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The association between gastro esophageal reflux disease and bariatric surgery

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ABSTRACT

Background: Obesity is ordinarily accompanying gastro esophageal reflux disease. Thus, losing weight will improve it. In contrary it can occur after bariatric surgery as a complication and in some cases, it may appear and develop for the first time as consequence of bariatric surgery. *Aims:* To determine the association between gastro esophageal reflux disease and bariatric surgery among patients underwent bariatric surgery in Hail region, Saudi Arabia. *Methodology:* From February to June 2022, a cross sectional study included all patients who underwent bariatric surgery in Hail region. The extracted data had been manipulated statistically using IBM SPSS version 22.0. *Results: Out* of 477 patients that managed by the mean of bariatric surgery, 379 participants were responded effectively to the study survey. In consideration of demographics, 41.7% of the participants were aged 15-30 years. Most of them (55.9%) were male. Before surgery, 32.7% had gastro esophageal reflux disease and 60.5% of them had shown improvement after surgery. Post surgical procedure, 16.1% of the participants had a newly developed gastro esophageal reflux disease. Nearly, 67.3% of the participants had a laparoscopic sleeve gastrectomy and 48.8% were diagnosed with gastro esophageal reflux disease. Statistics indicate that bariatric surgery and gastro esophageal reflux disease are significantly correlated (P=0.000). *Conclusion:* Each patient should be made aware of the risks of gastro esophageal reflux disease accompanying such procedures.

Keywords: Bariatric, Corpulence, Gastric bypass, Gastroesophageal reflux disease (GERD), Gastric sleeve, Obesity.

1. INTRODUCTION

Obesity (corpulence) is a significant societal health medical condition and is viewed as a pandemic overall, including Saudi Arabia (Kelly et al., 2008; Ng et al., 2014). The commonness of corpulence has expanded from 7% to 25% throughout recent years and by 2030 it is expected that obesity will influence 60% of the total world's population (Kelly et al., 2008). In Saudi Arabia, it is assessed that one individual out of each and every three grown-ups is obese (Al Khalid et al., 2016). Hail region has reported the most noteworthy

pervasiveness level in Saudi Arabia with a corpulence prevalence of 63.6% (Ahmed et al., 2014). It is well known that obesity contributes to a number of chronic disorders, including gastro esophageal reflux disease (GERD), where esophageal reflux disease is one of the diseases associated with obesity (El Serag et al., 2021). GERD is defined as a disorder of the digestive system in which food, fluids and acidic stomach juices return from the stomach into the esophagus (Maret Ouda et al., 2020). The pathogenesis of GERD is due to any condition that might cause relaxation of the lower esophageal sphincter (LES) such as hiatus hernia (HH) and increased intra abdominal squeezing force (Yadlapati and Pandolfino, 2020).

GERD is diagnosed clinically, through the appearance of explicit symptoms such as heartburn, acidity, regurgitation, difficulty swallowing and pain when swallowing, in addition to other symptoms outside the esophagus such as sinusitis, pharyngitis and cough, which may affect the quality of life and well being of the individual (Felinska et al., 2020). GERD may worsen if left untreated, which may cause reflux erosive esophagitis (EE), necrosis, strictures, ulceration and Barrett's esophagus (BE) (Rettura et al., 2021). The relationship between obesity and GERD has been hypothesized, as obesity in the abdominal area increases intra abdominal pressure, which promotes gastro esophageal reflux disease. Studies have shown that GERD affects 22% of obese people (Felinska et al., 2020; Wei et al., 2019). There has been evidence that patients with EE or BE have higher amount of abdominal visceral fat than those without (Bilski et al., 2022). Thus, losing weight will improve the effectiveness of the digestive system and GERD, which will improve the quality of life (GU et al., 2019; Thalheimer and Bueter, 2021). Bariatric operations had emerged as the preferred weight reduction method in Saudi Arabia (Alkhaldy et al., 2019; Fetuga et al., 2011). It includes gastric bypasses (GB), sleeve gastrectomies (SG) and laparoscopic gastric bandings (Stegenga et al., 2014). Both GB and SG are the most common performed bariatric surgical procedures worldwide including Saudi Arabia. While is less favored to use laparoscopically adjustable gastric bandings. On another hand, pancreatobiliary diversion with duodenal switch is a less frequent procedure nationally and internationally (Stegenga et al., 2014). Although such procedures are an efficient, beneficial and desirable method to lessen weight, nevertheless GERD can occur following the procedure as a complication. Depends on the type of procedure performed, occasionally it can cause GERD to manifest and develop for the first time (Elzouki et al., 2022).

Studies showed that SG was associated with post procedural increase in the prevalence of GERD (Pavone et al., 2022). On another sense, different studies showed that bariatric surgery reliably improves or may worsen GERD, especially after sleeve gastrectomy (Elzouki et al., 2022). Recent research among those undergone gastric bypass surgery showed a better effect and a lower risk of developing new or worsening GERD compared to patients who underwent gastric sleeve surgery (Vilallonga et al., 2021). It is interesting that GERD may be a comorbidity of obesity or a side effect of bariatric surgery.

As a result, GERD is a concern for many bariatric patients and bariatric surgery patients as the quality of life of patients can be affected by GERD. Because the research on obesity and gastro esophageal reflux surgery in Saudi society is uneven and few, therefore, the existing study endeavors for measuring the prevalence of bariatric surgery and GERD and shedding light on the association between bariatric surgical procedures and GERD in Hail district.

2. MATERIALS AND METHODS

Study design

The relationship between GERD and bariatric surgery was assessed by the cross sectional web based survey. A representative sample (n = 379) of the bariatric surgery patients in the region of Hail, Saudi Arabia, participated in the survey. The study was conducted from February to June 2022.

Sampling and Sample size

Based on the specified standard deviation of 1.96 for the 95% confidence interval, a 50% response distribution accompanied by a 5% margin of error and the total adult population in the Hail region 548,577, (15 to over 50 years old) (according to the statistical year book issued by the General Authority for Statistics 2019). The minimum required sample size was calculated by Raosoft's sample size calculator = 384, (Alsofayan et al., 2022). (N=477) respondents participated in the survey, after removing the participants (based on the exclusion criteria), we formed a representative sample of bariatric surgery patients in the region of Hail, Saudi Arabia (N = 400).

Inclusion criteria

Bariatric surgery patients, (15 to over 50 years old), living in Hail region, Saudi Arabia.

Exclusion criteria

General population and bariatric surgery patients younger than 15 years

Preparing the study instrument

The researchers conducted a translated electronic questionnaire; the data was collected by the quantitative method. The data was collected from the participants who underwent bariatric surgery included the following

1. Socio-demographic data of the participants (age, gender and nationality)
2. Smoking habit and presence of chronic illness.
3. Anthropometric characteristics (body mass index)
4. In addition to ten elements to assess the association between bariatric surgery and GERD, which included in two sections: The first section is four questions about bariatric surgery and the second section contains six questions about GERD.

Data management

Self administered questionnaire takes about 3–5 minutes and the recall period is a week. On a scale of 0 to 3, six items were rated. The total score attained by addition of the upper most marks of these 6 items. Hence the lowest scoring is 0, while the highest aggregate is 18. Whereas 11 to 18 points indicate 89% likelihood of GERD, 8 to 10 points indicate 79% likelihood, 3 to 7 points = 50% likelihood and total score of 0 to 2 points indicate 0% likelihood of GERD. In order to analyze, review and encrypt the extracted data, IBM SPSS version 22.0 (SPSS, Inc Chicago, IL) was utilized. The descriptive analysis was carried out in the form of frequency and percentage for all demographic data, elements of bariatric surgery and GERD. Statistical significance was determined utilizing Chi squared test, mean while a P value under 0.05 deemed significant. Out comes were displayed in the form of tables and figures.

3. RESULTS

The study included 379 participants (Males, 212 (55.9%) and females, 167 (44.1%)), with male to female ratio of 1.3:1. Their mean age was 32.81 years (range, 15 to 62 years). Saudi constituted 339 (89.4%) of the participants, while only 40 (10.6%) were non Saudi (Table 1). It was found that 113 (29.8%) of the study participants were smokers and 147 (38.8%) had chronic disorders.

Table 1 Characters of the studied sample, Hail, Saudi Arabia

Variables		n=379	%
Age (years)	15 – 30 years	158	41.7
	31 – 40 years	140	36.9
	41 – 50 years	66	17.4
	More than 51 years	15	4.0
Gender	Male	212	55.9
	Female	167	44.1
Nationality	Saudi	339	89.4
	Non-Saudi	40	10.6
Smoking habit	Smoker[1]	113	29.8
	Non-smoker[2]	266	70.2
Chronic diseases	Yes [3]	147	38.8

1- Include Smoker 113 (29.8%), smoking after the operation 2 (0.5%), smoking before the operation 35 (9.2%) and used to smoke and still smoke 76 (20.1%).
2- Include Non smoker 266 (70.2%), Never 261 (68.9%) and smoking before the operation 5 (1.3%).
3- Include 119 (31.4%) had one chronic disease, 21 (5.5%) had 2 chronic diseases, 7 (1.8%) had 3 or more chronic diseases.

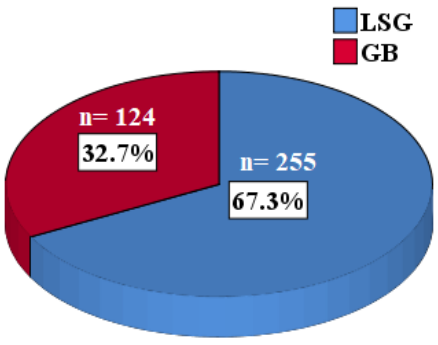

Figure 1 Types of bariatric surgery among participants

Table 2 GERD and bariatric surgery, Hail, Saudi Arabia

Item		No	%
Type of Bariatric surgery			
Laparoscopic sleeve gastrectomy (gastric sleeve)		255	67.3
Gastric bypass		124	32.7
Long has the operation been			
Less than a year[1]		154	40.6
More than a year		225	59.4
Body mass index (BMI)			
BMI before the bariatric surgery	30-34.9	21	5.5
	35-39.9	59	15.6
	40-44.9	112	29.6
	45-49.9	112	29.6
	50-54.9	45	11.9
	55-59.9	20	5.3
	more than 60	10	2.6
BMI after the bariatric surgery	less than 18.5	14	3.6
	18.5-24.9	142	37.5
	25-29.9	99	26.1
	30-34.9	67	17.7
	35-39.9	34	9.0
	40-44.9	14	3.7
	45-49.9	6	1.6
	more than 50	3	0.8
Diagnosis of Gastroesophageal reflux disease			
Before the bariatric surgery	124/379	32.7	
Improved after bariatric surgery	75/124	60.5	
Newly developed after bariatric surgery	61/379	16.1	
They have not been diagnosed	194/379	51.2	
They have family been diagnosed with GERD	148/379	39.1	
Symptoms with regard to (GERDQ score)			
Heartburn [1]	224/379		59.1
Regurgitation of food or sour liquid[2]	213/379		56.2
Upper stomach pain[3]	207/379		54.6
Nausea[4]	220/379		58.0
Disrupted sleep[5]	163/379		43.0
Use of Heartburn drugs [6]	227/379		59.9

1- Include 1 day (107; 28.2%), 2-3 days (79; 20.8%), 4-7 days (38; 10.0%) and Never (155; 40.9%)
2- Include 1 day (78; 20.6%), 2-3 days (80; 21.1%), 4-7 days (55; 14.5%) and Never (166; 43.8%)
3- Include 1 day (83; 21.9%), 2-3 days (79; 20.8%), 4-7 days (45; 11.9%) and Never (172; 45.4%)
4- Include 1 day (64; 16.9%), 2-3 days (39; 10.3%), 4-7 days (37; 9.8%) and Never (159; 42.0%)
5- Include 1 day (86; 22.7%), 2-3 days (40; 10.6%), 4-7 days (37; 9.8%) and Never (216; 57.0%)
6- Include 1 day (69; 18.2%), 2-3 days (59; 15.6%), 4-7 days (99; 26.1%) and Never (152; 40.1%)

Generally, participants had undergone different types of bariatric surgery. Among them, 255 (67.3%) underwent laparoscopic sleeve gastrectomy (gastric sleeve), while 124 (32.7%) underwent gastric bypass (Figure 1). A 225 (59.4%) of them has subjected to bariatric surgery more than a year ago, while the rest underwent surgery within this year. Before bariatric surgery, all participants had a Body mass index (BMI) greater than 30; while after bariatric surgery 156 (41.2%) had a BMI equal or less than 24.9. Relating to

the family history of GERD, there were 148 (39%) participants who had family history of GERD. The most common reported symptom was heart burn in 224 (59.1%), followed by nausea in 220 (58%) (Table 2).

Among patients who under gone laparoscopic sleeve gastrectomy (gastric sleeve) (n=255) almost 159/255 (62.3%) of participants had no history of GERD, 43/255 (16.9%) had a history of GERD prior to intervention and of them 17/43 (39.5%) continued to have GERD symptoms following the procedure, while 53/255 (20.8%) were newly diagnosed with GERD after surgery. In contrast, among those who had underwent gastric bypass (n=124), 35/124 (28.2%) had no history of GERD, 81 (65.3%) had a history of GERD prior to the procedure (of them 32/81 (39.5%) continued to have GERD symptoms after the procedure, while 8/124 (6.5%) were newly diagnosed with GERD following surgery. The differences in the occurrence of GERD in relation to type of surgery was significant (P=0.000) (Table 3).

Table 3 The diagnosis of GERD in relation to bariatric surgery

Medical historyof Bariatric surgery	Gastroesophageal reflux disease								p-value
	GERD before surgery		Continued to have GERD after surgery		Newly developed GERD after surgery		Had no GERD		
	No	%	No	%	No	%	No	%	
Laparoscopic sleeve gastrectomy (gastric sleeve) (n=255)	43	16.9	17/43	39.5	53	20.8	159	62.3	0.000*
Gastric bypass (n=124)	81	65.3	32/81	39.5	8	6.5	35	28.2	
Total (n=379)	124	32.6	49/124	39.5	61	16.1	194	51.1	

* P < 0.05 (significant)

Table 4 The Diagnosis of Gastroesophageal reflux disease regarding Demographic factors, Hail, Saudi Arabia

demographic factors	Diagnosis of Gastroesophageal reflux disease						p-value
	After the bariatric surgery		Before the bariatric surgery		Undiagnosed		
	No	%	No	%	No	%	
Age (years)							
15 – 30 years	25	6.6	44	11.6	89	23.5	0.238
31 – 40 years	26	6.9	45	11.9	69	18.2	
41 – 50 years	7	1.8	30	7.9	29	7.7	
More than 51 years	3	0.8	5	1.3	7	1.8	
Gender							
Male	33	8.7	89	23.5	90	23.7	0.000*
Female	28	7.4	35	9.2	104	27.4	
Nationality							
Saudi	54	14.2	111	29.3	174	45.9	0.967
Non-Saudi	7	1.8	13	3.4	20	5.3	
Smoking habit							
Smoker	18	4.7	48	12.7	46	12.1	0.017*
Non-smoker	43	11.3	76	20.1	148	39.1	
Chronic diseases							
Yes	24	6.3	53	14.0	70	18.5	0.108
No	37	9.8	71	18.7	124	32.7	

* P < 0.05 (significant)

About 11.9% of patients aged 31 to 40 years tended to experience GERD following bariatric surgeries. While most of the patients who did not experienced GERD were from the age group between 15 to 30 years. In the current study, participants' age and the date of diagnosis did not show statistically significant differences (P=0.238). With respect to gender differences in the time of diagnosis of

GERD, males were more commonly diagnosed before and after the bariatric surgery, while females tend to not possess a history of GERD. There was significant difference between the gender and time of experiencing symptoms (P=0.000). Regarding nationality and the time of experiencing GERD, Saudi people were more commonly experienced GERD pre and post bariatric procedures. It was not possible to find statistically significant differences between the nationalities and the time of experiencing GERD (P=0.967). In respect to smoking habit and differences in time of experiencing GERD, non smokers were more commonly had a history of GERD pre and post intervention. The difference between smoking habit of the participants and time of experiencing GERD was significant (P=0.017). On another hand, per surgical presence of chronic disease and development of GERD did not appear to significantly differ (P=0.108) (Table 4).

4. DISCUSSION

In severe and complicated obesity, bariatric surgery is the most familiar treatment modality (Järvholm et al., 2021). The mean age of the participants was 32.81 years; this was in accordance with the other study in Saudi Arabia when the mean age was 33.3 years (Alfadda et al., 2021), while it was younger than in the study in Norway (Järvholm et al., 2021). The age range in the current study was from 15 to 62 year, it was aligned with the internationally recommended age range for bariatric surgery of 18 to 65 years old (Luesma et al., 2022). According to our study, 16.1% of participants suffered from GERD following bariatric surgery, 32.7% were diagnosed with GERD before bariatric surgery and 51.2% of bariatric surgery patients were not diagnosed with GERD. An earlier cross sectional study in Saudi Arabia had found similar results, when 11.5% of patients were diagnosed with GERD before laparoscopic sleeve gastrectomy and 14.6% after laparoscopic sleeve gastrectomy, but the majority 73.8% were not diagnosed or they had no symptoms (Elhady et al., 2019). Whereas, as opposed to the current study, a former study in Asir, Saudi Arabia stated that 32.2% of bariatric surgery patients experienced GERD symptoms post operatively (Dalboh et al., 2021).

Regarding the association between the prevalence of GERD and characteristics of patients, in general, half of the bariatric surgery patients, participated in study were not diagnosed with GERD and 48.8% were diagnosed with GERD, most of them were before bariatric surgery. The results of our study showed a statistical significance between bariatric surgery and GERD (P= 0.000). A significant effect of gender and smoking habits with GERD was observed, as P=0.000 and P=0.017 respectively. On the other hands, bariatric surgery patients with GERD were not significantly influenced by age, nationality, or chronic diseases, since these variables do not show statistically correlation with the presence of post-surgical GERD.

A former Saudi Arabian study found an opposite finding, as there was no statistically noteworthy association with age, gender and diabetes as a chronic disease ($p > 0.05$), but it showed significant association with smoking (P=0.02) (Luesma et al., 2022). Similar to this, a Colombian study found that age and gender did not significantly influence the prevalence of GERD after weight lowering surgeries (Daes et al., 2012). We believe it would be helpful to construct larger studies that examine every predictive factor that influences the occurrence of GERD indicators following weight reducing surgeries, as these results are limited, heterogeneous and contradictory. Lack of sufficient Saudi Arabian studies in such arena lends strength to this study, especially in the Hail region, that focuses on investigating the prevalence of GERD after bariatric surgery.

Hence, more research should be conducted and patients who need bariatric surgery should be informed about its advantages as well as disadvantages. The study limitations stem from the fact that it focused only on adult populations, while it does not include those less than 15 years of their age.

5. CONCLUSION

In order to ensure patients' long-term success, we clarify that GERD is a crucial perioperative consideration for whom undergoes bariatric surgery and thence, patients should be evaluated in depth, to ensure that the most appropriate bariatric procedure will be chosen for them. Each patient should be made aware of the risks of GERD accompanying such procedures. GERD symptoms can be alleviated more effectively with gastric bypass than with sleeve gastrostomy. Those with preoperative GERD should be informed about the possibility of not disappearance of the symptoms post operatively and in contrary, those without pre operative GERD should be informed about the possibility of a newly development of GERD post operatively. Gastric bypass is the best operative manner for sufferers from pre operative GERD. To diminish the probability of GERD following sleeve gastrectomy, future randomized multicenter study must concentrate on adjunct anti reflux procedures.

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Authors' contribution

Fauwaz FA: Principal conductor was responsible for conceptualizing and introducing the manuscript, as well as contributing substantially to its discussion and results.

Saleh AA: Contributed to the design of study, wrote introduction and reviewed central academic integral parts decisively.

Abdullah IA: Lead the result division, organized data and finalized the outline of the manuscript.

Hamoud AA: Assisting with data collection, identification of the interrelated manuscript to add and participation of materiality and approaches.

Saadeldin AI: In addition to stating the subject matter of manuscripts, reviewing study statistics and redrafting a fundamental intellectual element, he coordinated the task. The manuscript was intellectualized, modified and adjusted by every one of authors in various approaches.

Ethical consideration

Research Ethics Committee of the University of Hail granted the ethical approval for this study (Code: H-2022-163). The purpose and how to use the results of the study were explained to each participant. In addition, each participant was given the freedom to participate in the study. Participants were informed that their answers would be confidential and used only for scientific purposes.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data materials availability

Data that support the findings of this research are embedded within the manuscript

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