

A Study on the Correlation between Individual Meals, Total Diet, and Gastroesophageal Reflux Disease

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Conflict of interest: Nil

Abstract:**Objectives:** The objective of this study is to explore the relationship between dietary patterns, encompassing overall food intake and specific meals, and the occurrence of symptoms related to gastroesophageal reflux disease (GERD).**Methods:** A year-long case-control study at a tertiary care centre assessed 61 individuals with recurrent heartburn, regurgitation, or both, confirming GERD diagnosis through gastroenterological evaluation. Controls without these symptoms, matched for age and gender, were chosen, consisting of 64 individuals aged 14 years or above. The study gathered demographic data, and employed a 3-day food record for precise dietary assessment, to explore the GERD-diet association.**Results:** In a total of 125 participants, age differences between those with GERD symptoms (n=61) and those without symptoms (n=64) were non-significant (p=0.91), and gender proportions showed no significant variations. The GERD group exhibited a slightly higher percentage of unemployed individuals (84 %) and notable educational disparities (p=0.007), with 18.8% being illiterate compared to 7.2% in the non-GERD group. Regarding dietary intake, no significant differences in total energy or macronutrient distribution were observed, emphasizing an overall dietary similarity. Meal-specific analyses for breakfast, lunch, and dinner revealed no substantial variations in energy intake or macronutrient composition between the two groups.**Conclusion:** The study found no significant age and gender differences between individuals with and without GERD symptoms. Despite educational and employment disparities, dietary patterns, including total energy and macronutrient intake, showed overall similarity, suggesting that GERD symptoms were not strongly associated with these demographic and dietary factors in the studied cohort.**Recommendation:** Further research is recommended to explore additional factors contributing to GERD symptoms and to assess the impact of interventions on dietary habits, education, and employment in the context of GERD prevention.**Keywords:** GERD, Gastroesophageal Reflux Disease, Dietary Patterns, Demographics.

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Introduction

Gastroesophageal reflux disease (GERD) is a prevalent health issue with significant consequences that results from the regurgitation of gastroduodenal contents into the esophageal lumen [1,2]. Epidemiological investigations suggest diverse prevalence rates, spanning from 10 - 48% in Western nations and reaching to approximately 5% in Asia [3, 4]. GERD manifests through distinctive symptoms like retrosternal burning sensation (heartburn) and a sour taste in the mouth (acid regurgitation), significantly affecting patients' well-being [5]. This condition poses a substantial risk for esophageal adenocarcinoma (EA) and Barrett's metaplasia, contributing to absenteeism and

decreased work productivity [6]. Given the global increase in EA cases, comprehending the factors influencing GERD development becomes imperative.

Despite advancements in understanding GERD's pathogenesis, risk factors remain poorly elucidated. While several studies focus on physiological aspects, there's limited exploration from a dietary perspective [7-11]. In particular, the existing research has primarily explored the impact of fat on postprandial esophageal acid exposure or the motility of the lower esophageal sphincter in patients with severe GERD [12-14]. Furthermore,

the studies on the effect of total dietary intake on GERD are limited [15,16].

In one study consisting of 371 participants, a significant relationship between fat-rich diet and GERD symptoms have been noted, although this becomes nonsignificant when the body mass index (BMI) is adjusted, owing to the connection between obesity and GERD symptoms [15]. Recent insights into this topic suggests the need for further investigation of the association between dietary fat intake and specific food sources to confirm these findings [17,18]. Overall, more comprehensive studies are required in this area as the existing studies conducted to identify the correlation between dietary factors and GERD have presented conflicting results [19-22].

Given the importance of promoting the health of the population, especially those with GERD, it is noteworthy that the role of individual meals in the diet concerning GERD has not been thoroughly explored. To address this gap in knowledge, the present study aims to investigate the association of both total diet and individual meals, providing a comprehensive understanding of the dietary factors influencing GERD.

Materials and Methods

Study Design: A case control study was carried out on individuals who presented to a tertiary care centre over a period of 1 year. Those reporting regular esophageal burning, acidic belching, or both at least once a month in the past year underwent further evaluation by a gastroenterologist to confirm the diagnosis of GERD. The control group was defined by individuals who had similar age and gender but displayed no GERD symptoms. For accurate diagnosis of GERD, a symptom checklist comprising of the incidence rates of acid reflux and heartburn was used.

Inclusion and Exclusion Criteria: Inclusion criteria involved consenting individuals aged 14 years or older seeking medical care at a tertiary care centre. Patients with prior history of gastric surgery, gastric or esophageal tumors, vagal neurectomy, peptic ulcers, calorie-controlled diet, and those with a medication history of nitrates, calcium-channel blockers, H₂-receptor antagonists (H₂-RA), proton pump inhibitors (PPIs) were excluded from this study. Participants with a history of taking hormonal medications were also excluded while those using antacids were advised to stop its usage four weeks prior to the study.

Study Size: The study included 125 patients who did not have any prior surgical or medication history which could possibly affect the study.

Study Setting: This study conducted at a tertiary care centre, noted the patient's demographic details using a simple questionnaire. The participants body mass index (BMI) was then determined using suitable formula such as the Quetelet's formula. A 3-day food record diary was given to the patients for accurate recording of the macronutrient contents ingested by them during 2 business days and 1 leisure day. The participants were instructed by trained dietitians for maintaining their regular diet and guiding them on diary completion. An in-person interview ensured that the recorded foods reflected their typical dietary patterns. On collection of the data, a Nutritionist III software was employed for analyzing it. Additionally, the caloric density was also calculated.

Bias: Potential bias may arise from relying on self-reported data, including dietary habits and symptoms. Additionally, the study may be prone to selection bias due to its recruitment from a specialized clinic, possibly affecting the generalizability of the findings.

Ethical Consideration: Ethical considerations in this study encompassed securing informed consent, safeguarding participant privacy during symptom reporting, and following confidentiality guidelines for sensitive data collection.

Statistical Analysis: Data analysis used SPSS version 16, presenting continuous variables as median and range. Statistical tests included X², Mann-Whitney U, and student t tests. Associations with GERD were assessed using odds ratios (OR) through logistic regression, considering "no reflux" as reference, and multiple logistic regression models adjusted for BMI and education level. Significance was set at $P < 0.05$.

Results/Outcomes

Participants: The study involved 125 individuals, with 61 showing GERD symptoms and 64 without GERD symptoms. Demographic comparisons revealed no significant age difference between the groups, with an average age of 33.1 years. Gender distribution, occupation, marital status, smoking habits, and menopausal status were examined also examined as a part of this. While gender proportions showed slight variations, occupational status identified a higher percentage of unemployed individuals in the GERD symptoms group (84%). Education levels also exhibited a prominent difference among the groups with a p-value of 0.007, indicating a higher proportion of illiterate individuals in the GERD cohort (18.8% vs. 7.2%) (Table 1).

Table 1: General Characteristics of 125 individuals in the study cohort

	Patients with symptoms of GERD (n=61)	Patients with no symptoms of GERD (n=64)	P-value
Average Age (years)	33.1	33.1	0.91
Gender			
Men	15 (25.4 %)	17 (27.1 %)	0.42
Women	46 (74.6 %)	47 (72.9 %)	
Profession			
Unemployed	51 (84 %)	52 (82 %)	0.11
Employed	10 (16 %)	12 (18 %)	
Job sector of employed participants			
Public sector	4 (6.6 %)	5 (6.3 %)	0.12
Private sector	6 (9.4 %)	7 (11.7 %)	
Unemployed or not in labor force			
Pensioned	7 (11.4 %)	12 (18.7 %)	0.13
Homemaker	36 (58.5 %)	26 (41.4 %)	
Scholar	8 (13.2 %)	14 (21.6 %)	
Education			
Uneducated	11 (18.8 %)	5 (7.2 %)	0.007
Educated	39 (63.9 %)	37 (57.6 %)	
College education	11 (17.9 %)	22 (35.1 %)	
Marital status			
Single	14 (23.5 %)	20 (30.6 %)	0.42
Married	47 (76.4 %)	44 (69.3 %)	
Smoking			
Non-smoker	29 (47.5 %)	32 (50.7 %)	0.23
Smoker	32 (52.5 %)	32 (49.3 %)	
Status of menopause			
Post-menopausal	11 (17.9 %)	7 (11.4 %)	0.18
Pre-menopausal	50 (82.1 %)	57 (88.6 %)	

The study further evaluated the dietary intake patterns of 125 individuals, particularly the total daily energy intake, which is expressed in kilocalories per day. This comparison revealed no noteworthy difference amongst the two groups ($p=0.81$). Subsequent examination of the percentage of energy derived from carbohydrates, fat, and

protein showed slight variations, but p-value was found to be insignificant. Further exploration of specific macronutrient values for carbohydrates, sugar, protein, fat, and cholesterol did not unveil any significant disparities between the two groups. This suggests a general trend with similarity in overall dietary composition in both groups (Table 2).

Table 2: Dietary Intake Patterns and Macronutrient Composition in Individuals with and without GERD Symptoms

	GERD Symptoms (n=61) (range)	No GERD Symptoms (n=64) (range)	P-value
Total dietary intake			
Energy (kcal/d)	1914.2 (814-3746)	1816 (992.3-3501.2)	0.81
% Energy from carbohydrates	56.0 (38 - 75)	55.2 (38 - 75)	0.98
% Energy from protein	13.0 (9-27)	12.0 (9 - 27)	0.05
% Energy from fat	32.0 (17-46)	27.0 (17 - 46)	0.55
Carbohydrates (g/d)	247.1 (96.2-514.1)	265.2 (121.6-654.7)	0.49
Sugar (g/d)	18.9 (1.8-47.5)	25.0 (1.3-121)	0.35
Protein (g/d)	58.3 (25.3-165.2)	66.5 (38-146.3)	0.15
Fat (g/d)	64.3 (12.6-135.7)	68.6 (24.3-124.7)	0.75
Cholesterol (mg/d)	165.5 (8.4-754.1)	267.1 (26.9-538)	0.71
Breakfast			
Energy (kcal/d)	455.5 (43.2-1036)	367.0 (22.8-1617)	0.26
% Energy from carbohydrates	66.8(14-84)	59.0 (5-98)	0.18
% Energy from protein	11.0 (5-22)	16.0 (0-26)	0.64
% Energy from fat	28.0 (6-76)	29.0 (0-89)	0.19

Lunch			
Energy (kcal/d)	665.1 (137.4-1551)	589.2 (286.6-2598)	0.19
% Energy from carbohydrates	45.0 (26-76)	51.0 (28-81)	0.36
% Energy from protein	12.0 (5-26)	13.0 (6-30)	0.14
% Energy from fat	34 (4-66)	38.0 (9-60)	0.12
Dinner			
Energy (kcal/d)	437 (25.5-1132)	458 (0-1397)	0.46
% Energy from carbohydrates	43 (13-81)	68 (0-79)	0.42
% Energy from protein	16 (5-41)	18 (0-34)	0.41
% Energy from fat	29 (2-78)	25 (0-776)	0.11

Discussion

This study represents a preliminary exploration into the correlation of GERD with both overall dietary habits and specific meal components, a unique aspect that distinguishes it. Surprisingly, our investigation found no significant differences in the total dietary intake of the individuals with and without GERD symptoms. Moreo-ver, as mentioned earlier, with the exclusion of percentage of energy obtained from protein, the other dietary factors failed to show a significant association with GERD. This observation is contrary to the known physiological effects of protein, including its role in increasing lower esophageal sphincter pressure and stimulating the secretion of gastrin, ultimately promoting the emptying of stomach [23, 24]. The present observation aligns with previous findings that propose a potential pathophysiological link between GERD manifestation and decreased LES pressure [25, 26].

The work reported by El-Serag et al. revealed significantly elevated dietary consumption of saturated fatty acids, average fat servings, and energy obtained from fat, particularly in individuals with GERD, revealing a dose-dependent relationship between the disease and total fat [15]. While this link between fat and GERD became non-significant on adjusting BMI, it was distinguishing as the study had relied on a food frequency questionnaire, that is often susceptible to recall bias. Contrastingly, the present investigation employed a three-day food record and therefore offers more reliable results. The 3-day meal record was employed for this study as it is the established gold standard for dietary assessment [27].

In an investigation by Pehl et al., which was conducted on 60 reflux patients, a significant link was noted between perceived reflux events and higher intakes of cholesterol, saturated fatty acids, and fat-derived calories [20]. However, Pehl's study lacked a control group and had a limited number of participants, rendering its generalizability. In contrast, the present study, with adequate test and control group, identifies the differences between individuals with and without GERD and correlates the impact of their diet on the disease manifestation. In one study by Nandurkar et al.

which involved 211 community subjects, no significant association between diet and reflux symptoms were noted [16].

It remains unclear if the GERD patients had altered their diet during the study, as dietary adjustments are often recommended for GERD management. Some patients with non-severe GERD may resist dietary changes, possibly due to the pleasure derived from certain foods. It is also unclear whether patients experienced symptoms during food recording, potentially influencing the type and quantity of food consumed.

Conclusion

The present study, utilizing a comprehensive 3-day food record, revealed no significant differences in total dietary intake between individuals with and without GERD symptoms. However, a noteworthy association was found between GERD and the percentage of energy derived from total protein. These findings underscore the intricate relationship between specific dietary components and GERD, emphasizing the importance of considering individualized dietary patterns in understanding and managing this health condition. Further research is warranted to explore these associations in larger, diverse populations and to elucidate the potential impact of individual dietary behaviours on GERD.

Limitations

Limitations include potential recall bias due to self-reported dietary data and uncertainties regarding whether patients altered their diets during the study, impacting the observed associations with GERD. Additionally, the study's sample size may limit generalizability, warranting caution in extrapolating findings to broader populations.

Recommendations

The study recommends further investigations with larger and diverse populations to validate observed associations between dietary factors and GERD. Longitudinal designs are encouraged to assess the dynamic impact of dietary changes on GERD over time, and exploring personalized dietary interventions is advised for more effective symptom management.

Generalizability: The generalizability of the study may be limited due to the specific population and geographic location studied, cautioning against direct extrapolation of findings to broader and diverse populations. Additionally, individual variations in dietary habits and cultural factors may influence the applicability of the study's results to other settings.

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List of Abbreviations

GERD - Gastroesophageal Reflux Disease

EA - Esophageal Adenocarcinoma

PPIs - Proton Pump Inhibitors

H2-RA - H2-Receptor Antagonists

BMI - Body Mass Index

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