THE ASSOCIATION BETWEEN BODY MASS INDEX (BMI) AND GASTROESOPHAGEAL REFLUX DISEASE (GERD) INCIDENCE AMONG VISITORS AT THE GASTROENTEROLOGY CLINIC OF RSUP DR. MOHAMMAD HOESIN PALEMBANG

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ABSTRAK

Penelitian ini memiliki tujuan untuk mengetahui hubungan antara IMT terhadap kejadian GERD pada pengunjung Poli Gastro RSUP Dr. Mohammad Hoesin Palembang. Pengambilan sampel dilakukan dengan teknik *random sampling* menggunakan instrumen kuesioner dan ditemukan sebanyak 153 sampel memenuhi kriteria inklusi. Data dianalisis menggunakan SPSS *Statistic* V27 dalam bentuk analisis univariat, bivariat (uji *chi-square*) dan multivariat (regresi logistik metode *enter*). Hasilnya, mayoritas pasien GERD memiliki usia 36—65 tahun (46,7%), jenis kelamin laki-laki (46,2%) dan IMT kategori gemuk (65,9%). Tidak ditemukan hubungan yang signifikan antara usia dan jenis kelamin terhadap kejadian GERD, namun terdapat hubungan yang signifikan antara IMT terhadap kejadian GERD (p=0,003) dan menjadikannya sebagai faktor yang paling memengaruhi terhadap kejadian GERD (p= 0,012). Dapat disimpulkan bahwa terdapat hubungan yang signifikan antara IMT dan GERD serta tidak ditemukan hubungan yang signifikan antara usia dan jenis kelamin terhadap kejadian GERD.

ABSTRACT

The Association Between Body Mass Index (BMI) and Gastroesophageal Reflux Disease (GERD) Incidence Among Visitors at The Gastroenterology Clinic of RSUP Dr. Mohammad Hoesin Palembang. This study aimed to determine the association between BMI and the incidence of GERD in visitors to the Gastroclinic of RSUP Dr. Mohammad Hoesin Palembang. A total of 153 samples met the eligibility requirements, this study used a random sampling technique and collected primary data through a questionnaire instrument. Data were analyzed using SPSS Statistic V27 in univariate, bivariate (chi-square test) and multivariate (logistic regression enter method) analysis. The majority of GERD patients were aged 36-65 years (46.7%), male sex (46.2%) and BMI in the obese category (65.9%). The results of this research showed no significant association among age and sex in the incidence of GERD, but there was a significant association between BMI on the incidence of GERD (p=0.003) thus being the most significant variable in this research (p=0.012). In conclusion, there is a significant association between BMI and the incidence of GERD while there is no significant association among age and sex in the incidence of GERD.

INTRODUCTION

Gastroesophageal Reflux Disease (GERD) is a global health concern, with its prevalence varying by region.[1–3] Lu estimated the global prevalence at 13%, with higher rates in the Americas and Europe compared to Asia.[4,5] In Asia, although GERD is less common, its prevalence has been increasing due to factors like obesity and unhealthy lifestyles.[6,7] In Indonesia, while official statistics are unavailable, Konsensus Penatalaksanaan Penyakit Refluks Gastroesofageal estimates a prevalence of 9.35% based on GERD-Q studies.[1] The Digestive Endoscopy Center at RSUP Moh Hoesin Palembang reported a 6.9% prevalence from 2016–2017.[8] Darnindro found that GERD cases at Fatmawati Hospital reached 49% with the highest incidence in the elderly (44%).[9]

Gastroesophageal Reflux Disease (GERD) is a chronic gastrointestinal condition in which stomach acid or contents flow back into the esophagus, causing symptoms such as heartburn or regurgitation, typically after meals, at night or at any time. GERD can progress from reflux esophagitis to Barrett's esophagus, a condition that involves precancerous changes in the esophagus and may eventually lead to esophageal adenocarcinoma, a severe and potentially life-threatening complication of GERD with associated esophageal damage.[3] While the exact aetiology remains unclear, several risk factors predispose individuals to GERD, such as unhealthy lifestyle and high BMI.[2,10] These factors contribute to weakened esophageal pressure, increased acid production, delayed gastric emptying and prolonged acid exposure, which in turn lead to loosening of the lower esophageal sphincter (LES) or frequent episodes of transient lower esophageal sphincter relaxation (TLSER), which contribute to the development of GERD.[1]

A study conducted by Syam et al demonstrated that elevated BMI and age ≥50 years are significant risk factors for the occurrence of GERD among doctors.[11] Another study by Sadafi in Iran found that several risk factors contribute to the development of GERD, one of which is the increase in BMI due to unhealthy eating habits and lifestyle choices.[12] This leads to a decrease in the tone of the lower esophageal sphincter (LES) and an increase in transient lower esophageal sphincter relaxation (TLSER) mechanism.[11,12] In contrast, research by Pardede found no significant association between BMI and the incidence of GERD.[13]

The diagnosis of GERD is primarily based on an assessment of the symptoms described by the patient. According to the The World Gastroenterology Organization (WGO), the presence of heartburn, acid or bitter regurgitation, or both occurring at least twice weekly is indicative of GERD.[14] To ensure a more accurate diagnosis, additional diagnostic procedures such as GERD-Q instrument may be employed. The GERD-Q instrument is a rapid diagnostic tool with sensitivity of approximately 78,6%, specificity of around 92,9% and diagnostic accuracy of around 85,7%. This instrument has been translated into Bahasa Indonesia, validated and proven to exhibit high reliability (cronbach alpha = 0,834) making it an effective and dependable diagnostic resource for GERD in Indonesia particularly within the primary healthcare.[1]

The prevalence of GERD and its related complications continues to increase. Several population-based and hospital-based studies have explored the association between body mass index (BMI) and GERD. However, recent research on the association between BMI and GERD in patients of gastroenterology clinics is limited. Therefore, this study aims to analyze the association between body mass index (BMI) and gastroesophageal reflux disease (GERD) incidence among visitors at the gastroenterology clinic of RSUP Dr. Mohammad Hoesin Palembang. Furthermore, this study also investigates the demographic characteristics and other potential risk factors associated with GERD.

METHOD

This study is a descriptive analytical observational with a cross-sectional design. The research was conducted using primary data collected through the GERD-Q questionnaire from visitors at the gastroclinic of RSUP Dr. Mohammad Hoesin Palembang in July 2024. The GERD-Q questionnaire has been validated through the Development, Implementation, Assessment of Novel Training in Domain-based Competencies (DIAMOND) study, which reported a sensitivity of 65% and a specificity of 71%. Another study conducted by Zaika et al, reported that the GERD-Q questionnaire had a sensitivity of 78.6%, a specificity of 92.9%, and a diagnostic accuracy of 85.7%. Additionally, a validation study using the GERD-Q in Indonesia conducted by Simadibrata et al, demonstrated a Cronbach's alpha value of 0.834, indicating that the questionnaire is both valid and reliable. Related risk factors were also assessed for their association with GERD using a dietary habits and lifestyle questionnaire based on Riskesdas guidelines. All visitors who met the inclusion criteria were included using a random sampling method where every participant had an equal chance of being selected. All information regarding the subjects was handled with the utmost care to ensure confidentiality and no personal details were disclosed or used beyond the scope of the study. The ethical protocol of this study has been approved by the Medical Research Ethics Committee at RSUP Dr. Mohammad Hoesin Palembang (No.DP.04.03/D.XVIII.06.08/ETIK/130/2024).

The inclusion criteria for this study were visitors to the gastroclinic at RSUP Dr. Mohammad Hoesin Palembang, aged 18 to 65 years and who were willing to participate. Exclusion criteria included individuals who were pregnant, had regularly used NSAIDs in the past month, or had a history of colorectal cancer, lower gastrointestinal diseases (such as IBD, IBS or diverticular disease), or liver and gallbladder disorders (including hepatitis, cirrhosis, cholelithiasis, choledocholithiasis, cholecystitis, or cholangitis).

The primary data collected through the questionnaire then categorized and analyzed using univariate, bivariate and multivariate analyses with IBM SPSS Statistics V27.0. The bivariate analysis used a chi-square test while multivariate analysis was performed using enter logistic regression. A p-value under 0.05 is regarded as statistically significant.

RESULT

A total of 153 participants were assessed in this study, with 70 individuals confirmed to have GERD based on the GERD-Q score. The results indicated that the average age of GERD participants was 49.80 years. The mean body weight of these individuals was 61.03 kg, while their average height was recorded as 160.77 cm. The mean BMI for participants diagnosed with GERD was calculated to be 23.50. Table 1 outlines the sociodemographic characteristics and risk factors for GERD. The majority of GERD subjects at the gastroclinic of RSUP Dr. Mohammad Hoesin Palembang were in individuals aged 36–65 years (46.7%), with 46.2% male and 54.5% housewives. Overweight and obesity category was present in 65.9% of cases. Dietary factors associated with GERD included fatty foods (56.8%), sweet foods or drinks (57.4%), spicy foods (50.9%) and acidic foods or drinks (61.3%). Smoking and alcohol consumption were observed in 50% and 60% of cases, respectively. The key findings in our study were associated with four significant risk factors: BMI, consumptions of fatty foods, sugary beverages, and acidic foods/drinks. Other risk factors did not show any significant associations.

Table 2 displays the multivariate analysis results, identifying BMI as the most significant determinant of GERD in this study. The association is confirmed by a p-value of 0.012 with the prevalence ratio (PR) for BMI was 2.646, indicating that individuals with higher BMI values have a 2.646 times greater risk of developing GERD. Furthermore, the beta-coefficient (b) for BMI was 0.973, suggesting that each unit increase in BMI raises the GERD risk by approximately 0.973 times. This association is further substantiated by a 95% confidence interval (CI) of 1.237–5.660 with WALD score 6.289, validating the statistical significance of the findings.

Table 1. Distributions of Risk Factors Among GERD and Non-GERD Groups (n=153)

Variables	GERD		No GERD		p
	n	%	n	%	
Age					
36—65 years	57	46.7%	65	53.3%	0,783
18—35 years	13	41.9%	18	58.1 %	
Sex					
Woman	33	45.2%	40	54.8%	1.000
Man	37	46.2%	43	53.8%	
Occupations					
Civil Servants	12	50%	12	50%	
Private Sector Employee	4	33.3%	8	66.7%	
Entrepreneurs (Self-Employed)	15	55.6%	12	44.4%	0.774
Laborers	11	33.3%	22	66.7%	
Housewife	24	54.5%	20	45.5%	
Unemployed	4	30.8%	9	69.2%	
Body Mass Index (BMI)					
Obesity (≥25kg/m^2)	29	65.9%	15	34.1%	**0.003***
Non-Obese (<25kg/m^2)	41	37.6%	68	62.4%	
Consumption of High-Fat Foods					
Frequently	46	56.8%	35	43.2%	**0.006***
No/Less	24	33.3%	48	66.7%	
Consumption of Sweets					
Frequently	39	57.4%	29	42.6%	**0.016***
No/Less	31	36.5%	54	63.5%	
Consumption of Spicy Foods					
Frequently	28	50.9%	27	49.1%	0.429
No/Less	42	42.9%	56	57.1%	
Consumption of Acidic Foods/Drinks					
Frequently	19	61.3%	12	38.7%	0.081
No/Less	51	41.8%	71	58.2%	
Smoking					
Frequently	8	50%	8	50%	0.924
No/Less	62	45.3%	75	54.7%	
Alcohol Consumption					
Frequently	3	60%	2	40%	0.846
No/Less	67	45.3%	81	54.7%	

Incidence spans the GERD and No GERD columns.

*Statistically significant (p<0.05)

Table 2. Multivariate Analysis of Risk Factors Among GERD Groups (n=70)

Variables	β	S.E	Wald	*p*	PR (CI 95%)
Body Mass Index (BMI)	0.973	0.388	6.289	**0.012***	2.646 (1.2—5.6)
Consumption of High-Fat Foods	0.555	0.393	1.990	0.158	1.741 (0.8—3.7)
Consumption of Sweets	0.444	0.387	1.315	0.252	1.559 (0.7—3.3)
Consumption of Acidic Foods/Drinks	0.426	0.442	0.927	0.336	1.531 (0.6—3.6)

*Statistically significant (p<0.05)

DISCCUSION

Gastroesophageal reflux disease is a chronic gastrointestinal condition that occurs due to backflow of the reflux into the esophagus showing some uncomfortable symptoms and potential complications. This condition is influenced by multifactorial risk factors, including physiological, lifestyle, and environmental aspects. This study found that GERD was most prevalent in individuals aged 36–65 years (46.7%), with the youngest participant being 19 years old and the oldest 65 years old. These findings are consistent with a study by Tarigan and Pratomo at RSUD Saiful Anwar Malang, which reported that 63% of subjects aged ≥40 years had GERD, compared to 36% in those aged <40 years.[15] The increased GERD risk with older age is attributed to inflammaging, a process that elevates pro-inflammatory mediators such as IL-6, TNF-α, and IL-1β, as well as reactive oxygen species (ROS) which collectively enhance esophageal mucosal permeability to gastric acid.[16] Additionally, older individuals often undergo polypharmacy, utilizing medications such as antihypertensive drugs and NSAIDs which inhibit COX-1 activity, this will reduce lower esophageal sphincter (LES) tone and increase the frequency of gastric reflux, thereby elevating the risk of GERD.[4,17]

This study observed a higher incidence of GERD in males (46.2%) compared to females (45.2%), consistent with Syam findings which indicated that 30.7% of males and 23.2% of females experienced GERD.[11] The greater incidence in males is potentially linked to lower estrogen levels as suggested by Sang Yoon Kim, who demonstrated that 17β-estradiol enhances esophageal mucosal resistance. The anti-inflammatory effects of estrogen may contribute to improved resistance of the esophageal mucosa to gastric acid.[18] However, this study did not identify a significant association between gender and GERD, which aligns with other research reporting inconsistent associations in this regard.

Table 1 in this research shows that most GERD subject were found among housewives (54.5%). This is consistent with study at RSUD Djamil Padang, which also found the highest GERD prevalence among housewives (27.92%).[19] Although research on the link between occupation and GERD is limited, individuals with sedentary lifestyles and higher BMI are more likely to develop GERD regardless of their occupation. Poor lifestyle habits can lower LES pressure, increase TLSER, delay gastric emptying, and activate sensory receptors in the esophagus, all of which contribute to GERD.[1,2,4]

This study found that 65.9% of individuals with obesity category (based on BMI) experienced GERD, supporting the theory that higher BMI is a significant risk factor for the condition. The accumulation of both visceral and subcutaneous fat disrupts the function of the esophagogastric junction (EGJ), leading to more frequent transient lower esophageal sphincter relaxation (TLSER). This increases gastric reflux exposure to the esophagus, which may contribute to the development of GERD over time.[1,10,20] These findings are consistent with Karim study, which reported a higher incidence of GERD in individuals with normal to elevated BMI (23%).[21] Furthermore, bivariate analysis demonstrated a significant association between BMI and GERD incidence (p=0.003).

Table 1 illustrates that 56.8% of GERD subjects often consumed fatty foods. This result aligns with the findings of Sakti where (24.8%) who regularly consumed fatty foods were diagnosed with GERD.[22] Fatty foods are known to stimulate cholecystokinin (CCK), a neurohormonal mediator that increases bile secretion. This process can cause hypotension in the lower esophageal sphincter (LES) and delay gastric emptying, thus promoting gastric reflux into the esophagus. Over time, this increased reflux exposure contributes to the irritation of the esophageal epithelium.[1,22] The present study reveals a statistically significant association between the consumption of fatty foods and the occurrence of GERD (p = 0.006), which is consistent with the findings of Sadafi's study (p = 0.035).[12]

Our study finds that (57.4%) of GERD subjects frequently consumed sweet foods and beverages, which aligns with findings from other research where 10.9% of GERD cases were attributed to the excessive consumption of sugary drinks and chocolate.[21] Overconsumption of sweet foods and drinks can delay gastric emptying, increase stomach acid secretion, and stimulate sensory receptors in the esophagus, all of which can contribute to the development of GERD.[1,2,10] A significant association was observed between sweet food and beverage consumption and the incidence of GERD (p = 0.005).

In this study, 50.9% of participants who consumed spicy foods experienced GERD. This is consistent with other research which found that a higher percentage of individuals with frequent spicy food consumption suffered from GERD.[23] Literature suggests that spicy foods can irritate the esophageal mucosa and thinning its protective barrier which facilitates gastric acid reflux into the esophagus. Moreover, spicy foods contain neurotoxins that delay gastric emptying, activating sensory receptors in the esophagus, leading to transient lower esophageal sphincter relaxation (TLSER) and hypotension of the LES which contributing to GERD.[23]

This study found that 61.3% of GERD subjects frequently consumed acidic foods and beverages. This finding aligns with Yuan study, which reported that 34.53% of participants with high acidic food consumption experienced GERD.[24] Consumption of acidic foods activates TAS2R receptors in the mouth which triggers an exaggerated cephalic phase, resulting in increased gastric acid secretion. TAS2R activation also raises gastrin levels which further stimulates sensory receptors in the esophagus, leading to LES hypotension and contributing to GERD development.[25]

According to the results presented in Table 1, 8 subjects (50%) GERD were smokers. This finding is consistent with Zein's study which showed that 9.5% of smokers with ≤2 years of smoking and 11.7% with >2 years of smoking experienced GERD with acid/bitter regurgitation.[26] Nicotine in cigarettes induces relaxation of the lower esophageal sphincter (LES), allowing gastric acid to reflux into the esophagus. Additionally, tobacco reduces bicarbonate levels in saliva, impairing esophageal acid clearance and contributing to GERD.[1]

This study showed that around 60% of individuals who consumed alcohol were diagnosed with GERD. This finding aligns with other study which reported that 11.4% respondents who consumed alcohol more than twice a week and 28.6% respondents who drank alcohol 2-4 times per

month experienced GERD. In contrast, those who drank alcohol less than once a month had a lower incidence of GERD.[27] Excessive alcohol intake is known to decrease lower esophageal sphincter pressure and impair esophageal peristalsis, which increases the exposure of the esophagus to gastric acid.[1]

Table 2 of this study presents the results of a multivariate analysis, showing that the most significant factor associated with the occurrence of GERD is body mass index (BMI) with p=0.012. This finding is consistent with a review by Vaishnav that obesity is an independent risk factor for GERD and endoscopic erosive oesophagitis.[28] Similarly, Sakti research found that elevated BMI were associated with higher risk of GERD.[22] An increase in body mass index (BMI) to overweight or obese categories can promote the release of pro-inflammatory cytokines, including IL-1β, IL-6, and tumor necrosis factor-alpha. These molecules enhance the permeability of the esophageal mucosa to gastric acid and digestive enzymes. Such changes contribute to a higher risk of gastric reflux into the esophagus, which may ultimately lead to the onset of GERD.[19]

The limitation of this study is its use of the GERD-Q questionnaire, which consists of six questions to assess GERD symptoms, with a sensitivity of 78,6% and specificity of 92,8%. While the GERD-Q is useful in primary care, a more accurate diagnosis could be obtained with other diagnostic tools such as endoscopy or proton pump inhibitor (PPI) testing. Additionally, a dietary history questionnaire was used to assess subjects' consumption of fatty, sweet, spicy, or acidic foods, alcohol, and smoking habits over the past month, based on the Riskesdas guidelines[29], which may be prone to recall bias and inaccuracies.

CONCLUSION

This study shows that the majority of GERD subjects were aged 36–65 years, male, and housewives. Most had a BMI ≥25 kg/m² and reported frequent consumption of fatty, sweet, spicy, or acidic foods, along with smoking and alcohol use. A significant association was found between BMI and GERD while there is no significant association among age and sex in the incidence of GERD. This study found that BMI is a significant risk factor as determined by multivariate regression analysis (p = 0.012).

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