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Epidemiology, Risk Factors, and Endoscopic Evaluation of Dyspepsia in the Rural Community of Odisha, India: A Community-Based Cross-Sectional Study

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Abstract

Background: Prevalence of dyspepsia varied worldwide, including in India. Studies from India reported a prevalence between 14.9 to 30.4%. Risk factors associated with dyspepsia are Helicobacter pylori infection, predominantly vegetarianism, smoking, and tobacco chewing. Most of the studies have not evaluated patients with dyspepsia using esophagogastroduodenoscopy. There is a scarcity of literature estimating the prevalence from India's rural population. The present study is designed to estimate the prevalence of dyspepsia, study the associated risk factors including dietary factors, and evaluate using esophagogastroduodenoscopy. ***Methods****:* It is a community-based cross-sectional study carried out using Rome III criteria. Multi-staged sampling was done and data was collected by house-to-house survey. The subjects with dyspepsia were mobilized to undergo esophagogastroduodenoscopy. The data were analyzed using SPSS and a two-tailed p-value < 0.05 was considered significant. ***Results:*** Prevalence of dyspepsia in the rural community was found to be 29.6%. In univariate model, associated risk factors of dyspepsia were older age group, predominantly vegetarian diet, regular tea intake, chewing tobacco, smoking, and gudakhu use. In multivariate analysis, only smoking tobacco was found to be significantly associated. Endoscopic evaluation revealed 56% had functional dyspepsia. Abnormal findings reported were esophagitis (26%), antral gastritis (9%), antral ulcer (7%), and inflammatory esophageal polyp (2%). ***Conclusion:*** Dyspepsia is a very common disease in Odisha with the majority diagnosed with functional dyspepsia. Smoking tobacco was found to be an independent risk factor for dyspepsia. Further studies using Rome IV criteria are recommended.

Keywords: Diet, dyspepsia, endoscopy, esophagogastroduodenoscopy, prevalence, Rome criteria, rural India.

INTRODUCTION

Dyspepsia is a gastro-duodenal symptom complex which means "difficulty in digestion". The symptoms are relatively non-specific and include general abdominal discomfort, early satiety, and abdominal bloating [1]. Prior to esophagogastroduodenoscopy, the patients are labeled as Uninvestigated Dyspepsia (UD) [2]. Following esophagogastroduodenoscopy, the above diagnosis can be categorized into either functional dyspepsia (FD) or organic dyspepsia [1]. The organic causes of dyspepsia include peptic ulcers, gastroesophageal reflux disease (GERD), and malignancy [3]. Patients often ignore initial symptoms and do not seek medical care until more severe symptoms manifest, such as belching, heartburn, nausea, vomiting, and abdominal pain. Though untreated dyspepsia is not associated with increased mortality, it significantly impacts the quality of life [1, 2].

There is regional variation in the prevalence of dyspepsia around the world. The prevalence of dyspepsia ranges from 7% to 45% globally and varies from 8% to 30% in the Asian population [1,4]. In a survey, Ghoshal

et al., reported the prevalence of dyspepsia in India to be 19% [5]. This variation in the reported prevalence could be related to the varied methods of survey, subjective symptom reporting, diagnostic criteria, and associated dietary and environmental factors [5]. Risk factors associated with dyspepsia include Helicobacter pylori infection, predominantly vegetarian diet, smoking, tobacco chewing, regular intake of tea, aerated drinks, alcohol consumption, psychological distress, anxiety, and NSAID use [5, 6].

There is a paucity of data regarding the prevalence and associated risk factors for dyspepsia in India. As per the 2011 census of India, 68% of the total population resides in villages. Since the prevalence of dyspepsia has not been reported in Odisha and the majority of Odisha's population resides in villages, the present study was designed to estimate the prevalence of dyspepsia using Rome III criteria, study the associated risk factors including dietary factors, and evaluate using esophagogastroduodenoscopy.

METHODS

***Study setting and design*:** It was a community-based cross-sectional study conducted from September 2016 to February 2017 in the Department of Gastroenterology of a tertiary care teaching hospital in the central revenue zone of Odisha. The study was approved by the Institutional Ethics Committee vide IEC/ IRB No – 308/27-04-2016.

Subjects: The study population comprised of subjects more than 18 years of age, including both sexes, residing in the rural area for at least 6 months. Subjects with known hepatic, pancreatic, and gallbladder disease were excluded from the study. Severely ill subjects were also excluded. The minimum sample size was calculated to be 236 by taking the prevalence of dyspepsia as 19% [5] with an absolute precision of 5%.

***Sampling*:** Multi-staged sampling was used in this study. In the first stage, out of the ten districts under the central revenue zone of Odisha, one district (Kendrapara) was selected randomly. In the second stage, out of 12 blocks one block (Marshaghai), and in the third stage, out of 12 villages, 5 were randomly selected by lottery method. The household list was obtained from the Accredited Social Health Activist (ASHA). Then using the table of random numbers, 65 households (taking into account the non-responders) from each village were selected and one person from each household was interviewed after obtaining written informed consent.

***Questionnaire*:** A questionnaire was designed that contained sociodemographic features (name, age, sex, socio-economic status, marital status), proper dietary history, addictions (tobacco, alcohol, smoking), along with symptoms of dyspepsia. The questionnaire was validated by a group of experts and translated into the local language (*Odia*) and reviewed. Dyspepsia was defined according to the Rome III criteria, which requires the presence of one or more of the following symptoms: (1) bothersome postprandial fullness; (2) early satiety; (3) epigastric discomfort, which occurred at least for the last 3 months with symptom onset at least 6 months ago [7].

The participants diagnosed with dyspepsia using this questionnaire were referred to the Department of Gastroenterology for esophagogastroduodenoscopy within 7 days. An esophagogastroduodenoscopy camp was also conducted at Raghunathpur PHC in coordination with the Department of Gastroenterology. Informed consent of referred subjects was obtained after counseling them about the nature, possible benefits, and risks of this procedure. The patients were advised to fast for 8 hours before the procedure. The esophagogastroduodenoscopy up to the second part of the duodenum was performed by qualified endoscopists and the findings were recorded. The endoscopists were blinded about the study and high-definition Olympus endoscopes were used.

Dietary definitions: Participants were considered nonvegetarians if they consumed meat, fish, or egg daily or every alternate day in a week, while others were considered predominantly vegetarians. Participants consuming fried foods or spices either daily or every alternate day, aerated drinks or fruits more than once a week, gudakhu (a local form of tobacco) once daily, and at least one cup of tea daily were considered significant consumers. Consumption of tobacco by chewing or smoking was considered a yes or no response, and quantification was not done.

Statistical analysis: Data were entered using Microsoft Excel 2010 and analyzed using Statistical Package for Social Sciences version 18 (PASW Statistics for Windows, Chicago: SPSS Inc.). Descriptive statistics were used and the results were expressed as mean ± standard deviation or frequency and percentage. Normally distributed quantitative and categorical variables were compared using Student's t-test and Pearson $\chi 2$ test respectively. Odds ratios (OR) with 95% confidence intervals (CI) were determined. Risk factors showing association with an α value of < 0.05 was considered statistically significant.

RESULTS

Out of 322 questionnaires, 300 were completed. Dyspepsia was diagnosed in 29.6% (n=89) of subjects using Rome III criteria. The average age of the participants was 50 (±16.4) years. Males comprised 64% (n=192) and 36% (n=108) were females. Among the participants, 88% (n=265) were married. Socioeconomic status was classified using Uday Pareek's scale and according to it, 52% of the participants belonged to lower socioeconomic status [8]. Middle-class participants constituted 48% (n=144) which included upper middle class (n=32/144; 22.2%), middle class (n=42/144;

29.1%), and lower middle class (n=70/144; 48.6%). The average BMI of the participants was 20.37 kg/m^2 (±3.9). In this study, people aged 50 years or more had a two times higher risk for dyspepsia than the younger age group [OR = 2.09 (1.22 - 3.58), p=0.006]. Males and females suffered equally from dyspepsia (28.6 vs 31.4). Prevalence of dyspepsia was higher among the lower socioeconomic status, although, it was not statistically significant. The marital status and BMI of the subjects did not have any significant association with dyspepsia as shown in Table-1.

Table 1: Demographic & Anthropometric profile of study population

Parameters	Dyspepsia Present (n = 89)	Dyspepsia Absent (n = 211)	p-value
Age (years)	55 ± 15.9	48.36 ± 16.2	0.001
Sex (male)	55 (61.7%)	137 (64.9%)	0.60
Socioeconomic Status (SES)			
Higher	0 (0%)	0 (0%)	—
Middle	36 (40.4%)	108 (51.1%)	0.08
Lower	53 (59.5%)	103 (48.9%)	
Marital status (married)	81 (91%)	184 (87.2%)	0.34
Height (cm)	159.4 ± 8	160.6 ± 9.5	0.30
Weight (kg)	51 ± 10	53.1 ± 12.3	0.16
BMI (kg/m^2)	20.08 ± 4.05	20.48 ± 3.75	0.68

In this study population, 29.6% (n=89) subjects complained of postprandial fullness, 29.3% (n=88) subjects complained of early satiety, and 30.3% (n=91) complained of epigastric discomfort. But using Rome III criteria, the prevalence of dyspepsia was found to be 29.6% taking into account the duration and onset of symptoms. Among the participants with dyspepsia, all symptoms were almost equally distributed i.e., early satiety - 63%; postprandial fullness - 57%; epigastric discomfort - 58%. The majority of the epigastric discomfort was reported in the form of pain (31%) followed by both pain and burning sensation (20%), and only burning sensation (6.7%).

Table 2: Dietary habits and lifestyle factors in the study population

Parameter	Dyspepsia Present (n = 89)	Dyspepsia Absent (n = 211)	p-value
Predominantly Vegetarian	85 (95.5%)	186 (88.1%)	0.04
Fried food	6 (6.7%)	16 (7.5%)	0.79
Spices	17 (19.1%)	41 (19.4%)	0.94
Fruit	2 (2.2%)	7 (3.3%)	0.62
Aerated drink	3 (3.3%)	17 (8%)	0.13
Regular tea intake	77 (86.5%)	157 (74.4%)	0.02
Chewing tobacco	57 (64%)	109 (51.6%)	0.04
Smoking	22 (24.7%)	30 (14.2%)	0.02
Alcohol	3 (3.3%)	23 (10.9%)	0.03
Gudakhu users	28 (31.4%)	41 (19.4%)	0.02

Table 2 shows the result of univariate analysis of the dietary and lifestyle risk factors in patients with dyspepsia. Participants who were predominantly vegetarian were at an increased risk of dyspepsia than the nonvegetarian; OR=2.85 (0.96-8.46), p=0.04. Prevalence was also high among the people who were taking tea regularly; OR=2.2 (1.11-4.36), p=0.02. Dyspepsia was found to be significantly associated with all types of tobacco abuse in this study. Current smokers comprised 17.3% and nearly half of them had dyspepsia; OR=1.98 (1.06-3.67), p=0.02. Half of the participants (55.3%) were consuming some form of chewing tobacco which was significantly associated with dyspepsia; OR=1.66 (1.00-2.77), p=0.04. We also found that people using gudakhu were at increased risk of dyspepsia; OR=1.90 (1.08-3.34), p=0.02. Alcohol was found to be inversely associated with dyspepsia; OR=0.28 (0.08-0.97), p=0.03. Fried foods, spices, fruits, and aerated drinks had no association with dyspepsia. However, on multivariate analysis, smoking was the only risk factor found to be independently associated with dyspepsia as shown in Table 3.

Table 3: Factors independently associated with dyspepsia on multivariate analysis

Parameters	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Age >50 vs. ≤50 years	2.09 (1.22 – 3.58)	1.4 (0.74 – 2.59)	0.29
Sex: male vs. female	0.87 (0.52 – 1.45)	0.6 (0.35 – 1.20)	0.17
Predominantly vegetarian: yes vs. no	2.85 (0.96 – 8.46)	2.2 (0.66 – 7.51)	0.19
Aerated drink: yes vs. no	0.39 (0.11 – 1.39)	1.0 (0.25 – 4.11)	0.99

Parameters	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Regular tea intake: yes vs. no	2.2 (1.11 – 4.36)	1.5 (0.75 – 3.29)	0.22
Smoking: yes vs. no	1.98 (1.06 – 3.67)	2.5 (1.20 – 5.40)	0.01
Gudakhu users: yes vs. no	1.9 (1.08 – 3.34)	1.4 (0.72 – 2.78)	0.31
Alcohol: yes vs. no	0.28 (0.08 – 0.97)	0.3 (0.08 – 1.18)	0.08

Most of the participants (65%) self-medicated to relieve their symptoms by using over-the-counter medication (antacids) without consulting a physician. All the participants with dyspepsia were counseled to undergo esophagogastroduodenoscopy for further evaluation. Only 53% (n=47) of participants consented to undergo the procedure. The procedure was completed successfully in 43 participants, while the remaining 4 participants were uncooperative. Normal endoscopic findings up to the second part of the duodenum were reported in 56% (n=24) of the participants. Among the abnormal findings reported, 26% (n=11) had esophagitis, 9% (n=4) had antral gastritis, 7% (n=3) had antral ulcer, and 2% (n=1) had inflammatory esophageal polyp, Table 4.

Table 4: Endoscopy findings in patients with dyspepsia

Endoscopic Findings	n (%)
Normal	24 (56%)
Esophagitis	
Grade A	5 (12%)
Grade B	4 (9%)
Grade D	2 (5%)
Antral gastritis	4 (9%)
Antral ulcer	3 (7%)
Esophageal inflammatory polyp	1 (2%)
Total	N = 43

DISCUSSION

A huge number of patients visiting gastroenterology clinics in India are diagnosed with dyspepsia. The prevalence of dyspepsia varies worldwide. A good number of studies have reported prevalence in the western countries and urban populations of India. However, there are a limited number of literatures estimating prevalence in the rural population of India. The prevalence of dyspepsia using Rome III criteria in a rural population of Odisha in India was 29.6%. Globally, the prevalence of dyspepsia varies widely from 7- 45%. [5] The prevalence was reported to be 7.9% in Singapore [9], 18.4% in Hongkong [10], 23-25.8% in the USA [11], 30.4% in urban India [12], and 34.2% in New Zealand [13]. The prevalence of dyspepsia in this study is in concordance with previous Indian studies. The wide variation in the prevalence of dyspepsia might be due to varied diagnostic criteria used, different regions of the survey, and various methods of survey. The lifestyle and habitual differences among the population from urban and rural India could be another possible factor.

Rome III diagnostic criteria for Functional Dyspepsia involves the fulfillment of symptoms for dyspepsia for the required duration along with ruling out structural disease by upper endoscopy to explain the symptoms [14]. Further, functional dyspepsia is divided into postprandial distress syndrome (postprandial fullness and/or early satiety) and epigastric pain syndrome (epigastric pain/ burning) [14]. Rome IV diagnostic criteria for functional dyspepsia include one or more of the symptoms (bothersome postprandial fullness, bothersome early satiation, bothersome epigastric pain, bothersome epigastric burning) for the last 3 months with symptom onset at least 6 months prior to diagnosis, and no evidence of structural disease by upper endoscopy that is likely to explain the symptoms [15]. Although the Rome IV committee did not consider it necessary to perform an endoscopy for diagnosing functional dyspepsia, however, it could not be avoided either [16]. A study by Demirören et.al. states changes in Rome IV for functional dyspepsia are minimal [16]. In this study, the most prevalent symptoms of dyspepsia were postprandial fullness, early satiety, and epigastric discomfort which were equally complained by patients with dyspepsia which is in accordance with previous studies [17].

Subjects of the older age group are associated with an increased risk of dyspepsia, but no independent association was found. In a review analysis, Mahadeva et.al witnessed different trends in age groups, but age extremity as a predictor of dyspepsia was not concluded [18]. Many studies have found no association between gender and dyspepsia [5, 18, 19]. We have also arrived at the same conclusion in our study. The current study did not find any significant association between socioeconomic status and dyspepsia although there was a higher frequency in lower socioeconomic strata. In a survey, Douglas *et al.,* reported a stronger relationship between lower household income, larger household numbers, and higher frequency of gastrointestinal symptoms [20]. This might be due to a lower level of

education which resulted in decreased awareness about the diseases. Many surveys have established anxiety and psychological distress as contributory factors of dyspepsia [5, 6]. Koh *et al.,* reported similar results among nurses and also observed that marriage is a protective factor with respect to dyspepsia with an unclear explanation [21]. However, our study did not find any such associations with dyspepsia. No association was found between BMI and dyspepsia which is in accordance with other studies [6].

Other associated risk factors for dyspepsia were a predominantly vegetarian diet, regular tea intake, chewing tobacco, smoking, and gudakhu use. In a community-based study in Northern India, Ghoshal *et al.,* reported an independent association between dyspepsia and a vegetarian diet, chewing tobacco, intake of aerated soft drinks, and disturbed sleep [5]. A vegetarian diet is a major source of fermentable oligo-, di-, monosaccharides, and polyols (FODMAP) which include pulses, legumes, onion, and garlic [22]. Diet with low FODMAP has been used for Irritable Bowel Syndrome (IBS) as a first-line treatment internationally [23]. Though there is a similarity in pathogenesis and phenotypes of IBS and dyspepsia, currently there is less evidence for a low FODMAP diet in the treatment of dyspepsia. However, in multivariate analysis, no independent association was found between a predominantly vegetarian diet and dyspepsia. So further studies on dietary intervention are required. Though regular tea consumption was associated with dyspepsia in univariate analysis, it is not an independent risk factor for dyspepsia, which is in accordance with review reports by Mahadeva *et al.,* [18].

Tobacco consumption rate was high in this community, in different forms i.e., chewing and smoking. Every alternate person in this community was using tobacco in chewing form and 17% were current smokers. Gudakhu is a locally available form of tobacco that is used by rural people while brushing their teeth. Univariate model reported a significant association between all these three forms of tobacco with dyspepsia. However, only smoking tobacco was found to be an independent risk for dyspepsia. In different communities, Ghoshal *et al.,* and Nandurkar *et al.,* reported an independent association between smoking and dyspepsia [5, 24]. The mechanism behind this association was studied by Guslandi *et al.,* who reported a decrease in mucosal blood flow and alkali secretion in heavy smokers, which might lead to difficulty in mucosal repair and lead to dyspepsia [25]. Previously Tally et.al. didn't find any strong association between alcohol and dyspepsia [26]. In preclinical medical students, Jaber *et al.,* also reported no association between alcohol and dyspepsia [27]. Though significant numbers of people in the healthy group were abusing alcohol in this community, no independent association was found.

Existing literature seems to suggest that most of the cases of UD are found to be of functional origin after endoscopic evaluation [28]. Excluding functional dyspepsia, the organic causes of dyspepsia vary considerably. Gastritis was found to be the commonest cause in China in a survey by Hu *et al.,* whereas in India esophagitis was the commonest cause of dyspepsia [29, 30]. In this survey, among the subjects undergoing successful esophagogastroduodenoscopy, 56% (24) were found to be normal. Similar results had been reported by Khan *et al.,* and Sahib *et al.,* [28, 31]. Among abnormal findings, the most common was esophagitis followed by gastritis, gastric ulcer, and esophageal inflammatory polyp which is supported by Sarwar *et al.,* [32].

The present study is not without any limitations. Our dietary history included the frequency of consumption of dietary habits and proper quantification was not done. Helicobacter pylori testing was not carried out because of financial constraints.

CONCLUSION

Dyspepsia is a very common disease in Odisha with a prevalence of 29.6 %. Smoking tobacco was found to be an independent risk factor for dyspepsia. Most of the participants were diagnosed with functional dyspepsia after endoscopic evaluation.

Highlights:

- Prevalence of dyspepsia is well established in western countries and urban regions of India with minimal studies reporting from rural areas.
- Dyspepsia is highly prevalent in rural areas with majority of participants being diagnosed as functional dyspepsia after endoscopic evaluation. Smoking is an independent risk factor.
- Further studies using Rome IV criteria and quantification of tobacco consumption are recommended.

Declarations

Competing Interest: The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval & Consent to Participate: This study was approved by the Institutional Ethics Committee, S.C.B. Medical College and Hospital, Cuttack-753007, Odisha, India (IEC/ IRB No – 308/27-04-2016) and performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

All the methods in the study were carried out in accordance with relevant guidelines and regulations.

The study protocols were approved by the Institutional Ethics Committee.

Written informed consent in the local Odia language was obtained from all subjects and/or their legal guardian(s).

Consent for publication: Not applicable.

Availability of data & materials: The authors have the original data for reproduction to be provided upon request.

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Contributions:
AKD: Data collection, review of literature, execution of endoscopic procedure, preparation of manuscript.
AC: Execution of endoscopic procedure, revision of manuscript, reference management.
SS: Review of literature, revision of manuscript.
DR: Statistical analysis, review of manuscript.
PN: Planning of endoscopic procedure, review of manuscript.
SPS: Concept, planning of endoscopic procedure, review of manuscript, overall investigator.

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