

Relationship between Body Mass Index and Gastro-Esophageal Reflux Disease in Mosul City

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Abstract

Background: The gastro-esophageal reflux disease (GERD) considered as a diagnostic and therapeutic challenge. Its incidence is increasing parallel with obesity worldwide. This study tried to find a correlation between the disease and body mass index (BMI).

Aim of study: To identify the correlation between both, GERD and BMI.

Methods: This study done on (100) patients with gastro-esophageal reflux in Ibn-sena teaching hospital, Mosul city of Iraq from Jan 2014 to June 2014, the study endeavored to evaluate the correlation BMI with symptoms' severity of GERD through reflux episodes known by number of episodes per week, and also the influence of BMI on endoscopic changes.

Results: This study was carried out on 100 patients (53% male) and (47% female), the mean age $\pm$ SD of participants was 16.4 and mean 42.48 from 17-80 years, the BMI classified to normal <25 , overweight between (30-25), obese patients >30 . The symptoms severity increased with increase body mass index, but its relation with endoscopic findings were not significant.

Conclusions: The effect of increased body mass index on GERD is an increase in reflux episodes, but its relation to endoscopic finding was not significant.

Key word: GERD symptoms, body mass index, endoscopic findings.

INTRODUCTION:

Definition:

GERD is a persistent chronic disorder that occurs because of the retrograde passage of gastro-duodenal secretions back into the esophagus, leading to a variable scale of symptoms. Transient improper relaxation of the lower sphincter is the principal pathophysiologic mechanism in the mainstream of patients (65%) with GERD. Relaxation of the LES occurs in response to swallowing or esophageal distension. GERD is the most common and expensive digestive disease. GERD accounts for at least 9 million office visits to physicians in the USA each year, and annual direct costs for managing GERD exceed \$10 billion ⁽¹⁾.

The Gastro-esophageal reflux disease (GERD) was not recognized as a significant clinical problem until the mid-1930s and was not identified as a precipitating cause for esophagitis until subsequent to World War II. In the early period of twenty-first century, it has grown to be a very common problem and now accounts for a majority of esophageal pathology. It is recognized as a chronic disease, and when medical therapy is required, it is often lifelong treatment ⁽²⁾.

Pathophysiology:

The mucosa is subjected to the impacts of gastro-duodenal secretions for prolonged periods of time, leading to the occurrence of symptoms and, in a proportion of cases, oesophagitis. The tone of the lower

oesophageal sphincter is decreased in certain patients with gastro-oesophageal reflux disease, allowing reflux when intra-abdominal pressure rises. Others have adequate basal sphincter tone, but reflux develops as a result of numerous episodes of improper sphincter relaxation. Reflux is caused by a hiatus hernia when the pressure gradient between the abdominal and thoracic chambers is removed ⁽¹⁾.

In addition, the mucosal rosette formed by gastric folds of the lining mucosa and the contraction of the crural diaphragm at the LES acting like a pinchcock, prevent acid reflux. A great hiatus hernia may weaken this supportive mechanism ⁽³⁾.

The obesity can promote GERD by a mechanism which is not yet defined, but some competing hypotheses have been proposed. Theory of e intra-abdominal pressure proposes that obesity in general, as well as, abdominal obesity in particular interrupt the integrity of lower esophageal sphincter through escalating the intragastric pressure inducing segregation between LES and the extrinsic crural diaphragm or augmenting frequency of its transient relaxations. In contrast, the dietary habits theory suggests that dietary intake and habits may be the common denominator for the concurrent increase in the incidence of both obesity and GERD. Both theories were based on logical assumptions, and it is probable that both intra-abdominal pressure changes and dietary habits play important roles ⁽⁴⁾.

Three dominant mechanisms of esophago-gastric junction incompetence are documented ⁽⁵⁾:

1. Transient relaxations of LES (a vagovagal reflex wherein relaxation of LES is provoked by distention of stomach).
2. Anatomic alteration of the gastro-oesophageal junction integrative of hiatus hernia.
3. LES hypotension.

Healthy people have intermittent episodes of gastro-esophageal reflux due to the spontaneous opening of the lower esophageal sphincter (LES) ⁽⁶⁾.

The seriousness of GERD is dependent on the LES dysfunction in addition to the type, amount, frequency of fluid coming up from the stomach reaching esophagus, and the saliva neutralizing effect. When gastric acid refluxes back up inside esophagus, it creates a situation known as heartburn or acid indigestion. Many people suffer from heartburn sensation or acid indigestion; significantly most of them are overweight or being obese. Heartburn sensation or acid indigestion considered as the commonest feature of GERD, and habitually feels as chest pain of burning character behind the breast bone that referred to the throat, as well as, neck. Many people describe the impression or sensation of food coming back from stomach into the oral cavity and leaving bitter or acid taste ⁽⁷⁾.

Table (1): Factors Associated with Reflux ⁽⁸⁾.

Category	Factor
Lifestyle	Cigarette smoking Obesity
Eating habits	Eating large meals, Eating late at night Lying supine shortly after eating
Foods and beverages	Alcohol Citrus fruits and juices Coffee and Chocolate Fatty and fried foods Onions', Peppermint
Medications	Anticholinergic agents Aspirin and NSAIDs Calcium channel blockers Nitrates, Progesterone Opioids (due to delayed gastric emptying)

Body position	Bending over, exercising (both result in increased intra-abdominal pressure)
Other	Pregnancy Tight-fitting clothing Hiatus hernia

Obesity is clearly acknowledged as a potential risk issue for several chronic diseases, such as diabetes mellitus type 2 and cardiovascular diseases. Furthermore, obesity has lately been connected with numerous forms of gastrointestinal cancer, such as colon cancer, oesophageal adenocarcinoma and gallbladder disease. Obesity's potential role in gastrointestinal problems is unclear. Reports of many health researches show inconsistent findings. Most recent studies show a correlation of obesity with the appearance of gastrointestinal symptoms, particularly heartburn, as well as, regurgitation ⁽⁹⁾.

Gastro paresis (delayed stomach emptying) is more common in patients with moderate-to-severe reflux disease and is an important factor in 10% to 15% of patients with GERD with co-existent hiatal hernia. With overlapped reflux, fluid remained within a sliding hiatal hernia refluxes again back into the esophagus at swallow-related LES relaxation, this phenomenon that does not normally occur ⁽¹⁾.

SYMPTOMS:

Heartburn and regurgitation are the typical symptoms of GERD. Somewhat less common are dysphagia and chest pain. In each case, multiple potential mechanisms for symptom genesis operate that extend beyond the basic concepts of mucosal erosion and activation of afferent sensory nerves. Specifically, hypersensitivity and functional pain are increasingly recognized as cofactors ⁽¹⁰⁾.

Nonetheless, the dominant clinical strategy is empirical treatment with acid inhibitors, reserving further evaluation for those who fail to respond. Important exceptions to this are patients with chest pain or persistent dysphagia, each of which may be indicative of more morbid conditions. With chest pain, cardiac disease must be carefully considered. Chronic reflux, in the case of persistent dysphagia, can lead to the development of adenocarcinoma or peptic stricture, each condition can benefit from early recognition and/or specific therapy. Extra esophageal syndromes with an established association to GERD comprise of chronic cough, laryngitis, bronchial asthma, and dental erosions. A multitude of other conditions including pharyngitis, chronic bronchitis, pulmonary fibrosis, chronic sinusitis, cardiac arrhythmias, sleep apnea, and recurrent aspiration pneumonia have proposed associations with GERD ⁽¹¹⁾.

Given the prospective impact of obesity on GERD, we checked the prevalence and components of GERD clinical symptoms in a group of volunteers who attendant with any of the features of GERD. We present a comprehensive examination of the probable role of over weightiness, as well as, obesity on the severity and frequency of GERD presenting symptoms in our study sample ⁽¹²⁾.

We wanted to explore more and learn about the relationship between symptoms of gastro-esophageal reflux disease and BMI by verifying the relative risks among a wider range of BMI categories and among persons with various degrees of frequency, severity, and duration of symptoms ⁽¹⁴⁾.

BMI is the most broadly used tool to determine obesity, which is equal to weight in kg/ height in m² (kg/m²) ⁽⁴⁾.

At a similar BMI, females have more fat than males in their body. BMI of 30 is most commonly used as a cut-off value for obesity in both men and women ⁽⁵⁾.

Some authorities make use of the expression “overweight” to describe the individuals with BMI >25 and

<30. High BMI is interrelated with features of GERD in normal weight, as well as, overweight women. Even slight weight gain among individuals of normal weight previously may lead to or aggravate features of gastro-esophageal reflux ⁽¹⁴⁾.

The eligible patients undergo upper endoscopy to diagnose erosive esophagitis and further classify the degree of erosions according to Los-Angeles's classification. Enrolled patients receive anthropometric measurements to record body weight, body height and waist circumference on the day of enrollment. Two consequences were studied: the symptoms severity of GERD and the Los-Angeles disease Classification of erosive esophagitis. Cases with endoscopically confirmed GERD usually did not undergo pH monitoring ⁽¹⁵⁾.

Aim of the study:

The current work aim was to examine the impact of body mass index (BMI) on the severity, as well as, frequency of reflux clinical symptoms and esophagitis (correlation of BMI with Heartburn).

Patients and Methods

Study design and setting:

To achieve the study aim, cross-sectional design was chosen for primary GERD and conducted in Ibn-Sena Teaching Hospital throughout the period extended from 25th of October 2020 until 31st of January 2021.

Patients:

A total of 100 patients aged 17 – 80 years (mean age = 42.48) with GERD (53 male and 47 female); who attending the Department of Internal Medicine/Centre of Endoscopy/Ibn-sena Teaching Hospital, were incorporated within the study.

1. Inclusion criteria:

- a. Patients presented with symptoms and signs of G.E.R.D. confirmed by endoscopy.
- b. Age of patients more than 17 years old.

2. Exclusion criteria:

- a. Age less than 17 years old.
- b. Secondary G.E.R.D. like gastric outlet obstruction.

Ethical consideration:

1. Formal approval was taken from Arabic committee for medical specialization & scientific council for medicine of Arabic Board.
2. Formal approval was taken from Ibn-Sena Teaching Hospital authority.
3. Verbal approval was taken from patients and/or their kin.

Procedures:

A Pentax FG-29W model forward facing gastro-scope with a video display was employed. Cases and controls who gave written consents for the procedure had an endoscopic pre-medication of 10% xylocaine sprayed into the pharynx and a parenteral Midazolam or Diazepam of between 2.5 mg and 5 mg as well as 20 mg Hyoscine to induce smooth muscle relaxation. Cases and controls thereafter had the procedure performed on them. The lower ending of the oesophagus became visualized and any erosive mucosa break was illustrated and graded in accordance to the grading system of Los Angeles (LA) ⁽¹¹⁾.

The grading system of LA is detailed as follows:

1. Grade A: Considered as one (or more) mucosal break that not bigger than 5 mm not expands between the peaks of two mucosal folds.
2. Grade B: One mucosal break (or more) which bigger than 5 mm but does not expand between the two mucosal folds tops.
3. Grade C: One (or more) mucosal break that is continuous between the two or more tops of mucosa folds, but comprises less than 75% of the esophageal circumference.
4. Grade D: One mucosal break (or more) that at least comprises 75% of the whole esophageal diameters.

Data collection:

The data were gathered by direct interview using a special questionnaire. History was taken including age, gender, patient weight in Kg., patient height in cm, BMI, waist circumferences in cm, mid arm circumferences in cm, skin fold thickness, medical history, social history, drug history, surgical history, clinical features (presenting symptoms), result of OGD and clinical examination was done including general examination and systemic examination.

Statistical analyses:

The data collected, organized, and summarized in sheets of Excel software 2007. The statistical analysis performed by using IBM-SPSS 26. The normality of these data tested by Shapiro-Wilk analysis, and the nonparametric tests were decided to be chosen. Frequencies, medians, and ranges were calculated. The Spearman correlation was used to find the correlation between the GERD and BMI; 0.9-1.0 considered as strong, 0.7-

0.9 high, 0.5-0.7 moderate, 0.3-0.5 low. P-value ≤ 0.05 considered as significant.

Results:

The study was carried out on (100) patients (53 % male) and (47% female); the patients aged 17 – 80 years with median of (42.0). The GERD (A, GERD (B), GERD (C), and GERD (D) represent (64%), (27%), (8%), and (1%) respectively.

In our study (32%) was normal weight, (42%) over weight and only (26%) was obese.

I- Demographical variables:

Age distribution: figure (1) Shows the age distribution of the study sample and illustrates that the sample distributed with median of (42.0) with range (65.0). The Percentiles 25, 50, and 75 are 28.00, 53.0, and 42.0 respectively.

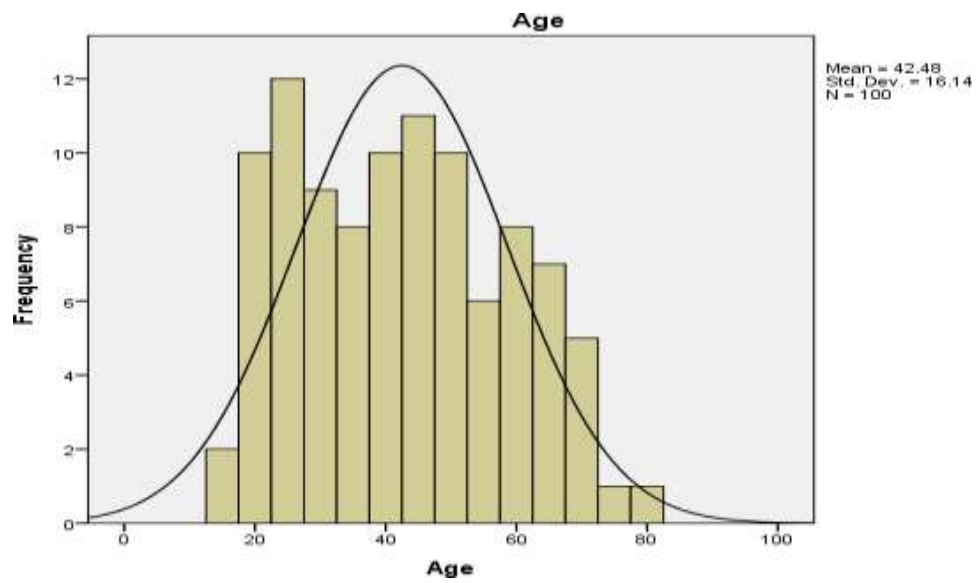


Figure (1): Age distribution of study sample.

Distribution of study sample according to sex: Figure (2) Illustrates the distribution of study sample according to sex, and reveals that 53.0% are males and 47.0% females.

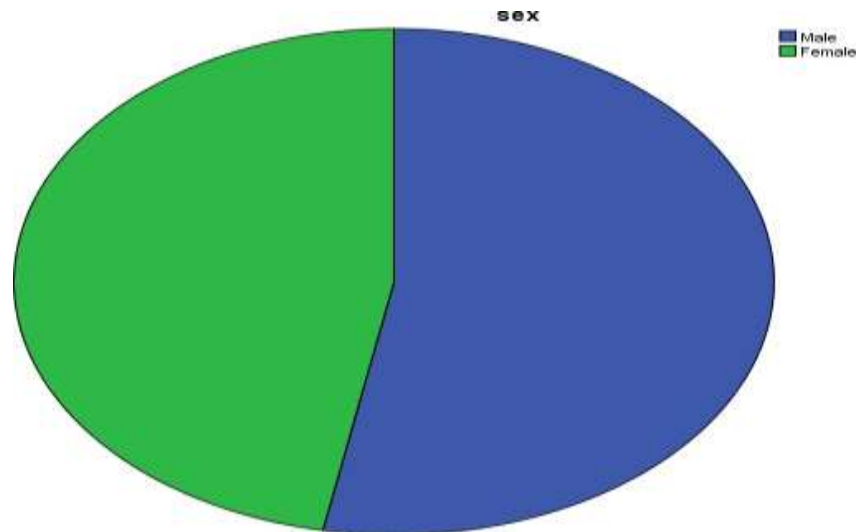


Figure (2): Sex distribution of study sample.

a. Distribution of study sample according to waist ratio:

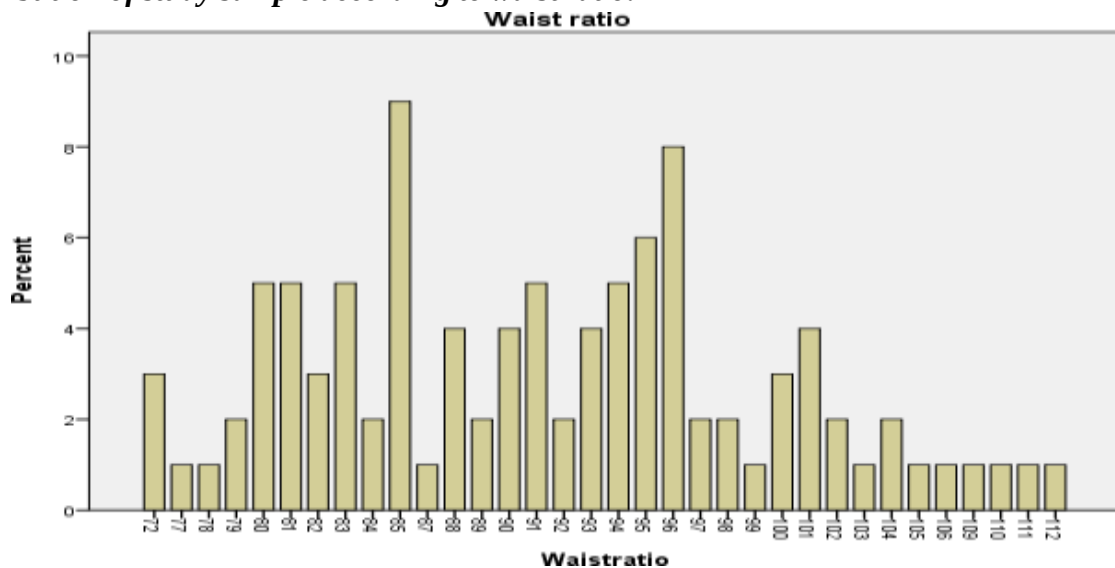


Figure (3): Distribution of study sample according to waist ratio.

b. Distribution of the study sample according to BMI: figure (4) Shows the distribution of the study sample according to BMI and illustrates that the sample distributed with median of (27.0) with range (30.0). The Percentiles 25, 50, and 75 are 24.00, 27.0, and 30.0 respectively.

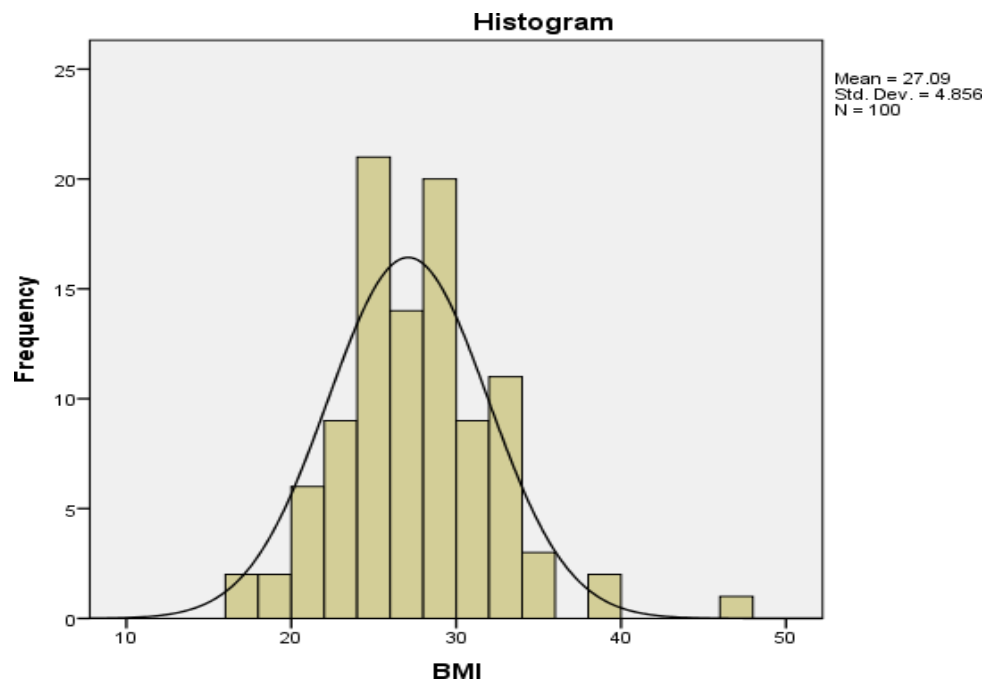


Figure (4): distribution of the study sample according to BM

Table (2) demonstrates distribution of the study sample according to BMI and reveals those normal individuals BMI less than 25 represents 32.0%, out of which the males are 59.4%. The BMI 25-30 forms 42.0% of total sample with predominance of males in 61.9%. Above 30, the predominance shifts toward females and constitutes 65.0%, 80.0%, and 100.0% of BMI (30-35), (35-40), and (>40) respectively.

Table (2): Distribution of the study sample according to BMI.

BMI	Males n=57		Females n=43		Total n=100	
	No.	%	No.	%	No.	%
Less than 25	19	59.4%	13	40.6%	32	100.0%
25-30	26	61.9%	16	38.1%	42	100.0%
30-35	7	35.0%	13	65.0%	20	100.0%
35-40	1	20.0%	4	80.0%	5	100.0%
More than 40	0	0.0%	1	100.0%	1	100.0%

Table (3) demonstrates distribution of the study sample according to classes of GERD and shows 64.0% of the sample having GERD A; 51.5% are males and 48.5% females. GERD B presents in 59.3% of males and 40.7% of females. GERD C is equally presents in both genders. The GERD D presents in only one female.

Table (3): Distribution of the study sample according to classes of GERD.

GERD severity	Males n=57		Females n=43		Total n=100	
	No.	%	No.	%	No.	%
GERD A	33	51.5%	31	48.5%	64	100.0%

GERD B	16	59.3%	11	40.7%	27	100.0%
GERD C	4	50.0%	4	50.0%	8	100.0%
GERD D	0	0.0%	1	100.0%	1	100.0%

Table (4) demonstrates distribution of the study sample according to waist ratio and displays that 85.0% of males have waist ratio of less than 102 and 62.0% of females have waist ratio of less than 88.

Table (4): Distribution of the study sample according to waist ratio.

Waist ratio	Males		Females		Total	
	No.	%	No.	%	No.	%
less than (102) cm	45	85.0%			45	45.0%
more than (102) cm	8	15.0%			8	8.0%
less than (88) cm			29	62.0%	29	29.0%
more than (88) cm			18	38.0%	18	18.0%

II- The correlation between BMI and GERD:

Table (5) shows Spearman's rho Correlation between classes of GERD with BMI and reveals **insignificant** association with $p=0.472$ and correlation coefficient of 0.073.

Table (5): Spearman's rho Correlation between classes of GERD with BMI.

Spearman's rho Correlations		Class	BMI
Class	Correlation Coefficient	1.000	0.073
	Sig. (2-tailed)	.	0.472
BMI	Correlation Coefficient	0.073	1.000
	Sig. (2-tailed)	0.472	.

Table (6) demonstrates Spearman's rho Correlation between BMI and no. of attacks of disease and portrays very highly significant statistical correlation at $p= 0.000$ with correlation coefficient of moderate strength ($r=0.673$).

Table (6): Spearman's rho Correlation between BMI and no. of attack.

Spearman's rho Correlations		BMI	No. of attack
BMI	Correlation Coefficient	1.000	0.673**
	Sig. (2-tailed)	.	0.000
No. of attacks	Correlation Coefficient	0.673**	1.000
	Sig. (2-tailed)	0.000	.

**** Correlation is significant at the 0.01 level (2-tailed).**

Discussion:

Some studies propose a relationship of GERD with obesity. However, sources of this relation are not

totally clear. These findings are consistent with the description of GERD in most studies Suter M. *et al.*,⁽¹⁶⁾.

Based on findings of present study, there were insignificant statistical correlation between genders with BMI; this result is comparable to other studies like Jacobson⁽¹⁷⁾ which shows matching result.

There were many previous studies as a study of Nilsson M *et al.*, discussing the impact of different genders on GERD. One famous study observed a cohort based on large scale population and established that obese females had an increased risk for GERD symptoms in comparison with obese males, and the risk was maximum in premenopausal females and postmenopausal females receiving estrogen therapy⁽¹⁸⁾.

In the current work there is no significant statistical correlation between sex (gender) and GERD, as in two large studies in this subject Murray L *et al.*,⁽³⁾ and Togerson JS *et al.*,⁽⁶⁾.

Although the male gender in our study is (53%) in comparison to female (47%), it is mainly due to social habits or religious cause. However, numerous studies discovered that the increased risk of acid-related esophageal disease among overweight, as well as, the obese persons was neither confounded nor modified by gender as described by Peura D *et al.*,

⁽¹⁹⁾ According to the age-intervals' distribution of the study sample and illustrates that the sample distributed with median of (42.0). In our study there is no significant statistical correlation between age and GERD. Spearman's rho Correlation between classes of GERD with BMI and reveals insignificant association with $p=0.472$ and correlation coefficient of (0.073).

We see many of patient having class B or C according to Los-Angeles's classification but with little signs, symptoms and no. of attacks of disease, so this classification reveals insignificant association in our study unlike other studies, I think because personal variation in judgment of this classification.

Waist circumference, an indicator of abdominal obesity, has stronger correlation with intra-abdominal pressure and low-grade inflammatory state when compared with BMI⁽²⁰⁾.

Although in our study female show more higher (38%) than (15%) in male of Waist circumference but this is also show is no significant statistical correlation between Waist circumference and GERD as incidence of the disease Researchers speculate that estrogen may predispose heavy women to GERD because it stimulates the production of nitrous oxide which relaxes smooth muscles such as the LES⁽²⁰⁾. In our study (32%) of the cases are normal weight and (42%) over weight and only (26%) of the sample will be obese, in patients with GERD, higher BMI was associated with more frequent and more severe heartburn and regurgitation, as well as with esophagitis, Nilsson M *et al.*,⁽¹⁸⁾ Lagergren J *et al.*,⁽²¹⁾ Hampel H⁽²²⁾.

Spearman's rho Correlation between BMI and number of attacks and portrays show a very highly significant statistical correlation at ($p=0.000$) with correlation coefficient of moderate strength ($r=0.673$). So, the main correlation is that the severity of the disease affected by higher BMI mainly central obesity. Result in our study is parallel to the result in other international studies like Lagergren J *et al.*,⁽²¹⁾ Hampel H⁽²²⁾. Up till now no population-based research of the correlation of GERD symptoms and BMI has been conducted in the UK and merely a little of such researches have been performed in other countries. Lagergren J *et al.*,⁽²³⁾ Stanghellini V *et al.*,⁽²⁴⁾ Locke GR *et al.*,⁽²⁵⁾ Lee SJ *et al.*,⁽²⁶⁾ Ruhl CE *et al.*,⁽²⁷⁾.

Finally, present study showed a higher predominance of GERD in obese population when compared to data of non-obese patients still, it was not demonstrated a positive statistically relevant correlation between increase in BMI and GERD prevalence in the studied obese population, as occurred in other studies⁽²⁸⁻³⁰⁾. In obese patient with clinical features of GERD, LRYGB was recommended as it is more successful

procedure for improving the symptoms of GERD as it plays significantly an important function in weight reduction without changing the LES anatomy and increasing intra-gastric pressure ⁽¹³⁾.

Our report had some limitations:

1. There is small sample of patients (100) cases thus the correlation of GERD with BMI may be different in other groups. We discovered that a BMI range of 25 to 30 is present in (42%). These findings may have important implications with respect to future studies for goals of weight loss in this group of patients.
2. It was a retrospective study.
3. Cases with endoscopically confirmed GERD usually did not undergo pH monitoring, which prevented them from being included in this study.
4. As this work conducted at a tertiary referral hospital, the result cannot be generalized. In addition, obesity was evaluated only by BMI in this study.

Conclusion and Recommendation:

Conclusion:

The effect of increased body mass index on GERD is an increase in reflux episodes, but its relation to endoscopic finding was not significant.

There is correlation among both BMI and no. of attacks of disease in a very highly significant statistical correlation.

Spearman's rho correlation between classes of GERD, age, sex with BMI reveals insignificant association.

Recommendation:

1. Large size prospective studies about GERD are recommended to know the most common type of clinical presentation.
2. In other study of GERD, the technique should be used in GERD assessment.
3. Establishment of registry about GERD in Ibn-Sena hospital.

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