
	3-4 serving /day	40	75.5%
	More than 4 serving/day	6	11.3%
Milk and dairy products	I do not eat	11	20.8%
	2-3 serving /day	33	62.3%
	More than 3 serving/day	9	17.0%
Meat	I do not eat	4	7.5%
	3-5 serving /day	45	84.9%
	5-8 serving/day	4	7.5%
Water	1-4 cups daily	18	34.0%
	5-8 cups daily	18	34.0%
	8-12 cups daily	17	32.1%
Main meals	Breakfast	1	1.9%
	Lunch	1	1.9%

	Dinner	4	7.5%
	Lunch + Breakfast	5	9.4%
	Breakfast + Dinner	6	11.3%
	Dinner + Lunch	9	17.0%
	All	27	50.9%
Snacks	1 snack per day	28	52.8%
	2 snakes per day	19	35.8%
	3 snakes per days	6	11.3%
Most of the meals eaten at	Day	18	34.0%
	Night	16	30.2%
	Both	19	35.8%
Exercises	I do not do exercise	8	15.1%
	I do irregular exercise	28	52.8%
	I do regular exercise	13	24.5%
	I do cardio exercise	1	1.9%
	I do resistance exercise	3	5.7%
Pregnancy	No	47	88.7%
	Yes	6	11.3%

In addition, it was found that those who followed a diet with clinical dietitian after surgery had a higher percentage of gaining > 10 kg compared to those who did not follow such a diet. However, this difference was not statistically significant (p=0.276). Similarly, there was no significant difference in weight gain based on whether participants had lost weight when they followed a diet before surgery or had information about healthy diet and lifestyle before surgery. Participants who did not regularly visit the clinical dietitian after the operation had a significantly higher percentage of gaining 5-10 kg (p=0.016). Similarly, those who consumed more unhealthy snacks had a significantly higher percentage of gaining > 10 kg (p=0.079). However, there were no significant differences in weight gain based on the consumption of fast food, sweets, soft drinks, sugar, starch, fruit, vegetables, milk and dairy products, meat, water, main meals, snacks, most of the meals eaten, exercises, and pregnancy (Table 4-5).

Table 4: The knowledge and practice of follow regular diet and visit to the clinical dietitian before and after the surgery and weight regain

		The rate of weight gain after surgery						
		< 5Kg		5-10		> 10 kg		P-value
		Count	Row N %	Count	Row N %	Count	Row N %	
Did you follow a diet with clinical dietitian?	No	12	33.3%	11	30.6%	13	36.1%	0.276
	Yes	3	17.6%	4	23.5%	10	58.8%	
Did you lose weight when you followed a diet before surgery?	No	10	28.6%	9	25.7%	16	45.7%	0.829
	Yes	5	27.8%	6	33.3%	7	38.9%	
Do you have information about healthy diety and healthy surgery (Food groups-	No	6	21.4%	7	25.0%	15	53.6%	0.268
	Yes	9	36.0%	8	32.0%	8	32.0%	

Calories-Food label-Exercise)								
Did you follow a diet after the operation?	< 1 year	1	10.0%	7	70.0%	2	20.0%	0.016 *
	1 Year	3	23.1%	4	30.8%	6	46.2%	
	> 1 year	11	36.7%	4	13.3%	15	50.0%	
Did you regularly visit the clinical dietitian after operation?	No	13	28.3%	15	32.6%	18	39.1%	0.154
	Yes	2	28.6%	0	0.0%	5	71.4%	
Fast food	I do not eat	9	37.5%	5	20.8%	10	41.7%	0.562
	Twice a week	5	20.8%	9	37.5%	10	41.7%	
	More than 4 times/week	1	20.0%	1	20.0%	3	60.0%	

Table 5: The frequency of consuming different dietary options and weight regain

		The rate of weight gain after surgery						
		< 5Kg		5-10		> 10 kg		P-value
		Count	Row N %	Count	Row N %	Count	Row N %	
Sweets	I do not eat	4	57.1%	0	0.0%	3	42.9 %	0.221
	Twice a week	8	29.6%	8	29.6%	11	40.7 %	
	More than 4 times/week	3	15.8%	7	36.8%	9	47.4 %	
Unhealthy snacks	I do not eat	8	50.0%	4	25.0%	4	25.0 %	0.079
	Twice a week	4	17.4%	5	21.7%	14	60.9 %	
	More than 4 times/week	3	21.4%	6	42.9%	5	35.7 %	
Soft drinks	I do not eat	9	30.0%	8	26.7%	13	43.3 %	0.866
	Twice a week	4	33.3%	4	33.3%	4	33.3 %	
	More than 4 times/week	2	18.2%	3	27.3%	6	54.5 %	
Sugar	I do not eat	5	41.7%	3	25.0%	4	33.3 %	0.427
	2-4 TEA SPOON PER DAY	7	22.6%	11	35.5%	13	41.9 %	
	More than 4 times/week	3	30.0%	1	10.0%	6	60.0 %	

Starch	I do not eat	1	25.0%	1	25.0%	2	50.0 %	0.997
	4-6 serving /day	13	28.9%	13	28.9%	19	42.2 %	
	More than 6 serving/day	1	25.0%	1	25.0%	2	50.0 %	
Fruit	I do not eat	4	36.4%	2	18.2%	5	45.5 %	0.640
	2-3 serving /day	11	28.9%	11	28.9%	16	42.1 %	
	More than 3 serving/day	0	0.0%	2	50.0%	2	50.0 %	
Vegetable	I do not eat	3	42.9%	1	14.3%	3	42.9 %	0.831
	3-4 serving /day	10	25.0%	12	30.0%	18	45.0 %	
	More than 4 serving/day	2	33.3%	2	33.3%	2	33.3 %	
Milk and dairy products	I do not eat	5	45.5%	2	18.2%	4	36.4 %	0.296
	2-3 serving /day	8	24.2%	12	36.4%	13	39.4 %	
	More than 3 serving/day	2	22.2%	1	11.1%	6	66.7 %	
Meat	I do not eat	0	0.0%	1	25.0%	3	75.0 %	0.664
	3-5 serving /day	14	31.1%	13	28.9%	18	40.0 %	
	5-8 serving/day	1	25.0%	1	25.0%	2	50.0 %	
Water	1-4 cups daily	5	27.8%	4	22.2%	9	50.0 %	0.848
	5-8 cups daily	4	22.2%	6	33.3%	8	44.4 %	
	8-12 cups daily	6	35.3%	5	29.4%	6	35.3 %	
Main meals	Breakfast	0	0.0%	1	100.0 %	0	0.0%	0.551
	Lunch	1	100.0%	0	0.0%	0	0.0%	
	Dinner	0	0.0%	1	25.0%	3	75.0 %	
	Lunch + Breakfast	0	0.0%	2	40.0%	3	60.0 %	
	Breakfast + Dinner	1	16.7%	2	33.3%	3	50.0 %	
	Dinner + Lunch	3	33.3%	2	22.2%	4	44.4 %	
	All	10	37.0%	7	25.9%	10	37.0 %	

Snacks	1 snack per day	10	35.7%	7	25.0%	11	39.3 %	0.569
	2 snakes per day	4	21.1%	7	36.8%	8	42.1 %	
	3 snakes per days	1	16.7%	1	16.7%	4	66.7 %	
Most of the meals eaten at	Day	4	22.2%	6	33.3%	8	44.4 %	0.846
	Night	4	25.0%	4	25.0%	8	50.0 %	
	Both	7	36.8%	5	26.3%	7	36.8 %	
Exercises	I do not do exercise	2	25.0%	2	25.0%	4	50.0 %	0.195
	I do irregular exercise	6	21.4%	9	32.1%	13	46.4 %	
	I do regular exercise	4	30.8%	3	23.1%	6	46.2 %	
	I do cardio exercise	0	0.0%	1	100.0 %	0	0.0%	
	I do resistance exercise	3	100.0%	0	0.0%	0	0.0%	
Pregnancy	No	15	31.9%	13	27.7%	19	40.4 %	0.244
	Yes	0	0.0%	2	33.3%	4	66.7 %	

The results show that the majority of participants in all groups gained more than 10 kg after surgery, except for those who underwent gastric bypass surgery. However, the difference in weight gain between gastric sleeve and bypass surgeries was not statistically significant (p=0.514). The table also shows that age, ideal body weight, weight before surgery, and minimum weight reached were different for each group. Participants who gained less weight after surgery (less than 5 kg) had a higher mean age and ideal body weight than those who gained more weight. However, there were no significant differences in weight before surgery or minimum weight reached between the groups. The statistical significance values indicate that there were no significant differences in weight gain after surgery based on gender, BMI index, or type of surgery. However, there were some trends in the data, such as obese participants having a higher percentage of gaining > 10 kg and those with lower BMI having a higher percentage of gaining 5-10 kg (Table 6-7).

Table 6: The relation between demographic factors and weight regain

		The rate of weight gain after surgery						
		< 5Kg		5-10		> 10 kg		P-value
		Count	Row N %	Count	Row N %	Count	Row N %	
Gender	Male	11	30.6%	11	30.6%	14	38.9%	0.629
	Female	4	23.5%	4	23.5%	9	52.9%	
BMI index	Underweight	1	50.0%	1	50.0%	0	0.0%	0.652
	Normal	4	36.4%	5	45.5%	2	18.2%	
	Overweight	3	30.0%	2	20.0%	5	50.0%	
	Obese 1	3	33.3%	1	11.1%	5	55.6%	
	Obsess 2	1	11.1%	3	33.3%	5	55.6%	

	Obese 3	3	25.0%	3	25.0%	6	50.0%	
Type of bariatric surgery	Gastric sleeve	15	28.8%	15	28.8%	22	42.3%	0.514
	Bypass	0	0.0%	0	0.0%	1	100.0 %	

Table 7: The relation between demographic factors and weight regain

The rate of weight gain after surgery		Age	Ideal body weight	Weight before bariatric surgery	Minimum weight you reached
< 5Kg	Mean	42.13	73.50	140.13	80.43
	Std. Deviation	12.58	9.75	33.65	12.81
5-10	Mean	40.20	67.50	127.06	71.73
	Std. Deviation	9.76	10.70	17.86	19.39
> 10 kg	Mean	37.65	61.85	137.30	78.74
	Std. Deviation	7.73	7.24	15.47	14.71
P-value		0.386	0.079	0.250	0.270

Discussion:

That has been demonstrated that bariatric surgery is an effective treatment for obesity and the health issues it is associated with, causing significant weight loss and comorbidity improvement [8–10]. Long-term weight management following surgery is still difficult, though, because weight regain is a frequent issue [11,12]. The purpose of this study was to examine the possibility of weight gain following bariatric surgery and its contributing determinants.

The results of this study show that weight rebounding following bariatric surgery is a widespread issue, with most patients suffering some degree of weight increase following their lowest weight. This study's average weight regain from the patients' lowest weight was over 17%, which is consistent with earlier research finding a weight regain of 10–20% following bariatric surgery [13–18] while some other studies reported even higher percentage of weight gain after bariatric surgery. In a study of 300 RYGB patients, the authors found that 37% of them had significant weight regain at 7-year follow-up using the definition of ≥ 25% increase from nadir weight [19]. In addition, a systematic review found that up to 76% of SG patients had significant weight regain at 6-year follow-up [20]. This weight gain is concerning since it might cause comorbidities to reappear and lower patients' quality of life [21].

While procedural failures like gastric band slippage, gastro-gastric fistulas, dilated gastric fundus, enlargement of the gastric pouch or gastro-jejunal stoma, and slippage of the gastric band can lead to weight regain [20,22,23], the most frequent causes are believed to be dysregulated (like loss-of-control eating) or maladaptive (like grazing) eating, noncompliance with dietary recommendation [24,25]. Comorbid mental conditions, in particular a history of depression, have also been mentioned as potential reasons why treatment doesn't work [26,27].

Age and the optimal body weight were found to be related to weight increase following surgery. The mean age and desired body weight of those who gained less weight after surgery were greater than those who

gained more weight. This implies that individuals who are older and who have a greater target body weight may experience better weight management results following bariatric surgery. This finding is consistent with prior studies that have shown the greater weight loss after RYGB is associated with greater age and less pre-operative BMI. [5,28,29].

The study did not find any significant difference in average weight gain between sex, BMI, or type of procedure. There were some trends, however, an increased rate of >10 kg among obese participants and increased rate of 5–10 kg weight gain among those with lower BMI. Those trends could be further investigated in future studies with a larger sample size. The analysis also showed that a post-op weight gain of 5 to 10 kg was significantly more likely for those who failed to attend regular clinical nutritionist visits. This suggests that a part of the dietary advice may be important to repeat once a dietitian after bariatric surgery [30]. The importance of dietary management after bariatric surgery cannot be overemphasised as it is necessary to keep the initial weight down and not to regain weight that was lost surgery [31]. Quite a proportion of patients gained more than 10 kg, and in patients with more unhealthy snacks this percentage was increased, which is a strong argument to keep promoting healthy eating after the initial surgery.

One of the study's limitations is its small sample size, limiting how generalizable the findings may be. With a larger sample, a deeper analysis of the factors related to the post bariatric surgery weight regain could be performed. Furthermore, the research has not examined psychosocial factors that might lead to weight gain after surgery including mental health and disordered eating. Also the type of a surgical technique that had been applied for each patient is not known, which is another limitation of the study. Various surgical methods might result in various weight loss as well as weight regain during follow-up, which can be useful in the study of factors for weight regain after surgery.

Notwithstanding these limitations, this is a valuable study that identifies factors associated with weight regain after bariatric surgery. Age, ideal body weight, regular clinical dietitian follow-up, and eating behaviors may all potentially be important factors in weight control after surgery. The above research emphasizes that continuing medical condition treatment plays an important role in the treatment of obesity and its comorbidities. Future research should explore the role of psychological factors. influencing weight regain after bariatric surgery and replicate these relationships on a larger group. Furthermore, research into the effectiveness of diverse surgical techniques for controlling and preventing the rebound of body weight should also be realized in clinical practice.

Eventually, relapse of weight gain after bariatric surgery could be a common occurrence and has to be managed to prevent from recurrence. Besides emphasizing the importance of close postoperative follow-up by a clinical dietitian and nutrition intervention on weight maintenance after surgery, this study may provide information on the risk for weight regain after surgery. The study highlights the importance of treating medical diseases for reversal of obesity and related comorbidities. Additional research is needed to confirm these findings and to guide clinical practice in the long-term management of bariatric surgery patients.

References:

1. Velapati SR, Shah M, Kuchkuntla AR, et al. Weight Regain After Bariatric Surgery: Prevalence, Etiology, and Treatment. Curr Nutr Rep. 2018;7(4):329-334. doi:10.1007/s13668-018-0243-0
2. Althumiri NA, Basyouni MH, AlMousa N, et al. Obesity in Saudi Arabia in 2020: Prevalence, Distribution, and Its Current Association with Various Health Conditions. Healthcare. 2021;9(3):311. doi:10.3390/healthcare9030311
3. Alqahtani SJ, Alfawaz HA, Moubayed NMS, et al. Bariatric Surgery as Treatment Strategy of Obesity in Saudi People: Effects of Gut Microbiota. Nutrients. 2023;15(2):361. doi:10.3390/nu15020361
4. Baig SJ, Priya P, Mahawar KK, Shah S. Weight Regain After Bariatric Surgery—A Multicentre

Study of 9617 Patients from Indian Bariatric Surgery Outcome Reporting Group. Obes Surg. 2019;29(5):1583-1592. doi:10.1007/s11695-019-03734-6
5. El Ansari W, Elhag W. Weight Regain and Insufficient Weight Loss After Bariatric Surgery: Definitions, Prevalence, Mechanisms, Predictors, Prevention and Management Strategies, and Knowledge Gaps—a Scoping Review. Obes Surg. 2021;31(4):1755-1766. doi:10.1007/s11695-020-05160-5
6. Bastos ECL, Barbosa EMWG, Soriano GMS, Santos EA dos, Vasconcelos SML. Fatores determinantes do reganho ponderal no pós-operatório de cirurgia bariátrica. ABCD Arq Bras Cir Dig (São Paulo). 2013;26(suppl 1):26-32. doi:10.1590/S0102-67202013000600007
7. Schliemann D, Woodside J V. The effectiveness of dietary workplace interventions: a systematic review of systematic reviews. Public Health Nutr. 2019;22(5):942-955. doi:10.1017/S1368980018003750
8. Wolfe BM, Kvach E, Eckel RH. Treatment of Obesity. Circ Res. 2016;118(11):1844-1855. doi:10.1161/CIRCRESAHA.116.307591
9. Noria S, Grantcharov T. Biological effects of bariatric surgery on obesity-related comorbidities. Can J Surg. 2013;56(1):47-57. doi:10.1503/cjs.036111
10. Han Y, Jia Y, Wang H, Cao L, Zhao Y. Comparative analysis of weight loss and resolution of comorbidities between laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass: A systematic review and meta-analysis based on 18 studies. Int J Surg. 2020;76:101-110. doi:10.1016/j.ijsu.2020.02.035
11. Alfadda AA, Al-Naami MY, Masood A, et al. Long-Term Weight Outcomes after Bariatric Surgery: A Single Center Saudi Arabian Cohort Experience. J Clin Med. 2021;10(21):4922. doi:10.3390/jcm10214922
12. Noria SF, Shelby RD, Atkins KD, Nguyen NT, Gadde KM. Weight Regain After Bariatric Surgery: Scope of the Problem, Causes, Prevention, and Treatment. Curr Diab Rep. 2023;23(3):31-42. doi:10.1007/s11892-023-01498-z
13. Tolvanen L, Christenson A, Surkan PJ, Lagerros YT. Patients' Experiences of Weight Regain After Bariatric Surgery. Obes Surg. 2022;32(5):1498-1507. doi:10.1007/s11695-022-05908-1
14. Elhag W, El Ansari W. Weight Regain and Insufficient Weight Loss after Bariatric Surgery: A Call for Action. In: Bariatric Surgery - From the Non-Surgical Approach to the Post-Surgery Individual Care. IntechOpen; 2021. doi:10.5772/intechopen.94848
15. Ribeiro-Parenti L, Baratte C, Poghosyan T. Weight Regain after Bariatric Surgery. J Clin Med. 2023;12(9):3265. doi:10.3390/jcm12093265
16. Wittgrove AC, Clark GW. Laparoscopic Gastric Bypass, Roux en-Y - 500 Patients: Technique and Results, with 3-60 month follow-up. Obes Surg. 2000;10(3):233-239. doi:10.1381/096089200321643511
17. Sjöström CD, Lissner L, Wedel H, Sjöström L. Reduction in Incidence of Diabetes, Hypertension and Lipid Disturbances after Intentional Weight Loss Induced by Bariatric Surgery: the SOS Intervention Study. Obes Res. 1999;7(5):477-484. doi:10.1002/j.1550-8528.1999.tb00436.x
18. King WC, Hinerman AS, Belle SH, Wahed AS, Courcoulas AP. Comparison of the Performance of Common Measures of Weight Regain After Bariatric Surgery for Association With Clinical Outcomes. JAMA. 2018;320(15):1560. doi:10.1001/jama.2018.14433
19. Cooper TC, Simmons EB, Webb K, Burns JL, Kushner RF. Trends in Weight Regain Following Roux-en-Y Gastric Bypass (RYGB) Bariatric Surgery. Obes Surg. 2015;25(8):1474-1481. doi:10.1007/s11695-014-1560-z
20. Lauti M, Kularatna M, Hill AG, MacCormick AD. Weight Regain Following Sleeve Gastrectomy—a Systematic Review. Obes Surg. 2016;26(6):1326-1334. doi:10.1007/s11695-016-2152-x
21. Pi-Sunyer FX. The Impact of Weight Gain on Motivation, Compliance, and Metabolic Control in Patients with Type 2 Diabetes Mellitus. Postgrad Med. 2009;121(5):94-107. doi:10.3810/pgm.2009.09.2056

22. Karmali S, Brar B, Shi X, Sharma AM, de Gara C, Birch DW. Weight Recidivism Post-Bariatric Surgery: A Systematic Review. Obes Surg. 2013;23(11):1922-1933. doi:10.1007/s11695-013-1070-4
23. Heneghan HM, Yimcharoen P, Brethauer SA, Kroh M, Chand B. Influence of pouch and stoma size on weight loss after gastric bypass. Surg Obes Relat Dis. 2012;8(4):408-415. doi:10.1016/j.soard.2011.09.010
24. Hsu LKG, Benotti PN, Dwyer J, et al. Nonsurgical Factors That Influence the Outcome of Bariatric Surgery. Psychosom Med. 1998;60(3):338-346. doi:10.1097/00006842-199805000-00021
25. Amundsen T, Strømmen M, Martins C. Suboptimal Weight Loss and Weight Regain after Gastric Bypass Surgery—Postoperative Status of Energy Intake, Eating Behavior, Physical Activity, and Psychometrics. Obes Surg. 2017;27(5):1316-1323. doi:10.1007/s11695-016-2475-7
26. Kalarchian MA, Marcus MD, Levine MD, Soulakova JN, Courcoulas AP, Wisinski MSC. Relationship of psychiatric disorders to 6-month outcomes after gastric bypass. Surg Obes Relat Dis. 2008;4(4):544-549. doi:10.1016/j.soard.2008.03.003
27. Semanscin-Doerr DA, Windover A, Ashton K, Heinberg LJ. Mood disorders in laparoscopic sleeve gastrectomy patients: does it affect early weight loss? Surg Obes Relat Dis. 2010;6(2):191-196. doi:10.1016/j.soard.2009.11.017
28. Sherman WE, Lane AE, Mangieri CW, Choi YU, Faler BJ. Does Preoperative Weight Change Predict Postoperative Weight Loss After Laparoscopic Sleeve Gastrectomy? Bariatr Surg Pract Patient Care. 2015;10(3):126-129. doi:10.1089/bari.2015.0023
29. Gerber P, Gustafsson UO, Anderin C, Johansson F, Thorell A. Effect of age on quality of life after gastric bypass: data from the Scandinavian Obesity Surgery Registry. Surg Obes Relat Dis. 2022;18(11):1313-1322. doi:10.1016/j.soard.2022.06.017
30. Johnson Stoklossa C, Atwal S. Nutrition Care for Patients with Weight Regain after Bariatric Surgery. Gastroenterol Res Pract. 2013;2013:1-7. doi:10.1155/2013/256145
31. Bettini S, Belligoli A, Fabris R, Busetto L. Diet approach before and after bariatric surgery. Rev Endocr Metab Disord. 2020;21(3):297-306. doi:10.1007/s11154-020-09571-8