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RESEARCH ARTICLE

Association of Gerd with Obesity & the Waist Circumference "A Reflux or Reflex Affair!

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ABSTRACT

Gastroesophageal reflux disease (GERD) is a digestive disorder that affects the lower oesophageal sphincter and causes injury to the oesophagus from chronic reflux exposure to stomach acid. Gastroesophageal reflux disease is one of the most common health problems in the world today. Up to 80% of the patients with reflux disease experience difficulty in sleeping, working and eating thereby contributing to an impaired quality of life. The financial burden of GERD Gastroesophageal reflux disease on the health sector is enormous. World wide GERD is increasingly and of late is being reported from Asia and south east Asian countries. The relationship of GERD with obesity is assumed but the evidence is equivocal. Substantial studies that report an association between the two and an equal number concluding that there is no association between GERD and obesity.

In Malaysia Obesity is on the rise among its residents the Malay, the Chinese and among the Indian population. A cross sectional study was therefore conducted to establish an association if any between moderate & severe GERD versus Obesity and Waist circumference.

Results: A total of one hundred and fifty five subjects had GERD, Among the one hundred and fifty five, 111 subjects were obese, only forty four had a normal body mass index. The Obese subjects in both the moderate and severe categories had varying grades of obesity I-III. The majority of the obese were among the Malay population. The Body mass index and waist circumference was noted to be higher than their Chinese counterparts. In this study five subjects were noted to have Non erosive reflux disease (NERD). A total of seventeen patients had Barrett oesophagus nine of whom were males. Interestingly the severity of the self reported Clinical symptoms in those patients with Barrett oesophagus was less. The current trend in the rise of obesity with its co morbidities and the increasing prevalence of gastroesophageal reflux disease is likely to impose huge financial costs that will impact economy of the health care sector of many developing nations including Malaysia in this part of the world.

Conclusion: Obesity is on the rise worldwide as is witnessed in Malaysia. GERD and non erosive reflux disease is prevalent among the population in Kelantan. Body mass index and waist circumference were not found to be associated with the severity of GERD in both the moderate and severe categories.

Keywords: Gastroesophageal reflux disease (GERD), Obesity, Reflux, Waist Circumference, BMI.

Introduction

GERD is defined as "a condition which develops when the reflux of stomach contents causes troublesome symptoms and/or complications"[1]. The word troublesome is used if the symptoms affect the individuals well being and interferes with the quality of life. The prevalence of gastroesophageal reflux disease has been steadily increasing in the United States, Western Europe, Scandanavian countries and Australia[2]. In Western countries approximately 20-40 per cent of the adult population experiences regular heart burn, the primary symptom of gastroesophageal disease.

It has been noted that less than half of the affected will see their primary care physician with their symptoms and less than 20% will undergo endoscopy[3]. Gastroesophageal reflux disease GERD leads to substantial costs to both the patient and the society. The amount spent on anti reflux medication sums up to USD $6 billion and over USD $10 billion for the care of gastroesohageal disease in the United States[4]. The prevalence of gastroesophageal disease in Asia is 5 % with evidence that it is at an increasing trend[5].The financial burden in this eastern part of the world is reportedly enormous as well.

Symptomatic GERD is defined as two to five episodes of reflux with one night time episode in a week. The symptoms of GERD are mild if they occur two or more days a week, and moderate if the symptoms occurred more than three or more days a week and interfered with normal activities. Severe GERD if the symptoms are incapacitating with inability to perform normal activities[6].

Pathophysiology of gastroesophageal reflux disease

Gastroesophageal reflux occurs when the pressure in the lower oesophageal sphincter is lower than the intra abdominal pressure. The lower oesophageal sphincter is formed by a 2.5-4.5 cm of circular smooth muscle fibres in the distal oesophagus. The physiological anti reflux barrier has three main components and only when this defence is overcome that reflux induced damage ensues[7].

The first component is a persistently high lower oesophageal sphincter pressure. The normal resting pressure is between 15-35mm Hg[8]. The pressure of 5-10 mmHg is sufficient to prevent reflux symptoms at rest and hence is referred to as static anti reflux barrier. The second component is the anatomical crural diaphragm which is said to form an external sphincter, exerting pressure on the outside of the lower oesophageal sphincter. The oesophagus runs through the crural diaphragm as it passes through the diaphragmatic hiatus of the diaphragm. This hiatus is approximately 2cm in length. The size may vary but it contracts whenever the intra abdominal pressure increases such as when coughing or exercise. This may be referred to as a dynamic anti reflux barrier. The third mechanism for the anti reflux barrier is the flap valve mechanism formed by the sharp angle between the cardia of the stomach and the distal oesophagus, the angle of His[9]. The episodes of reflux were initially ascribed to a permanently low resting tone of the lower oesophageal sphincter however there are studies that have revealed that the episodes of reflux are due to transient relaxations of the lower oesophageal sphincter[10]. A transient increase in intra abdominal pressure and a spontaneous free reflux associated with a low resting pressure of the lower oesophageal sphincter are the other two mechanisms through which the reflux occurs. Once the reflux has taken place the degree of mucosal damage varies, depending on the ability of the oesophagus to get rid of the content of the reflux material and the degree of mucosal resistance. The mucosal resistance is brought about by the stratified squamous epithelial barrier. The saliva that is swallowed offers an additional protection by neutralising the acid and aids in its removal[11]. Prolonged exposure to the acid is related to the severity of the gastroesophageal disease in these individuals as the oesophageal pH remains below 4 than others with milder form of gastroesophageal disease[12]. There is also some evidence that patients with Barrett oesophagus have less frequent or less severe symptoms this is attributed to the development of a more acid resistant columnar mucosa[13].

A delay in gastric emptying is another cited factor this was noted on the basis of retention at 4 hours and is seen in 26% of GERD patients[14]. It has been hypothesized that a delayed emptying may lead to gastroesophageal reflux disease by an increased gastric content that inturn increases the transient relaxations of the lower gastroesophageal sphincter via gastric distension[15]. It is interesting to note that people with a hiatal hernia have more reflux[16]. This is because the gastroesophageal junction normally protects against reflux during both static and dynamic states. During a sudden rise in the intra abdominal pressure the crural diaphragm acts as a secondary sphincter. In the people with a hiatal hernia this mechanism is substantially impaired as the diaphragmatic sphincter is anatomically distanced from the gastroesophageal junction thereby failing to function as antireflux mechanism[17]. The greater the size of the hiatal hernia there is greater impairment in the oesophageal emptying thereby prolonging acid reflux time following the reflux event.

Aetiology of gastroesophageal reflux disease

It has long been suggested that there is a substantial genetic component in the gastroesophageal reflux disease. A Familial aggregation has been observed both for gastroesophageal reflux disease and Barrett oesophagus. There are two large studies that confirm these findings[18]. This genetic association was found to be 43% of the variance in liability to gastroesophageal reflux disease[19]. As much as one third of GERD emphasizes hereditary risk factors that need to be taken into account and that environmental factors may also play a role in the aetiopathogenesis of gastroesophageal reflux disease. Recently the gene associated with syndromic gastroesophageal reflux disease (GERD 1) has been found and is being studied[20].

Asians have been reported to have a smaller gastric parietal mass and a lower acid output compared to Caucasians[21]. A low acid secretion would hence be associated with a reduced prevalence of GERD. However,

a rise in acid secretion, irrespective of Helicobacter pylori status has been observed over a period of twenty years in Japan has been reported to be the cause of a gradual rise in the incidence of gastroesophageal reflux disease in that country[22]. In a comparative study of Singaporean and English patients, race was found to be the single most independent predictive factor for reflux oesophagitis along with a hiatus hernia[23]. Asian patients had a four fold decrease risk of getting oesophagitis and a three fold decreased risk of having hiatus hernia compared to the Caucasian counterparts[24].

The last few decades have witnessed a rapid increase in the prevalence of overweight and obesity both in the western world as well as in the eastern parts of the globe especially among lower middle income groups in both India and China[25]. Overweight and obesity satisfy several criteria for the association of gastroesophageal reflux disease and its related disorders like oesophageal erosions, oesophagitis and eventually oesophageal adenocarcinoma.

The Obese patients have an increased risk for hiatal hernia that initiates and promotes gastroesophageal reflux disease[26]. Transient lower oesophageal sphincter relaxation is the mode of reflux. Recent studies show the risk for obesity related among Asians has risen from a lower BMI of 23 (twenty three)[27]. Therefore, it appears that higher postprandial intragastric pressure in abdominal obesity leads to more intense stimulation of stretch and tension mechanoreceptors at the proximal receptors that brings about postprandial transient lower oesophageal sphincter relaxation.

Waist circumference was an independent risk factor for increased intragastric pressure. These associations were stronger in men than women.

A dose response relationship such that the higher the BMI and waist circumference the greater the intra gastric pressure and gastroesophageal pressure gradient[28] Visceral fat is metabolically active and has been associated with low levels of sero protective adiponectin or proinflammatory cytokines like interleukin-1b, interleukin-6 and tumor necrosis factor. The latter two have been shown to be over expressed in erosive oesophagitis and Barrett oesophagus[29]

The Nord-Trodelag health survey (HUNT) concluded that obese women had an increased risk of reflux symptoms when compared to obese men the risk being higher in premenopausal and post menopausal women on oestrogen therapy[30]. The proposed hypothesis for this correlation was an increased nitric oxide synthesis under the influence of oestrogen[31].

Nitric oxide is the predominant relaxing transmitter in the gastrointestinal tract.

Smoking tobacco can induce reflux episodes by lowering the lower oesophageal sphincter resting pressure this is based on studies using oesophageal pH monitoring[32]. The intake of alcohol can also lower the lower oesophageal sphincter and trigger reflux episodes[33].

Certain food items like coffee, chocolate and peppermints have been found to promote reflux episodes[34]. In physiological studies, ingestion of dietary fat and mints have been shown to decrease lower oesophageal sphincter pressure and increase oesophageal acid exposure[35].

Lifestyle modification has an overall positive impact on gastroesophageal reflux disease. There are numerous studies that have shown that a reduction of weight decreases the prevalence of gastroesophageal reflux disease but a recently published systematic review, the evidence for the former is weak[36].

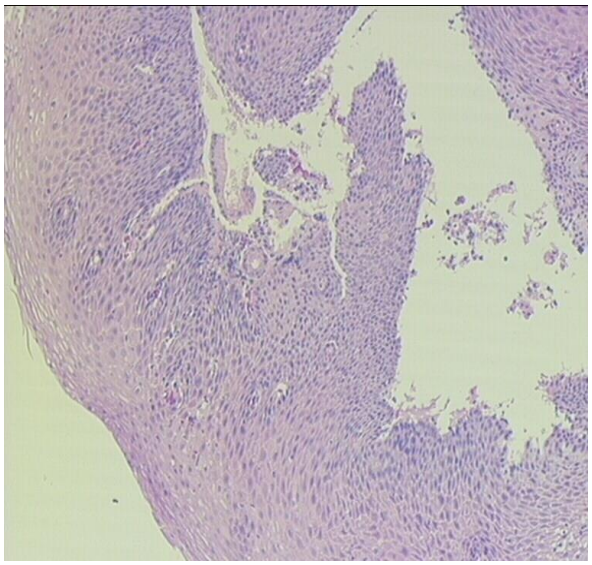


Fig 1.1. Showing Histological features of gastroesophageal reflux disease, basal cell hyperplasia and papillary projection from study subject.

One of the most common causes of chronic cough in the world today is gastroesophageal reflux disease. The prevalence being in the range of 20-41%[37] The patients who are asthmatics are reported to have a higher incidence of gastroesophageal reflux disease. 30-81%. The exact reason for the cause and effect of these respiratory disorders has yet to be elaborated. Asthma may cause or aggravate gastroesophageal reflux disease this is thought to be brought about by an increase in negative pleural pressure via airway obstruction thereby producing a high thoracoabdominal pressure gradient over the diaphragm[38]. The bronchodilators used in these respiratory disorders have shown to lower the lower oesophageal sphincter tone thereby predisposing to reflux[38].

Non erosive reflux disease. NERD is the most common phenotypic presentation of gastroesophageal reflux disease[39]. Non erosive reflux disease if they have no mucosal injury on endoscopic examination.

According to the group of expert panel at Geneva workshop "These are individuals who statisfy the definition of GERD but do not have either Barrett oesophagus or definite endoscopic oesophageal breaks".

The natural history studies on nonerosive reflux disease suggest that the vast majority of these patients never progress to develop erosive oesophagitis or Barrettes

oesophagus[40]. Hence therapeutic approaches such as on demand or intermittent therapy are an option for these patients.

Barrett Oesophagus:

Barrett oesophagus is named after Norman Rupert Barrett, a surgeon who drew attention to the short oesophagus in a report published in 1950. The eponym "Barretts" oesophagus has been retained even though Normal Barrett was not the first to describe the columnar lined oesophagus. In 1953 Allison and Johnstone stated that this columnar region was more likely oesophagus because the intrathoracic region lacked a peritoneal covering and it contained submucous glands within the columnar segment[41]. Although gastric fundus and gastric cardiac type epithelia can be found in Barrett oesophagus, it is the specialized intestinal metaplasia that is the most distinctive and important type of Barrett epithelium and it is the demonstration of this specialized intestinal metaplasia to establish the diagnosis.

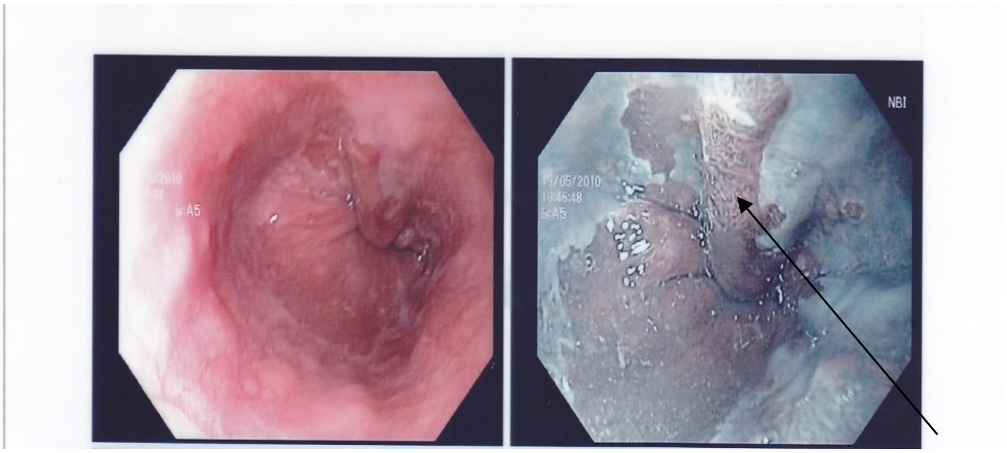


Fig 1.2 Endoscopic View of Migrated columnar epithelium

Barrett oesophagus showing migration of columnar epithelium on white light and Narrow band imaging.

Barrett oesophagus is a complication of GERD. The patients with Barrett s oesophagus tend to have a combination of clinical symptoms including hiatal hernia, reduced lower oesophageal sphincter pressures, delayed oesophageal acid clearance time and gastro duodenal reflux. This has been documented by the presence of bile in the oesophageal lumen. The oesophageal defence mechanisms against the noxious substances in the refluxate include an anti reflux barrier, an efficient clearing mechanism and epithelial defence factors.

The anti reflux barrier is a high pressure zone at the oesophagogastric junction that is generated by the tonic contraction of the lower oesophageal sphincter coupled with extrinsic compression of the right crus of the diaphragm. The system is proposed imperfect due to the existence of the physiological transient lower oesophageal sphincter relaxations (TLOSR). This transient lower oesophageal sphincter relaxation occurs primarily post meals but in the absence of a preceding swallow. There are studies that that indicate that about 95% of the reflux episodes in healthy controls occur during the TLOSR. Most of the reflux in patients with GERD occur through this mechanism.

ETHICAL APPROVAL

This study was approved by the Research and Ethical Committee, School of Medical Sciences.

GENERAL OBJECTIVE:

The general aim of this study is to ascertain if obesity affects the subjects with gastroesopheageal reflux disease by a comparison of body mass index and waist circumference for their independent associations with the severity of gastroesophageal reflux disease in endoscopy unit in HUSM Kubang Kerian Kelantan Malaysia.

SPECIFIC OBJECTIVE:

1. To compare body mass index and waist circumference for their independent associations with the severity of gastroesophageal reflux disease.
2. To compare the association between the group of patients with barrett oesophagus and those without barrett oesophagus using waist circumference.

RESEARCH HYPOTHESIS

There is a relationship between waist circumference and body mass index with the severity of gastroesophageal reflux disease.

There is an association of waist circumference of subjects with Barrett oesophagus compared to those with non Barrett oesophagus.

INCLUSION CRITERIA

1. Adults aged 20 to 70 years,
2. Either gender,
3. Symptomatic gastroesophageal reflux disease such as retrosternal heartburn, post meal reflux, bloating and sore throat.

EXCLUSION CRITERIA

1. Subjects under the age of 20years and over 70 years,
2. 2 Previous undergone an abdominal surgery,
3. Co Morbids like cirrhosis, end stage renal failure, cardiac failure.

This included the data collection sheet. The record sheet had patient particulars like name, age, race, marital status registration no, address, telephone number,

occupation and employment status, Co morbid illness, duration of symptoms, type of gastroesophageal reflux disease, weight, height and waist circumference.

STUDY DESIGN: Cross sectional study.

Methodology

All the subjects who were referred to endoscopy unit from various units were initially quantified Clinically based on the severity of their symptoms viz dyspepsia, retrosternal burning sensation and reflux symptoms into two groups the moderate and severe gastroesophageal reflux disease using the GERD Impact scale questioner. The participants were subjected to a face to face interview by the research officer to verify the symptoms. All eligible subjects once consented were then subjected to anthropometric measurements followed by endoscopic examination.

The assessment took 10-15 minutes/subject to complete. The height was taken as the maximum distance from the foot pedal to the highest point on the skull (ie. vertex of the head) with the head held in Frankfort plane[42]. The participants were asked to stand with their feet together and their arms hanging naturally by the sides. The heels, buttock, upper back and back of the head were in contact with the stadiometer with heels flat on ground and not elevated. The participant was then instructed to look straight ahead and take a deep breath. The headpiece of the stadiometer was brought down so that it was in contact with the vertex of the head. The weight was then recorded in the same machine as the subject remained still on the machine.

The Body mass index (BMI) was determined from the measured weight and height and calculated to the nearest 0.01 kg/m2.

The waist circumference (WC) was measured with the participant standing upright, with both feet together and the arms hanging freely by the sides. The measurement was taken at the end of a gentle expiration directly on the skin using a flexible tape at the level of the narrowest point between the lower costal border and the iliac crest[42].If the subject did not feel comfortable having the measurement taken directly on the skin, then it was taken on top of light clothing, and this adjustment of technique was noted.

Two measurements were taken to the nearest 0.1cm. Waist circumference can be used to express central adiposity[43]. The current WHO recommendations report on a WHO consultation on Obesity 1997 suggest that the waist circumference of 90 cm in males and 80cm in females is associated with an increased risk for cardiovascular diseases and diabetes mellitus.

On Endoscopy the severity of gastroesophageal reflux disease into moderate and severe grades on the basis of the Los Angeles classification. A biopsy specimen was taken 3cm from the Z- line and was sent to a single dedicated pathologist assigned for this study.

Los Angeles classification: Endoscopic visualization of extent of reflux insult.
Grade A: Mucosal break less than 5mm from gastroesophageal junction.
Grade B: Mucosal break more than 5mm from gastroesophageal junction.
Grade C: Mucosal break continuous between two mucosal folds.
Grade D: Mucosal break more than 75% of the oesophageal circumference.

A histological diagnosis of gastro oesophageal reflux disease was confirmed if the following were seen:

i. Hyperplasia of the basal layer and elongation of papillae,
ii. Infiltration of squamous epithelium with neutrophilic granulocytes with or
iii. without necrosis,
iv. Eosinophilic granulocytes and lymphocytes,
v. Congestion and ectasia in capillary vessels ascending in epithelial papillae as well as thickened vessel walls,
vi. Glycogen acanthosis of squamous epithelium,
vii. Balloon cells,
viii. Spongiosis of squamous epithelium with dilated intracellular spaces.

Moderate gastroesophageal reflux: Symptoms of heart burn for 3 or more days in a week, acid regurgitation and discomfort sufficient to interfere with normal activities[44].

Severe gastroesophageal reflux: Symptoms of heart burn for every other day, acid regurgitation and discomfort that is in capacitating with inability to perform normal activities [44].

Body mass index: Body Mass Index (BMI) is defined as follows
BMI = Weight (kg) /Height(m2).
The current WHO classification states that the cut off points for overweight and obesity are 25 and 30 kg/m2 respectively.

With a high prevalence of type II diabetes mellitus and cardiovascular risk factors in parts of Asia below those cut off points. Many Asian populations have a higher body fat percent at similar BMI, compared with Caucasian and European populations[44] The evidence from several Asian countries like Singapore[45], have shown that the risk of co morbidities begin to rise at lower BMI values[46]

Thus, based on current evidence, the following classification of weight by BMI for Asians is recommended:

Table 1: BMI Classification

Classification	BMI (kg/m2)	Risk of co morbidities
Underweight	< 18.5	Low (Risk of Clinical problems)
Normal range	18.5 – 22.9	Average
Overweight	➢ 23	Average
Pre obese	23 – 27.4	Increased
Obese I	27.5 – 34.9	Moderate
Obese II	35 – 39.9	Severe
Obese III	➢ 40	Morbid obesity

Central Obesity: BMI > 30 kg/m2

Waist circumference: It is a convenient, reliable and co relates well with abdominal fat content irrespective of the BMI. The waist circumference is also an independent risk factor for cardiovascular disease. It is most useful in individuals who are in the normal and overweight categories of the BMI. In those with a BMI > 35kg/m2 it is not recommended to measure the waist circumference as it loses its predictive value.

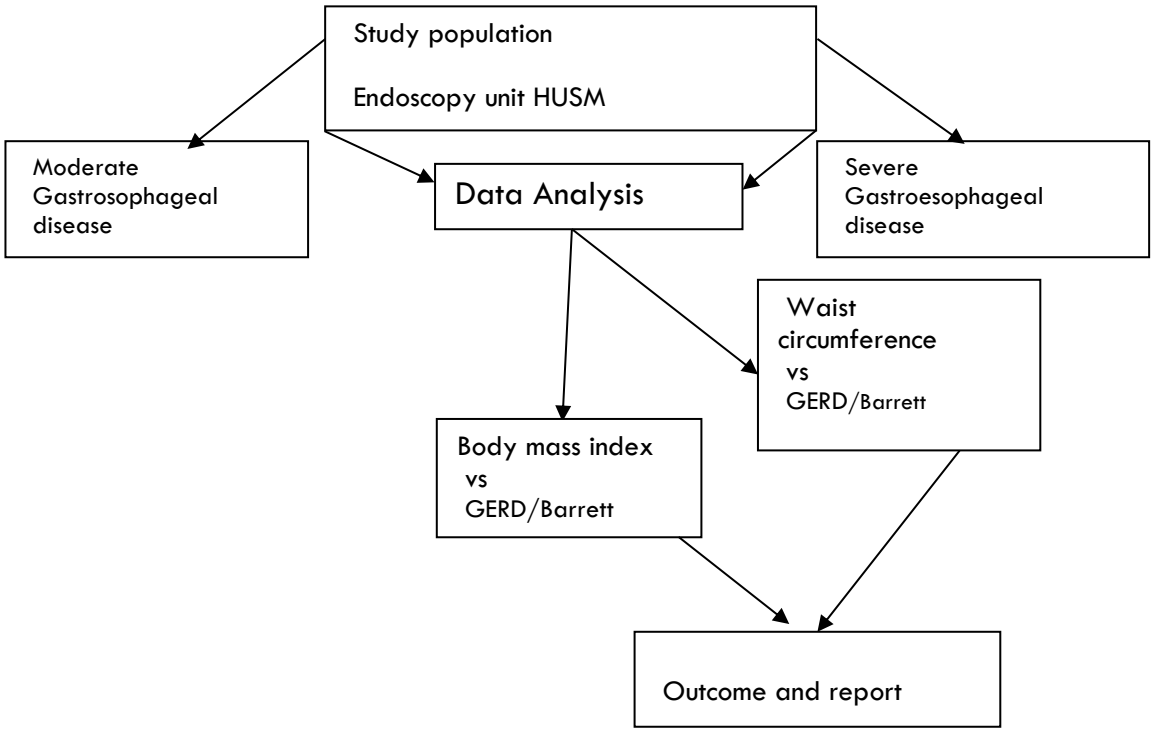
The BMI does not provide any indication of the distribution of fat in the body. Truncal distribution of the adipose tissue around the abdomen has a particularly strong relationship to the adverse metabolic and vascular effects of obesity while fat distributed around the hip carries a lower burden of the disease.

The current WHO recommendations report on a WHO consultation on Obesity 1997 suggest that the waist circumference of 90 cm in males and 80cm in females is associated with an increased risk for cardiovascular diseases and diabetes mellitus.

Due to a high prevalence of type 2 diabetes mellitus and cardiovascular diseases the risk factors for the development of these diseases in Asia are seen well below the recommended cut off limits.[45, 46]

Thus, based on the current evidence the waist circumference (WC) associated with an increased risk of complications from cardiovascular disease and health related quality of life is as follows WC: Men > 90 cm and Women >80cm.

Flow chart of the study.



Sample size calculated P.S Software :
Standard deviation:7.16
Expected outcome mean: 3
Alpha: 0.05,
Power of the study: 0.8
SAMPLE SIZE: 96/group
Modified based on 10% drop out:100/group.

The sample size was calculated using PS software. The dichotomous independent variables were two proportion. All the data entry and analysis were carried out using the social science and statistical package (SPSS) version 18. As this is a cross sectional study, Chi square was used for categorical variables and independent t-test was

applied for numerical variables. Data exploration was done to obtain descriptive statistical and graphs for all the variables. the p value of less than (alpha) of 0.05 was considered significant. The sample size was calculated to be 96 per group.

Result Analysis.

A total of one hundred and fifty five (155) patients who were referred to the endoscopy unit in HUSM were enrolled for the study.

Among the one hundred and fiftyfive subjects (155), forty-four (44) had normal BMI, six (6) subjects were underweight of which three (3) were Chinese females, two (2) were Malay females and one male Malay. The remaining had varying grades of obesity I-III (BMI 27.5-40). Two subjects (2) one male Malay and the other female Malay had morbid obesity. The minimum waist circumference was that of a female Malay sixty cm and the maximum was of a Malay female one hundred and twenty five cm.

On the basis of endoscopy using the GERD impact scale sixty eight had moderate gastroesophageal reflux disease and eighty seven had severe gastroesophageal reflux disease. Seventeen (17) had Barrett oesophagus suspected on endoscopy.

On the basis of HPE sixty one subjects had GERD, five (5) had NERD, seventy seven had normal report and twelve were inadequate sample for interpretation. However, none of the HPE showed features of Barrett oesophagus.

Demographic characteristics.

AGE DISTRIBUTION

Demographical data analysis of One hundred and fifty five patients revealed that the most common age group of presentation were middle aged group 47.77 yrs.

Table 2. Shows mean age of GERD.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	155	20	70	47.77	14.19

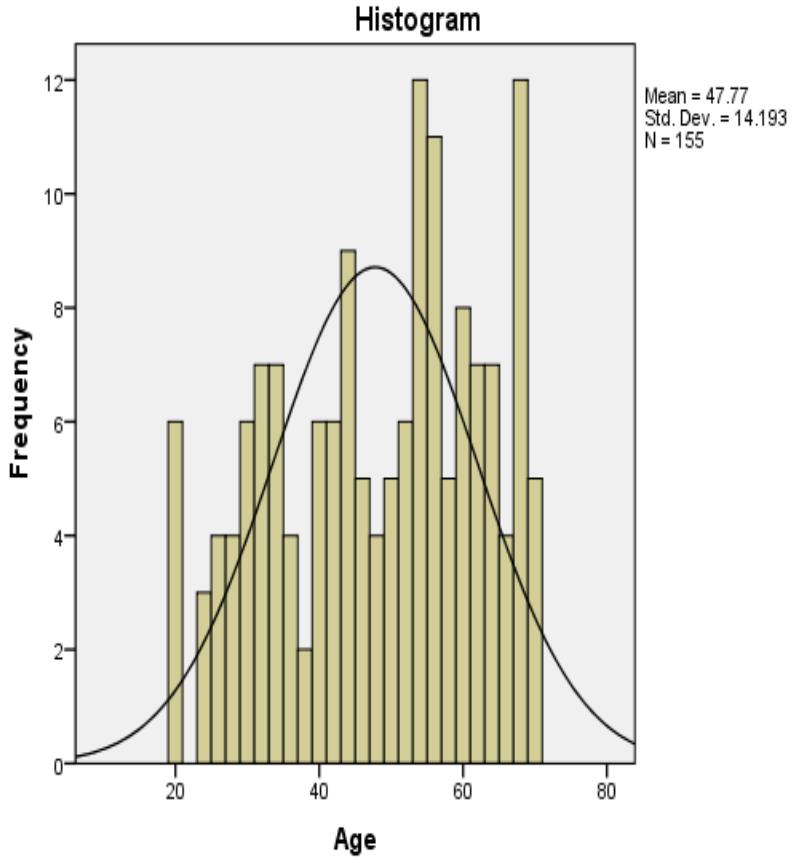


Figure 1.3: Age in years distribution of GERD subjects.

The mean age in the study was 47yrs the youngest patient was twenty years old and the oldest subject was 70yrs old.

Gender distribution

Among the one hundred and fifty five patients 79 were females, 76 males. Among the females group 61 were Malays, 17 were Chinese and 1 was an Indian. In the male group there were 64 Malays and 12 Chinese. In this study the predominant group constituted the Malays 80% followed by the Chinese at 18.7%. The Indians constituted the least number namely one.

Table 3. Gender distribution among GERD subjects

Gender	Frequency	Percent (%)
Female	79	50.96
Male	76	49.03
Total	155	100

Percentage distribution subjects with gastroesophageal reflux disease. The number of female subjects were slightly more than the males.

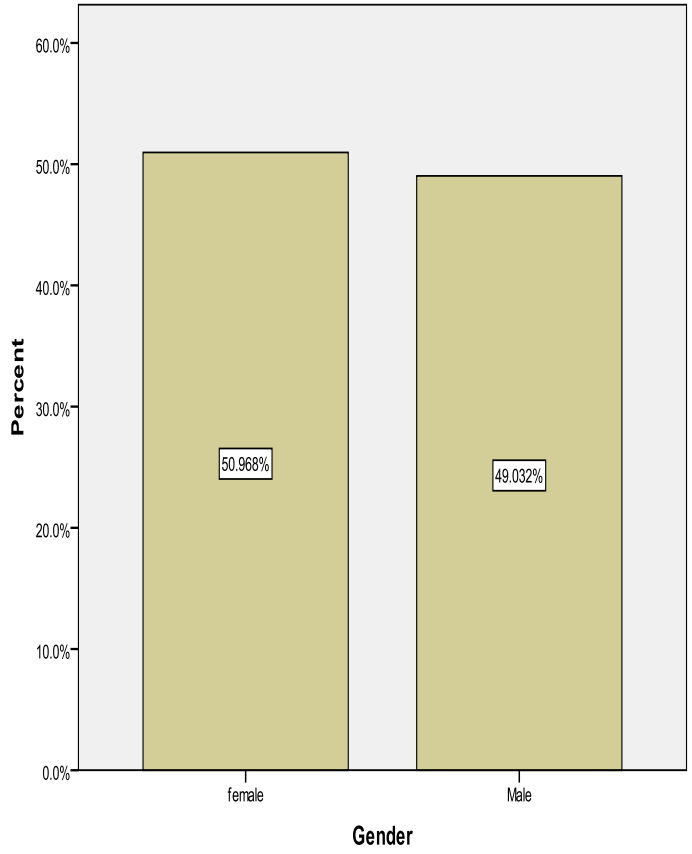


Fig 1.4 Bar chart by gender distribution.

Table 4. Race distribution among the subjects with GERD.

Race	Frequency	Percentage (%)
Malay	125	80
Chinese	29	18.7
Indian	1	0.6
Total	155	100

In this study it was noted that there was an increased predominance of the Malays 80% and a relatively increased number of the Chinese at 18.7% followed by one Indian who had symptoms of GERD.

Table 5. Weight distribution among gastroesophageal disease subjects.

N	**Minimum (kg)**	**Maximum (kg)**	**Mean**
155	37	104	66.36

Table 6. Shows the number of subjects with moderate, severe GERD and Barrett Oesophagus on endoscopy.

Gastroesophageal reflux	**Frequency**	**Percent (%)**
Moderate GERD	68	43.9
Severe GERD	70	45.2
Barrett oesophagus	17	11.0
Total	155	100

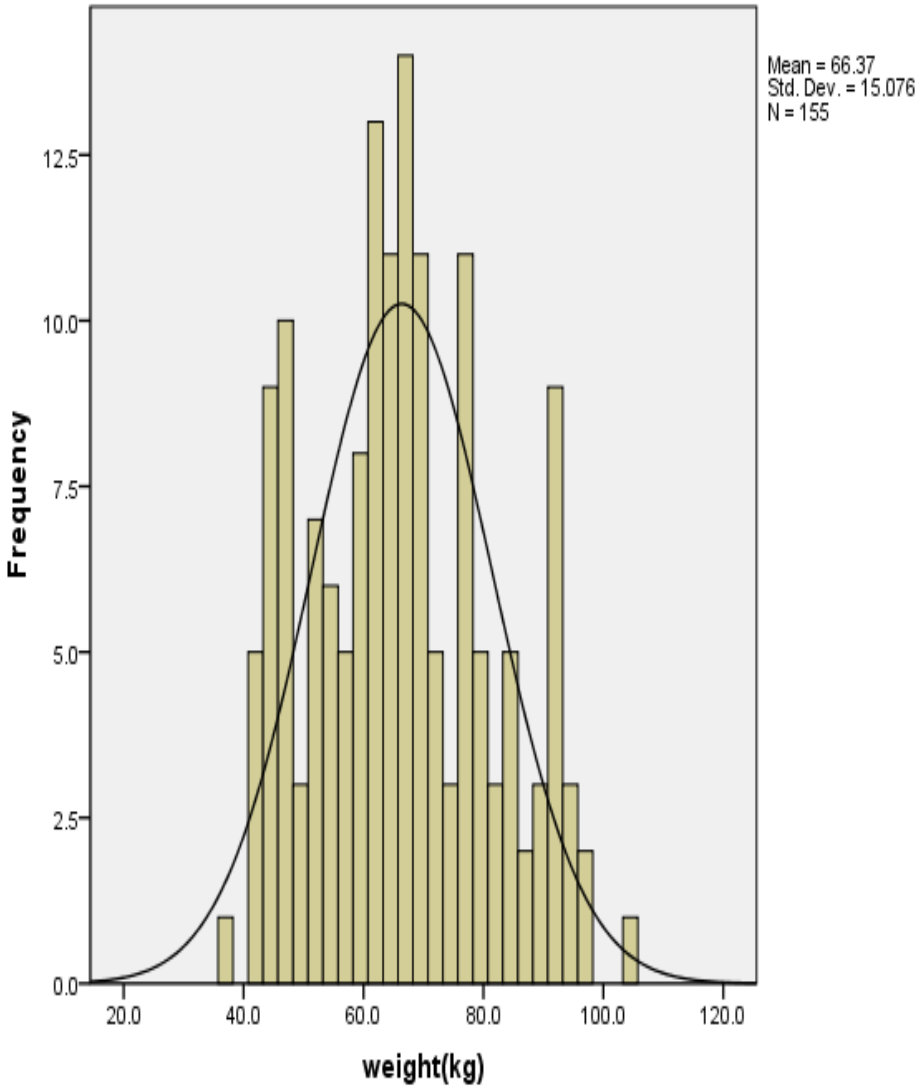


Fig 1.5: Histogram showing weight distribution among GERD subjects.

Most of the subjects in this study were obese as shown in the weight distribution above. The majority of those overweight were Malays. One female Malay and another male Malay had morbid obesity and six subjects were underweight three Chinese females and two female Malays and one male Malay.

Table 7. Shows the gender distribution among Moderate and Severe GERD.

Gender	Diagnosis	Subject
Female	Moderate GERD	34
Male	Moderate GERD	34
Female	Severe GERD	36
Male	Severe GERD	34
Female	Barrett Oesophagus (Endoscope)	9
Male	Barrett Oesophagus (Endoscope)	8

The total number of subjects with moderate gastroesophageal reflux disease were thirty four females and thirty four males in contrast to thirty six females and thirty four males with severe gastroesophageal reflux disease. The number of female subjects with Barrett oesophagus were nine and another eight who were males. On the basis of HPE out of the nine females seven had squamous epithelium the remaining two had squamo columnar junction epithelium with no evidence of Barrett oesophagus. Similarly, among the males six had squamous epithelium and the remaining two had squamo columnar junction epithelium and no features of Barrett oesophagus.

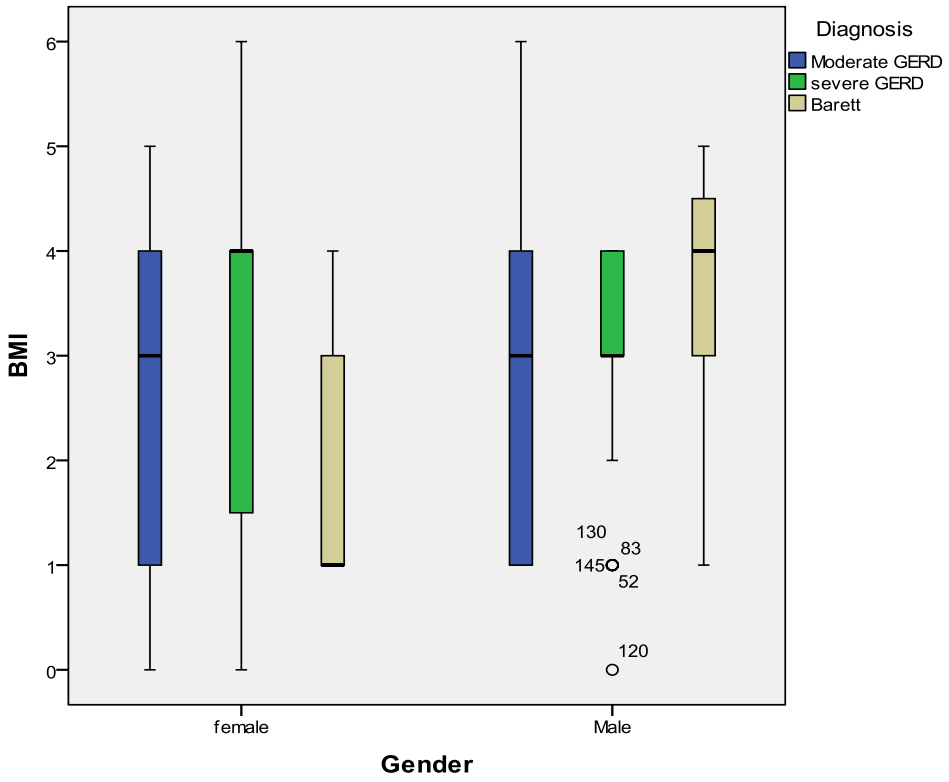


Figure: 1.6 BMI grading among GERD categories and gender using box plot results.

The number of female subjects with moderate gastroesophageal reflux disease were slightly more than those with severe gastroesophageal reflux disease. The number of male subjects with both moderate and severe gastroesophageal reflux were the same. The male subjects with suspected Barrett oesophagus had a higher BMI than their female counterpart. Five subjects as shown had low BMI.

Table 8. Results of BMI, Waist circumference and GERD

BMI	WC (cm)	GERD(Endoscopy)	GERD (HPE)	NERD
Underweight - 6	Minimum - 60	Moderate - 68	61	5
Normal – 44	Max – 127.5	Severe – 70	Normal - 77	
Obese – 103		BE – 17	Inadequate 12	
Morbid Obese- 2			Barrett oesophagus – nil Squamous epithelium - 13 Gastroesophageal junction- 4	

The total number of subjects with moderate gastroesophageal reflux disease were Sixty eight (68) viz thirty four (34) females and thirty four (34) males. Those with severe gastroesophageal reflux disease included a total of seventy (70) thirty six (36) females and thirty four (34) males with The number of female subjects with Endoscopic Barrett oesophagus were nine and another eight who were males this was however ruled out on the final HPE.

Table 9. Waist Circumference (WC) in those with Moderate & Severe GERD.

WC versus GERD	Subjects (n)	Mean	Std. Dev
Moderate	68	87.62	12.92
Severe	70	91.8	9.93
Barrett oesophagus (Endoscopy)	17	89.82	11.9

As shown from the table 68 subjects had moderate GERD and 70 subjects had severe GERD. The number of subjects in the severe group had large waist circumference than those with moderate gastroesophageal reflux disease. The subjects with suspected Barrett oesophagus had a borderline large waist circumference.

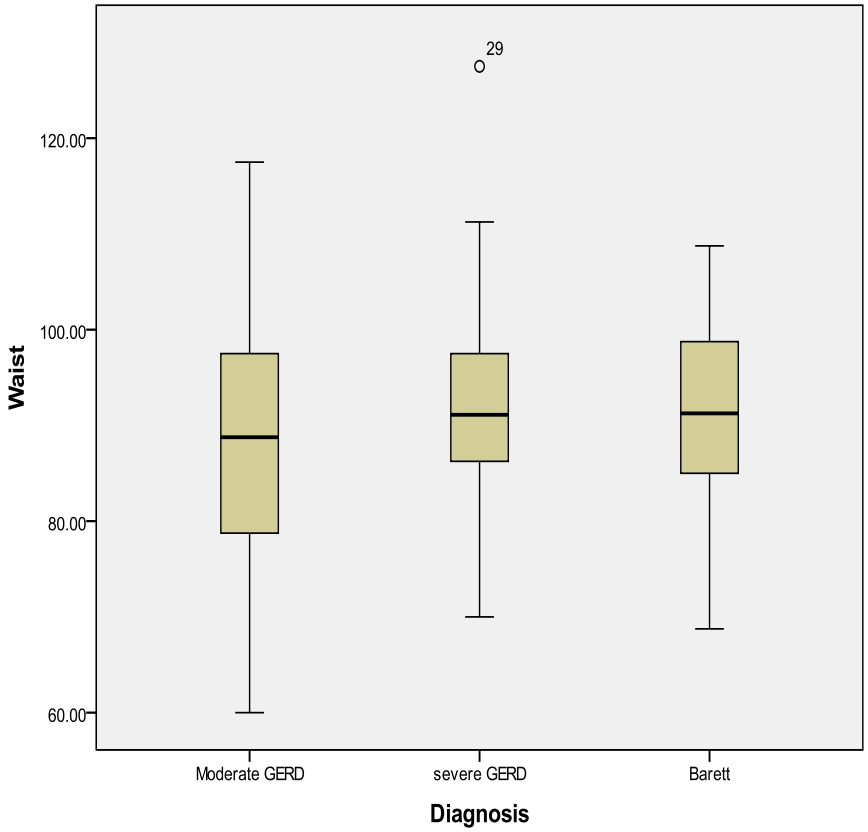


Fig 1.7 Stem and Leaf plot of Waist Circumference (WC) in cm among Moderate and Severe Gerd and in those with Endoscopically suspected Barrett oesophagus.

As seen in figure 5.0 the subjects with severe GERD and those with Barrett oesophagus had a greater waist circumference than those in the moderate GERD group. One subject (29) as shown in the figure had a very large waist circumference 127.5 cm.

Table 10. BMI and WC and their relation to gastroesophageal reflux disease & BE.

Waist circumference	n	Mean(cm)	SD	P
Moderate GERD	68	87.62	12.9	0.10
Severe GERD	70	91.86	9.9	
Barrett oesophagus (Endoscopy)	17	89.82	11.9	
Total	155			
Body mass index		BMI	SD	p
Moderate GERD	68	25.68	5.30	0.41
Severe GERD	70	26.84	5.59	
Barrett oesophagus (Endoscopy)	17	26.97	5.82	
Total	155			

The p value for the BMI was calculated to be 0.41 and for the waist circumference was calculated to be 0.10.

Hence it can be concluded that for this study there is no association of BMI and waist circumference to the severity of gastroesophageal reflux disease. The waist circumference in this study has no association to Barrett oesophagus.

Discussion

The Sample size calculated was two hundred of which we were able to collect one hundred and fifty five subject. Based on the gastroesophageal reflux disease impact scale, retrosternal heart burning sensation as the predominant symptom of reflux disease. This was followed by reflux regurgitation and upper stomach discomfort. Among the one hundred and fifty five (155) subjects forty four (44) had normal body mass index. The remaining one hundred and three (103) had varying grades of obesity I - III. The most relevant finding of this study is that there is an increased prevalence of over weightedness and obesity that was seen in the Malay population. On the basis of endoscopy sixty eight (68) subjects had moderate gastroesophageal reflux disease and eighty seven (87) had severe reflux disease. Based on histopathological examination sixty one (61) had reflux disease, seventy seven (77) had normal examination and five (5) had non erosive reflux disease. There were no histological evidences of Barrett oesophagus.

The Obese patients are not only at risk for cardiovascular diseases and diabetes mellitus, but also have a reduced health related quality of life once they develop gastroesophageal reflux disease[47]. Most of the Malay

subjects had higher body mass index as compared to their Chinese counterparts. Two subjects one a male Malay the other a female Malay had morbid obesity. A total of six subjects were found to be underweight of which three were Chinese females, two were Malay females and one male Malay.

Similarly, the waist circumference was noted to be higher among the Malay population when compared to the Chinese group. The minimum waist circumference was sixty cm (60) and the maximum one hundred and twentyseven (127).

The co morbidities associated with obesity produce financial costs to the health economy of many developing nations[48]. Thus, in the future increasing demands imposed on Malaysia will place a huge burden on the human and economic resources.

Body mass index and waist circumference was not found to be associated with severity of gastroesophageal reflux disease in both the moderate and severe categories. The risk for symptoms of gastroesophageal reflux disease did not rises progressively with both the increase in waist circumference and increasing Body mass Index. Similar findings were reported in studies conducted at Spain, Sweden, Netherland, Japan and Iran[49,50].

All these studies found no association of gastroesophageal reflux disease with an increase in body mass index. One possible reason for such differences in results was the study design and the number of subjects recruited in the study. Similarly in our study the initial calculated sample was two hundred. The study ended with one hundred and fifty five subjects this could have influenced the final result. The lack of inclusion of a control group could perhaps be another reason why no significant association was noted between body mass index and waist circumference as predictors for the severity of gastroesophageal reflux disease.

The subjects in our study with moderate gastroesophageal reflux disease had a waist circumference of 87.6cm. Those with severe gastroesophageal reflux disease 91.46, this mildly beyond the cut of 80cm in females and 90cm in males that is the recommended for Asian cut off waist circumference. It was noted that the waist circumference did not have an association to the severity of gastroesophageal reflux disease.

Conclusion There is a rise in obesity as evidenced by the prevalence of high grades of body mass Index in this region of the world. There is a rise in the incidence of gastroesophageal reflux disease as witnessed by an increase in referrals in hospitals. Non erosive reflux disease is an increasing recognised entity in gastroesophageal reflux disease. Body mass index and waist circumference do not have an association with the severity of gastroesophageal reflux disease.

Recognition

Concept & Design[1]
Supervision Approval of Manuscript [1,2,4]
Data Acquisition[5,6,7,8,9]
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