



GERD and Its Association with BMI in Adult Patients Undergoing Upper GI Endoscopy at the Kenyatta National Hospital

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Abstract

Background: Gastroesophageal reflux disease (GERD) is a common clinical problem affecting millions of people worldwide. GERD is highly prevalent in morbidly obese patients and a high body mass index (BMI) is a risk factor for this condition. However, there is differing data on the use of BMI as a predictor of GERD, its severity and frequency. We therefore aimed to determine the association between GERD and high BMI and to document the esophageal mucosal changes in these patients during endoscopy.

Methodology: We conducted a cross-sectional study among the 174 GERD patients to investigate the association between BMI and GERD at Kenyatta National Hospital endoscopy unit. Patients aged 18 years and above presenting with classical symptoms of GERD were evaluated upon voluntary enrolment. Ethical approval was sought from the KNH-UON ethics & research committee. A questionnaire was administered with demographic data (age, gender, weight, height) and specific questions assessing for GERD. At endoscopy, the mucosal changes were recorded. Data was then summarized using means, frequencies and proportions. Association between patient demographics and GERD was evaluated using the Student t-test or Mann-Whitney U test for continuous variables. Chi-square analysis was applied for categorical variables. A p-value of <0.05 was considered statistically significant.

Results: This was an analysis of 174 patients (56.9% Female, 43.1% Male) between ages 18- 80 years (\bar{x} =43) who underwent endoscopy. The BMI ranges were 14.5 to 38.6 Kg/m² (\bar{x} =26.6 Kg/m²). The proportion of patients who were overweight was 40.2% and obese patients made up 21.8% of the population. There was no significant association between BMI measurements and frequency scale of GERD (FSSG) symptoms (p=0.217). During endoscopy, 35.6% of the patients had esophagitis (LA-A -28.7%, LA-B - 6.9%). Hiatal hernia was diagnosed in 20.7% of the patients. There was no significant association between the diagnoses of esophagitis and hiatal hernia and the BMI status of the patients. However, older age was associated with a higher prevalence of hiatal hernia (p=0.002).

Conclusion: There was no association between increasing BMI and frequency and severity of GERD symptoms in the study population.

Keywords: Gastroesophageal Reflux Disease; Body Mass Index; Endoscopy

Abbreviations: BE: Barrett's Esophagus; BMI: Body Mass Index; ENT: Ear, Nose and Throat; GERD: Gastroesophageal Reflux Disease; GI: Gastrointestinal; ERC: Ethical Research Commission; HH: Hiatus Hernia; H2RA: Histamine-2 Receptor Antagonists; KNH: Kenyatta National Hospital; LES: Lower Esophageal Sphincter; UON: University of Nairobi; WHO: World Health Organization.

Introduction

Gastroesophageal Reflux disease is a common clinical problem affecting millions of people worldwide [1,2]. Its typical manifestations are heartburn and/or regurgitation. GERD can further be classified into erosive GERD and non-erosive GERD based on the endoscopic appearance of the esophageal mucosa [3]. Significant complications of GERD include; esophagitis, stricture formation, adenocarcinoma, respiratory and ear, nose and throat (ENT) disorders [4]. Due to increasing prevalence, its epidemiology has been a subject of growing interest [2,5]. Obesity is associated with GERD [6,7]. Overweight and obesity are defined as excessive fat accumulation in the body posing a risk to health. Body mass index, which is calculated as weight in kilograms divided by height in meters squared is used as a marker of obesity. A BMI value 25–30 represents overweight and BMI >30 indicates obesity. A BMI value <25 is considered as normal. Some studies have shown that GERD is highly prevalent in patients who are morbidly obese and that a high BMI is a risk factor for this condition [8-12]. Epidemiologic data also demonstrates that overall obesity is a risk factor for esophageal adenocarcinoma [2]. Globally, obesity has become a major health problem and its prevalence is increasing both in the developed and developing countries [13,14]. In Kenya, urbanization appears to be an important determinant in obesity [15,16]. There is differing data on the use of BMI as a predictor of GERD, its severity and frequency. In western countries, some studies have shown a positive correlation between high BMI and frequency of reflux [10,17], others have demonstrated a weak association [18] and others show no association [19,20]. A study done in 2019 on the black population of South Africa showed that GERD was more common in black females than males and the prevalence rose with increasing BMI [21]. In Kenya, a focal study on the management of GERD was published by Okoth, et al. [22]. However, this article had limited information on BMI. This study therefore aims to determine the association between GERD and BMI among adult patients undergoing upper GI Endoscopy at the Kenyatta National Hospital endoscopy unit.

Literature Review

Gastroesophageal reflux disease is a specific clinical entity that results from the reflux of gastric material through the lower esophageal sphincter (LES) into the esophagus or

oropharynx causing symptoms and/or injury to esophageal tissue. According to the Montreal definition, GERD is a condition that develops when the reflux of stomach contents causes troublesome symptoms and/complications [23]. It is commonly characterized by substernal chest pain referred to as heartburn [24]. Although heartburn is highly specific to characterize GERD, patients usually report a number of associated symptoms such as regurgitation, nausea, sore throat, cough and globus sensation [25,26]. GERD is often diagnosed based on typical symptoms of heartburn and regurgitation. Numerous esophageal manifestations that can occur due to esophageal mucosal injury are; reflux esophagitis, stricture, Barrett's esophagus (BE) and esophageal adenocarcinoma [27-29]. Extra esophageal symptoms include chronic cough, asthma, laryngitis and dental erosions [30]. If left untreated, GERD can complicate into Barrett's esophagus and esophageal adenocarcinoma [31,32]. In BE, metaplastic columnar mucosa replaces esophageal squamous mucosa damaged by GERD [33]. GERD and BE are major risk factors for esophageal adenocarcinoma [34]. The pathophysiology of GERD is complex and multifactorial and requires a tailored individual approach. Overall, it is due to a lack of balance between the protective mechanisms and aggressive chemical substances between the valvular mechanism and the trans-diaphragmatic pressure gradient. The esophagus propels food from the mouth to the stomach with regular contractions. It runs through the chest and through the tight esophageal hiatus in the diaphragm before reaching the stomach [35]. For the system to function optimally, the lower esophagus functions as an antegrade pump, pushing food contents towards the lower esophageal sphincter which acts as the valve [36]. The stomach acts as a reservoir and in delayed gastric emptying may contribute to reflux disease. Other underlying mechanisms include poor esophageal motility and dysfunctional LES [37]. Hiatus hernia (HH), is a condition in which parts of the abdominal contents, mainly the gastroesophageal junction and the stomach, are proximally displaced above the diaphragm through the esophageal hiatus into the mediastinum [38]. The relationship between hiatal hernia and GERD has been greatly debated over the past decades. It is now understood that both the anatomical (HH) and physiologic (LES) features of the gastroesophageal junction play an important role in the pathogenesis of GERD [35,38]. Age and obesity are major risk factors for development of hiatus hernia [39-41]. People who are overweight experience a progressive increase in intra-abdominal pressure which promotes herniation [29]. As barium swallow examinations are rarely performed nowadays and esophageal manometry is not widely available, the diagnosis of hiatus hernia usually solely relies on upper gastrointestinal endoscopy [42,43].

Both obesity and erosive esophagitis have a high prevalence worldwide. The relationship between them

remains controversial [44]. Several hypotheses have been proposed to explain how obesity can cause erosive esophagitis. Abdominal fat may cause reflux through an increase in intra-abdominal pressure and subsequent esophageal acid exposure [8,45]. Hormonal factors related to obesity are also important mechanical factors [46,47]. In western countries, GERD is the most common gastrointestinal disease and it is associated with a huge economic burden and decreased quality of life [48-51]. Gastroesophageal reflux disease affects 10% - 38% of adults in Europe and America [1] and the global incidence of GERD is expected to increase due to demographic, dietary and epidemiologic changes [52]. In Asia, the prevalence of GERD was estimated to be lower than the western countries [53]. However, studies done in the last decade show an increase in the prevalence [54,55]. The continent of Africa is conspicuously missing in the Global epidemiology map of GERD [2,56]. The true incidence of GERD is largely unknown in many African populations but its prevalence is believed to be increasing due to demographic, nutritional and lifestyle transition [57]. A study by Segal, et al. 2001 [58], found a lower prevalence of GERD in Sub Saharan Africa citing possible negative correlation between H. pylori infection and GERD. In their study, H. Pylori infection, which is usually acquired in childhood and is life long, was postulated to be protective against GERD [58]. Another study in Côte d'Ivoire, looking at a young population (mean age 28 ± 9), established an incidence of heartburn, once a week in 9.2 % of the subjects under study. The incidence was higher among female patients and individuals with a family history of heartburn [59]. Another study in Nigeria found an overall prevalence of 27.1% of GERD, with no significant sex

differences [60]. In Kenya, the prevalence of GERD is largely unknown. A study by Kimang'a and Revathi et al, 2010 investigating the prevalence of H. pylori, reported a 28.9 % prevalence of GERD in patients positive for H.pylori. Among these, 56-65.6% was female [61].

A diagnosis of GERD can be made based on symptoms [23]. Although GERD is a disorder of motility, the therapy of reflux diseases is aimed at reducing gastric acidity in order to decrease esophageal mucosal injury [27,49]. Lifestyle modifications maybe effective in decreasing or eliminating GERD symptoms, but the majority of patients require pharmacologic therapy. This varies with the severity of symptoms and ranges from intermittent antacid therapy for mild disease, to histamine-2 receptor antagonists (H2RA) for moderate symptoms, to daily proton pump inhibitor (PPI) therapy for severe symptoms of GERD [62-64]. A favorable response to anti-secretory medication is used to confirm the presence of GERD [64,65]. The main tests used when GERD is suspected are esophageal PH monitoring, endoscopy and manometry. Endoscopy is indicated in patients with heartburn and alarm symptoms (e.g., dysphagia, bleeding, anemia, weight loss and recurrent vomiting). However, it is not an appropriate first step in most patients with GERD [66]. At least 50% of patients with reflux symptoms have normal esophageal endoscopic findings (non-erosive reflux disease) or uncomplicated GERD [23,67]. The Los Angeles classification tool is used in the categorizing of GERD based on size and number of breakages on the esophageal mucosa [68] (Table 1).

Grade A	One (or more) mucosal break no longer than 5 mm that does not extend between the tops of two mucosal folds
Grade B	One (or more) mucosal break more than 5 mm long that does not extend between the tops of two mucosal folds
Grade C	One (or more) mucosal break that is continuous between the tops of two or more mucosal folds but which involve less than 75% of the circumference
Grade D	One (or more) mucosal break which involves at least 75% of the esophageal circumference

Table 1: Los Angeles endoscopic classification of GERD.

Relationship between GERD and BMI

Overweight and obesity are defined as excessive fat accumulation in the body posing a risk to health. Body mass index, which is calculated as weight in kilograms divided by height in meters squared is used as a marker of obesity. A BMI value of 25–30 represents overweight and BMI >30 indicates obesity. A BMI value <25 is considered as normal [69]. Multiple studies on the association between BMI and GERD have yielded inconsistent results. There is differing data on the use of BMI as a predictor of GERD, its severity and frequency. In western countries, some studies have shown a positive correlation between high BMI and frequency of

reflux [10,17], others have demonstrated a weak association [18] and others show no association [19,20]. There is also a gender variation as women with increased BMI were found to have a higher risk for esophagitis compared to those without [70,71]. There was no significant difference in males [71]. In normal weight females, moderate weight gain was also associated with GERD or GERD-like symptoms [72]. Erosive esophagitis has significant correlation with increasing BMI, but the staging and classification of endoscopic erosive esophagitis is independent of the BMI of the patients [73].

Globally, the association between BMI and GERD was high in the American population [17,74] while Europe had

no association [74]. In Africa, one study done in Nigeria in 2010 showed no correlation between increased body mass index and reflux symptoms in blacks [18,57]. Another study found a weak association between body mass index and reflux symptoms [18]. A recent study done in 2019 on the black population of South Africa showed that GERD was more common in black females than males and the prevalence rose with increasing BMI [21]. In Kenya, a focal study on the management of GERD was published by Okoth, et al. [22]. However, this article had limited information on BMI.

GERD is one of the most common gastroenterological disorders in the world and remains a frequent cause of hospital visits. Its association with BMI has been a subject of interest in its etiology and various studies done across the world have yielded discrepant results [17-21,70-72,74]. There is no data in Kenya to show an association between the two.

Methodology

Study Area

This study was conducted at the Kenyatta National Hospital endoscopy unit. This is a dedicated outpatient unit where upper and lower gastrointestinal evaluation is performed using endoscopes. Patients seen in this unit are those referred for evaluation of GI symptoms.

Study Population

The study included adult patients at the endoscopic unit presenting with the classical symptoms of GERD (heartburn and/or regurgitation) and undergoing upper endoscopy during the study period.

Inclusion Criteria: Patients ≥ 18 years

Exclusion Criteria: Patients with contraindications to upper GI endoscopy such as bleeding disorders and altered consciousness were excluded.

Study Design

This study was a cross-sectional study.

A minimum of 173 GERD patients were sampled to determine proportion with obesity/overweight within 5% level of precision.

Sampling Procedure

Consecutive sampling procedure was used to sample patients for enrollment into the study. Patients with clinical diagnosis of GERD presenting at the endoscopy unit with request for Upper GI endoscopic evaluation were approached

for recruitment to the study. The researcher explained to the subjects the objectives of the study and those who consented to participate were recruited.

Data Collection Materials and Techniques

Administering the Questionnaires: The validated GERD questionnaire tools were administered by trained research assistants to reduce inter-observer variability. The questionnaire had a section on demographic data such as age, gender, height and weight as well as a section assessing for GERD symptoms. The section assessing for GERD symptoms included a Likert scale for severity and frequency of symptoms (Appendix III). The weight (measured in kgs) and height (Meters) were taken using a standardized medical weighing scale. BMI was calculated as follows:

$$\frac{\text{weight (Kgs)}}{\text{height (m)}^2}$$

The subjects were then be categorized into Normal (<25), overweight (25-29.9), Obese (> 30) based on their BMI findings. In this study, classical GERD symptoms were defined as the presence of either heartburn or acid regurgitation. Heartburn was defined as "a burning pain or discomfort behind the breast bone in the chest" and acid regurgitation as "a bitter or sour-tasting fluid coming into the throat or mouth," definitions that have been validated previously [72]. The survey was conducted over a period of 3 months to give time for collection of required sample size.

Upper GI Endoscopy

- **Purpose:** To look at esophageal mucosal changes.
- **Preparation & consent:** The procedure was performed under local anesthetic. The back of the subject's throat was sprayed with the anesthetic. Light sedation was administered as needed. As the scope was passed down towards the stomach, the presence of GERD was assessed based on the presence, size and number of mucosal breakages at the gastroesophageal junction as per the Los Angeles classification [68]. Presence or absence of hiatus hernia was determined by assessing the gastroesophageal flap valve using the Hill Classification [77]. The findings were recorded in a data sheet for each patient (Appendix IV). When the procedure was completed, the subject was taken to the recovery ward where the blood pressure, heart rate and oxygen levels were monitored until they were fully awake.

Data Management

Data was coded and cleaned in SPSS version 25. The data was then be summarized by calculating frequencies, means and proportions. The period prevalence of patients with

GERD was calculated using the formula below:

$$pp = \frac{\text{Number of patients presenting with classical GERD between July and October}}{\text{Total number of patients at the MOPC and Endoscopic Unit between July & Oct}}$$

Associations between respondent demographic data (age, BMI from height and weight) and GERD was assessed by Student t test or Mann-Whitney U test for continuous variables. Chi-square analysis was applied for categorical variables (gender). A P-value of <0.05 was considered significant.

Results

This was an analysis of 174 patients who underwent endoscopy in the unit. As shown in Table 2, the mean age was 43± 14.1 years and majority (56.9%) was female. The patients had a mean weight of 71.2±10.8 Kg and mean height of 1.6± 0.1 meters.

Variable	Frequency (%)
Age in years	
Mean (SD)	43.0 (14.1)
Min - max	18.0-80.0
Gender	
Male	75 (43.1)
Female	99 (56.9)
Weight	
Mean (SD)	71.2 (10.8)
Min - Max	42.0-100.5
Height	
Mean (SD)	1.6 (0.1)
Min - Max	1.4-1.9

Table 2: Characteristics of the 174 study participants.

Overweight and Obesity: As shown in Table 3, the mean BMI was 26.6 Kg/m² ranging from 14.5 to 38.6 Kg/m². The

proportion of patients who were overweight was 40.2% and obese patients made up 21.8% of the population.

Variable	Frequency (%)	95% CI
BMI		
Mean (SD)	26.6 (3.9)	26.0-27.1
Min - Max Category, n (%)	14.5-38.6	-
Normal (<25)	66 (37.9)	31.0-44.8
Overweight (25-29.9)	70 (40.2)	33.3-47.7
Obese (≥30)	38 (21.8)	16.1-27.6

Table 3: Overweight and obesity in patients presenting with GERD.

When a Chi- Square was performed to determine the differences in the BMI by gender, it was found that males and females did not differ significantly as shown in Table 4 below.

Variable	Female	Male	P-value
BMI			
Normal	37(37.4)	29(38.7)	0.663
Overweight	38(38.4)	32(42.7)	
Obese	24(24.2)	14(18.7)	
BMI			
Normal	37(37.4)	29(38.7)	0.862
Overweight	62(62.6)	46(61.3)	

Table 4: Comparison between males and females by BMI.

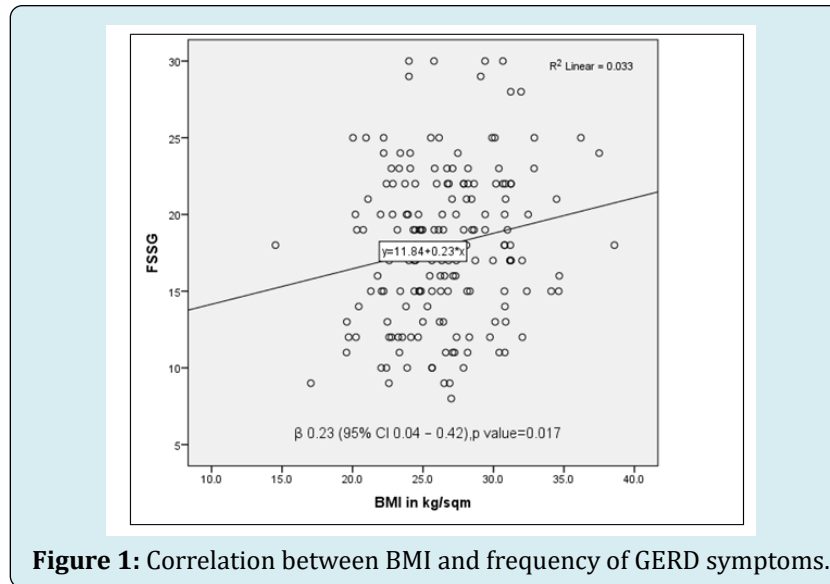
Frequency of GERD Symptoms and its Association with BMI: The mean score of the scale of GERD symptoms in the sample was 18 with 60.3% of the patients having scores of 10 to 19. As shown in Table 5, when BMI was categorized as normal and overweight/obese there was no association with the scale of GERD symptoms.

Variable	Frequency (%)	BMI		P value
		Overweight/ Obese	Normal	
FSSG				
Mean (SD) Category, n (%)	18.0 (5.0)	18.3 (5.0)	17.4 (5.0)	0.217
<10	5 (2.9)	3 (2.8)	2 (3.0)	0.759
19-Oct	105 (60.3)	63 (58.3)	42 (63.9)	
20+	64 (36.8)	42 (38.9)	22 (33.3)	

Table 5: Frequency of GERD symptoms by BMI status.

However, as illustrated in Figure 1, there was a positive relationship between BMI measurements and frequency scale of GERD symptoms. Increasing BMI was significantly

correlated to higher frequency scale of symptoms, β 0.23 (95% CI 0.04-0.42), $p=0.017$.



Endoscopic findings among GERD Patients: As shown in Table 6, 35.6% of the patients had esophagitis and 28.7% were LA-A and 6.9% LA-B. Hiatal hernia was diagnosed in 20.7% of the patients. There was no significant association between diagnoses of esophagitis and hiatal hernia with BMI status of the patients (Table 6).

Variable	Frequency (%)
Esophagitis	
Absent	112 (64.4)
LA-A	50 (28.7)
LA-B	12 (6.9)
Hiatal hernia	
Absent	138 (79.3)
Hills-I	14 (8.0)
Hills-II	14 (8.0)
Hills-III	8 (4.6)

Table 6: Endoscopic findings of the 174 study participants.

When we explored the association between endoscopic findings and BMI, there was no association as shown in the Table 7 below.

Variable	Overweight/obese	Normal	P value
Esophagitis			
Present	38 (35.2)	24 (36.4)	0.875
Absent	70 (64.8)	42 (63.6)	
Hiatal hernia			
Present	22 (20.4)	14 (21.2)	0.894
Absent	86 (79.6)	52 (78.8)	

Table 7: Association between endoscopic findings and BMI.

Similarly, when we tested for the association between BMI and endoscopic findings, it was found that obesity and overweight were not associated with esophagitis and hiatal hernia.

The details are shown in Table 8 below.

Variable	Normal	Obese	P value ¹	Overweight	P value ²
Esophagitis					
Present	24 (36.4)	19 (50.0)	0.174	19 (27.1)	0.248
Absent	42 (63.6)	19 (50.0)		51 (72.9)	
Hiatal hernia					
Present	14 (21.2)	7 (18.4)	0.733	15 (21.4)	0.975
Absent	52 (78.8)	31 (81.6)		55 (78.6)	

Table 8: Association between BMI and endoscopic findings.

¹Normal weight compared to obese,

²overweight

Discussion

GERD is a common clinical problem worldwide and obesity is known to be one of the factors associated with GERD. It has been studied that increasing BMI increases the risk of developing GERD [2,7] and that overweight and obesity contribute to its complications including esophagitis and esophageal adenocarcinoma [78]. Obese patients may experience extrinsic gastric compression by surrounding adipose tissue leading to an increase in intragastric pressure and subsequent relaxation of the LES [79-81] this study was undertaken with an aim to determine the association, if any between increasing BMI and severity of GERD symptoms and document the endoscopic findings in GERD patients with increasing BMI. In this study, more than 60% of the patients were overweight or obese. The proportion of patients who were overweight was 40.2% and obese patients made 21.8% of the population. There were more overweight and obese female patients (57.4%) than males (42.6%) although the differences were not statistically significant. However, these findings are indicative of the trends in previous studies. A study on prevalence and factors associated with overweight and obesity in Kenya showed that the likelihood of having overweight and obesity was increased among women, urban residents and individuals with higher education [82].

The mean frequency scale of GERD symptoms in the study population was 18. The overweight and obese had a mean frequency of 18.3 compared to 17.4 in the normal (Table 3). There was no significant difference between obese patients and those with normal weight in relation to the number of GERD symptoms. Similar results were seen when patients with normal weight were compared to the overweight category. However, there was a positive correlation between increasing BMI and frequency of symptoms (Figure 1). A 10 unit increase in BMI increased frequency of symptoms by a scale of 2 (β 0.23). Studies on the same have shown that the majority of GERD symptoms have likelihood of occurring with increasing BMI [76] and successful weight loss is associated with fewer GERD symptoms [3]. Many factors may contribute to the development of GERD. Among them, there are non-modifiable factors such as age, gender or genetic factors. It has been shown that the risk of GERD symptoms in the adult population increases with age [56,83]. However, this study showed no age association with severity of symptoms (Table 4). This finding is in keeping with a previous study done on the influence of age on GERD in symptomatic patients [84]. In this study, the gender of the patients was not associated with severity of symptoms. This is in contrast to the West where several studies have shown that women are more likely to develop GERD symptoms [84-88]. However, some studies have shown that the disease occurs with similar frequency in men and women [89].

In this study, erosive esophagitis was absent in 64.4% of the population. About a third of the patients had esophagitis (35.6%). Of these, 28.7% were LA- A and 6.9% LA- B. Studies done have shown that at least 50% of patients with reflux symptoms have normal esophageal endoscopic findings (non-erosive reflux disease) [23,67]. Many studies have also shown that reflux esophagitis is more common in men [90-93]. Hiatal hernia was diagnosed in 20.6% of the patients. The presence of esophagitis was not significantly associated with age and gender. However, patients with hiatal hernia were significantly older (mean 49.3 years) compared to those without hernia (mean 41.3 years), $p=0.002$. Our study was not without limitations. The major limitation is that it was hospital based. This has the potential to cause underestimation of the prevalence because it focused on the patients who presented to hospital. In the same vein, our findings are valid to the study population but cannot be extrapolated to the entire population because the study participants were conveniently recruited. Therefore, our study findings should be interpreted in this context.

Conclusions

- The prevalence of overweight patients with GERD is high in the study population
- The prevalence of obesity in the study population was fairly low
- Increasing BMI influences the severity of GERD symptoms in the study population.
- Increasing BMI does not predict the presence of Hiatal hernia and esophagitis in the study population.

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