

COMPARISON OF THE PREVALENCES OF AND FACTORS ASSOCIATED WITH GASTROESOPHAGEAL REFLUX DISEASE IN RURAL AND URBAN BALI, INDONESIA

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Abstract. The prevalences of and factors associated with gastroesophageal reflux disease (GERD) in urban and rural areas of Bali, Indonesia have not been published. In this cross-sectional study, we aimed to compare the prevalences of and factors associated with GERD in urban and rural Bali, Indonesia, in order to better inform efforts to manage these conditions by location. Urban study subjects were recruited consecutively from those having a medical checkup at either one of 2 referral hospitals in Denpasar City, Bali and rural study subjects were recruited consecutively from those presenting to the health center in Kintamani District, Bali during the study period. The minimum numbers of study subjects calculated to be needed from rural and urban areas were: 150 and 200 subjects, respectively. Inclusion criteria for study subjects were being aged ≥ 18 years and being healthy. Exclusion criteria for study subjects were being aged < 18 years, regularly using a proton pump inhibitor or H-2 blocker or having a history of gastrointestinal disease. Each subject was asked to complete a questionnaire asking about demographics, symptoms of GERD, nutritional status, smoking history, alcohol, coffee intake, non-steroidal anti-inflammatory drug (NSAID) or steroid use and meat and/or fatty food consumption. The study was conducted during July-December 2019. A total of 400 subjects were included in the study; 58.5% ($n=234$) females: 250 urban subjects, 64.4% ($n=161$) females, and 150 rural subjects, 51.3% ($n=77$) males. The overall prevalence of GERD among study subjects was 21.3% ($n=85$): 27.3% rural subjects and 17.6% urban subjects ($p=0.021$). Among subjects with GERD, 87.8% of rural subjects and 34.1% of urban subjects ($p<0.001$) had low education levels (≤ 12 years education). Smoking was significantly ($p=0.046$) more common among rural subjects with GERD (31.7%) than urban subjects with GERD (13.6%). NSAID use was significantly ($p=0.012$)

more common among rural subjects (34.1%) than urban subjects with GERD (11.4%). Frequent consumption of fatty foods was significantly ($p=0.006$) more common among urban subjects (88.6%) than rural subjects with GERD (63.4%). In summary, the prevalence of GERD in Bali was significantly more common among rural than urban subjects. Rural subjects with GERD were significantly more likely to have a low education level, to smoke and to use NSAIDs while urban subjects with GERD were significantly more like to consume fatty foods. We conclude these factors need to be evaluated further to determine if they are merely associated with or if they cause GERD and if changing them can prevent GERD.

Keywords: gastroesophageal reflux disease, prevalence, rural, urban, risk factors

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INTRODUCTION

Gastroesophageal reflux disease (GERD) is one of the most frequently diagnosed gastrointestinal conditions in daily clinical practice (Katzka *et al*, 2020). GERD is defined as the pathological reflux of gastric contents into the esophagus causing symptoms and/or mucosal irritation (Roman *et al*, 2016). GERD is increasing in both incidence and prevalence worldwide (Boulton and Dettmar, 2022), even in regions that previously had low prevalence rates, such as the Asia-Pacific region (Goh *et al*, 2021). There is minimal data regarding GERD in the Indonesian

population (The Indonesian Society of Gastroenterology, 2014).

Previous meta-analysis on global prevalence of GERD (Nirwan *et al*, 2020) and study from southern India (Wang *et al*, 2016) reported GERD is more common among urban than rural subjects. However, a study from Jakarta, Indonesia reported GERD was more common among rural subjects (Hapsari *et al*, 2017)

We have been unable to find any previous studies of the prevalence of and factors associated with urban and rural subjects with GERD in Bali, Indonesia. Therefore, in this study we aimed to determine the prevalence

of GERD and the associated factors among subjects living in urban and rural Bali in order to inform efforts to manage GERD in these study subjects.

MATERIALS AND METHODS

Study design and population

We conducted a cross-sectional study in Bali, Indonesia during July-December 2019 using a questionnaire-based survey in order to identify the prevalence of and factors associated with GERD.

Urban subjects were recruited consecutively from healthy individuals who underwent medical checkups at either one of two referral hospitals in the city of Denpasar, Bali. Rural subjects recruited consecutively from individuals attending a public health center in Kintamani District, Bangli Regency.

The inclusion criteria for study subjects were being aged ≥ 18 years and healthy. Exclusion criteria for study subjects were being aged < 18 years old, regularly using a proton pump inhibitor or a histamine-2 blocker or having gastrointestinal disease.

The minimal sample sizes calculated to be needed for this study among urban and rural subjects were 200 and 150, respectively, using a 95% confidence interval (CI) and a 5% margin of error.

Data collection

Each subject was interviewed face-to-face using a GERD questionnaire (GERD-Q) (The Indonesian Society of Gastroenterology, 2014), an instrument validated for use in the Indonesian language (Simadibrata *et al*, 2011). The GERD-Q consists of 6 questions asking about the occurrence of heartburn, regurgitation, epigastric pain, nausea, disrupted sleep due to heartburn and use of over-the-counter medications to relieve heartburn or regurgitation within the previous seven days. Each question is scored on a scale of 0 to 3, giving a final score ranging from 0 to 18. Subjects with a score of at least 8 were considered to have symptomatic GERD and assessed for the presence of selected studied factors.

The selected studied factors were: age, sex, education level,

nutritional status, smoking history, alcohol consumption, coffee intake, non-steroidal anti-inflammatory drugs (NSAIDs) use, steroid use, meat consumption and fatty food consumption. Age was classified as being <40 or ≥40 years. Nutritional status was classified based on the measured body mass index (BMI) as being: underweight (<18.5 kg/m²), normal weight (18.5-22.9 kg/m²), overweight (≥23 kg/m²) and obese (≥25 kg/m²) (WHO Expert Consultation, 2004). Education level was classified as having a low education level (≤12 years of education) or a high education level (>12 years of education). Frequent consumption of fatty food or meat was defined as consumption of these food 3 or more days per week. Frequent consumption of coffee was defined as drinking 2 or more cups of coffee per day for 3 or more days per week.

Statistical analysis

We used bivariate logistic regression analysis using the to determine differences in GERD prevalence by selected studied factor for subjects living in rural or urban areas. All analyses were two-tailed and significance was set

at $p < 0.05$. Statistical analyses were conducted using the IBM Statistical Package for Social Sciences (SPSS) for Windows, version 21.0 (IBM, Armonk, NY).

Ethical considerations

Ethical approval to conduct this study was obtained from the Health Research Ethics Committee, Faculty of Medicine, Udayana University (2701/UN14.2.2.VII.14/LP/2019). Written informed consent was obtained from each study subject prior to inclusion in the study.

RESULTS

A total of 400 subjects were included in the study, 58.5% ($n=234$) females; consisting of: 250 urban subjects, 64.4% ($n=161$) females, and 150 rural subjects, 51.3% ($n=77$) males (Table 1). The overall prevalence of GERD in the total population was 21.3%. The prevalences of GERD among rural and urban subjects were 27.3% and 16.4%, respectively ($p=0.021$) (Table 2).

Significantly more ($p < 0.001$) rural subjects with GERD (87.8%) had a lower education level than urban subjects with GERD (34.1%). Significantly more ($p=0.046$) rural

subjects with GERD smoked (31.7%) than urban subjects with GERD (13.6%). Significantly more ($p=0.012$) rural subjects with GERD used NSAIDs (34.1%) than urban subjects with GERD (11.4%). Significantly more ($p=0.006$) urban subjects with GERD consumed fatty food

(88.6%) than rural subjects with GERD (63.4%) (Table 3). On the other hand, we found that frequent consumption of fatty food was more common in the urban subjects with GERD (88.6%) compared to the rural subject with GERD (63.4%) (Table 3).

Table 1
Characteristics of study subjects (N=400)

Variables	Rural (N = 150)	Urban (N = 250)
Age, <i>n</i> (%)		
<40 years	70 (46.7)	119 (47.6)
≥40 years	80 (53.3)	131 (52.4)
Gender, <i>n</i> (%)		
Female	73 (48.7)	161 (64.4)
Male	77 (51.3)	89 (35.6)
Educational level, <i>n</i> (%)		
Low (≤12 years)	127 (84.7)	70 (28.0)
High (>12 years)	23 (15.3)	180 (72.0)
BMI, <i>n</i> (%)		
Underweight (<18.5 kg/m ²)	13 (8.7)	3 (1.2)
Normal (18.5-22.9 kg/m ²)	80 (53.3)	96 (38.4)
Overweight (23-24.9 kg/m ²)	29 (19.3)	49 (19.6)
Obese (≥25 kg/m ²)	28 (18.7)	102 (40.8)

BMI: body mass index; kg/m²: kilogram per square meter

Table 2
GERD prevalence

GERD-Q	Prevalence of GERD, <i>n</i> (%)		<i>p</i> -value
	Rural (N=150)	Urban (N = 250)	
GERD	41 (27.3)	44 (17.6)	0.021
No GERD	109 (72.7)	206 (82.4)	

GERD: gastroesophageal reflux disease; GERD-Q: gastroesophageal reflux disease questionnaire

DISCUSSION

The overall prevalence of GERD among study subjects in our study was 21.3%, higher than the prevalence reported in a similar previous study Jakarta (9.35%) (Abdullah *et al*, 2016) and the prevalences reported in a review study where the subjects were from Southeast and western Asia (6.3%-18.3%) (Jung, 2011). However, the prevalence in our study was similar to a study from Cirebon, Indonesia (22.6%) (Zein *et al*, 2021), and to studies from southeast and western Asian and Asian countries (2.5-7.8%, and 8-20%), respectively (Goh *et al*, 2021; Bhatia *et al*, 2018).

In our study, the prevalence of

GERD was more common among subjects from rural areas, unlike the prevalences of GERD reported at a global level (Nirwan *et al*, 2020) and in southern India (Wang *et al*, 2016) were more common among urban subjects but similar to the results in studies from Jakarta, Indonesia and India (Hapsari *et al*, 2017; Kumar and Shivalli, 2014). Studies with higher prevalence of GERD among rural subjects may suggest other factors may be associated, similar to our study, such as lower education levels, higher smoking prevalences and greater use of non-steroidal anti-inflammatory drugs (NSAIDs).

The association between smoking and GERD seen in our study may be due to tobacco

Table 3
Associations between selected factors and GERD among subjects from rural and urban areas (N=400)

Variables	Rural (N=150)	Urban (N=250)	p-value
Gender, <i>n</i> (%)			0.617
Female	22 (53.7)	26 (59.1)	
Male	19 (46.3)	18 (40.9)	
Age, <i>n</i> (%)			0.216
<40 years	15 (36.6)	22 (50.0)	
≥40 years	26 (63.4)	22 (50.0)	
Education level, <i>n</i> (%)			<0.001
Low (≤12 years)	36 (87.8)	15 (34.1)	
High (>12 years)	5 (12.2)	29 (65.9)	
BMI, <i>n</i> (%)			0.067
Overweight/obese (≥23 kg/m ²)	23 (56.1)	33 (75.0)	
Normal/Under (<23 kg/m ²)	18 (43.9)	11 (25.0)	
Smoking, <i>n</i> (%)			0.046
Yes	13 (31.7)	6 (13.6)	
No	28 (68.3)	38 (86.4)	

Table 3 (cont)

Variables	Rural (N=150)	Urban (N=250)	<i>p</i> -value
Alcohol consumption, <i>n</i> (%)			0.466
Yes	8 (19.5)	6 (13.6)	
No	33 (80.5)	38 (86.4)	
Frequent consumption of fatty food, <i>n</i> (%)			0.006
Yes	26 (63.4)	39 (88.6)	
No	15 (36.6)	5 (11.4)	
Frequent consumption of meat, <i>n</i> (%)			0.573
Yes	32 (78.0)	32 (72.7)	
No	9 (22.0)	12 (27.3)	
Frequent consumption of coffee, <i>n</i> (%)			0.381
Yes	28 (68.3)	26 (59.1)	
No	13 (31.7)	18 (40.9)	
Drug (NSAID, steroid), <i>n</i> (%)			0.012
Yes	14 (34.1)	5 (11.4)	
No	27 (65.9)	39 (88.6)	

Note: Frequent consumption of fatty food or meat was defined as consumption of these foods 3 or more days per week while frequent consumption of coffee was defined as drinking 2 or more cups of coffee per day 3 or more days per week.

BMI: body mass index; GERD: gastroesophageal reflux disease; kg/m²: kilogram per square meter; NSAID: non-steroidal anti-inflammatory drug

causing a reduced lower esophageal sphincter pressure, decreases salivary bicarbonate production and increased acid clearance time, making reflux more likely to occur (Ness-Jensen and Lagergren, 2017). A study from Japan reported current and former smokers had higher prevalences of reflux esophagitis with the association being stronger for those who had smoked longer (Okamoto and Ito, 2023). Previous studies from Indonesia also reported GERD was more common among those who smoked (Syam *et al*, 2016; Zein *et al*, 2021).

In our study, NSAID use was more common among rural subjects. A study from rural West Java, Indonesia also reported finding a positive direct association between NSAID use and the prevalence of GERD (Hapsari *et al*, 2017), similar to studies from Iran and France (Saber-Firoozi *et al*, 2007; Ruszniewski *et al*, 2008). The study from France also found a greater subject knowledge about the adverse consequences of NSAIDs was associated with a lower prevalence of GERD (Ruszniewski *et al*, 2008).

In our study, urban subjects with GERD were significantly more likely to consume fatty food than rural subjects. Fatty foods may contribute to GERD by increasing esophageal acid exposure, reducing the tone of the lower esophageal sphincter and decreasing gastric motility (Newberry and Lynch, 2019). A previous study reported daily consumption of a high-fat diet was significantly associated with GERD (Zhang *et al*, 2021). High fat diets may result in higher body weights, especially among urban populations (Su *et al*, 2020; Andarwulan *et al*, 2021; NCD-RisC, 2019) increasing the risk for GERD in some populations but in our study the body mass indices of rural and urban subjects were similar, making this less likely a cause for GERD in our study subjects.

Our study had some limitations. First, we did not take a detailed diet history of our subjects and did not record the type, dosage, frequency or duration of NSAID use among our subjects.

In summary, the prevalence of GERD in Bali was significantly more common among rural than

urban subjects. Rural subjects with GERD were significantly more likely to have a low education level, to smoke and to use NSAIDs while urban subjects with GERD were significantly more like to consume fatty foods. We conclude these factors need to be evaluated further to determine if they are merely associated with or if they cause GERD and if changing them can prevent GERD. This may then be used to inform efforts to reduce GERD in the study population.

CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest in this work.

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