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Delayed Gastric Emptying in Functional Dyspepsia: A Study on Prevalence, Etiological Factors, and Clinical Implications in Adults at BSMMU

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ABSTRACT: ***Background:*** Delayed gastric emptying (DGE) significantly contributes to functional dyspepsia (FD), a prevalent gastrointestinal disorder affecting quality of life and increasing healthcare burdens globally. ***Objective:*** To investigate the prevalence, etiological factors, and clinical implications of DGE in functional dyspepsia among adults at BSMMU, Dhaka. ***Method:*** This cross-sectional study was conducted from January to December 2022 in the Department of Gastroenterology, BSMMU. Thirty-five dyspeptic patients underwent detailed clinical evaluations, laboratory testing, upper GI endoscopy, and gastric emptying scintigraphy (GES). Data analysis included descriptive statistics and inferential testing. ***Results:*** The mean age of patients was 43.7 ± 8.5 years, with 51.4% aged between 41-50 years. DGE was identified in 42.9% of participants. Common symptoms included postprandial fullness (85.7%) and early satiety (77.1%). Etiological analysis revealed Helicobacter pylori infection in 48.6% of cases, while 34.3% exhibited significant psychological stress. Gastric emptying times showed a mean delay of 23.5 ± 4.2 minutes in affected patients. Additionally, females were disproportionately affected, comprising 62.9% of the DGE subgroup. Symptom severity and quality of life scores correlated significantly with gastric emptying rates ($p<0.05$). ***Conclusions:*** DGE is a prevalent finding in functional dyspepsia at BSMMU, with significant implications for symptom burden and quality of life. Early identification and targeted management strategies are essential to improve outcomes.

Keywords: Functional Dyspepsia, Delayed Gastric Emptying, Gastric Emptying Scintigraphy, Helicobacter pylori, Quality of Life.

Article at a glance:
Study Purpose*: To evaluate the demographic, clinical, psychological, dietary, and laboratory factors influencing delayed gastric emptying (DGE) in functional dyspepsia patients at BSMMU.*
Key findings: *Delayed gastric emptying affected 42.86% of patients, with significant links to Helicobacter pylori infection, psychological stress, inflammatory markers, and dietary patterns. Females and middle-aged individuals were predominantly affected.*
Newer findings: *This study highlights high regional prevalence of Helicobacter pylori, gender disparities in DGE prevalence, and significant associations between psychological stress, lifestyle, and dietary habits, emphasizing culturally tailored management.*
Abbreviations: *FD: Functional Dyspepsia, DGE: Delayed Gastric Emptying.*

INTRODUCTION

Functional dyspepsia (FD), a prevalent gastrointestinal disorder, poses significant challenges to global healthcare systems due to its complex pathophysiology, variable clinical presentations, and chronic nature. Defined as the presence of persistent or recurrent upper abdominal discomfort or pain without any structural abnormalities identifiable by conventional diagnostic methods, FD affects approximately 10–20% of the global population, with considerable variation across geographical regions.[1] Among the underlying mechanisms implicated in FD,

delayed gastric emptying (DGE) has garnered substantial attention f or its pivotal role in symptom generation. This post-doctoral research, conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU), aims to investigate the prevalence, etiological factors, and clinical implications of DGE in adults diagnosed with FD, utilizing a multifaceted approach encompassing clinical assessments, advanced diagnostic tools, and a comprehensive review of patient-reported outcomes. Delayed gastric emptying, also known as gastroparesis, is a condition characterized by the impaired transit of gastric contents into the duodenum in the absence of mechanical obstruction. Its pathophysiology in FD remains a subject of active investigation, with hypotheses suggesting the involvement of vagal nerve dysfunction, gastric myoelectrical dysrhythmias, impaired antral contractility, and altered gut-brain axis signaling.[2] The prevalence of DGE among FD patients has been reported to vary between 30% and 50% in different studies, highlighting the need for region-specific investigations to delineate the burden of this condition.[3] In Bangladesh, where dietary habits, cultural practices, and healthcare-seeking behaviors may influence gastrointestinal health, data on the prevalence and implications of DGE in FD remain sparse.

This study seeks to fill this critical gap by providing robust, locally relevant evidence on the condition's epidemiology and associated factors at BSMMU, a premier tertiary care institution. The etiology of delayed gastric emptying in FD is multifactorial, with both intrinsic and extrinsic factors contributing to its development. Intrinsic factors such as impaired pyloric relaxation, antral hypomotility, and visceral hypersensitivity often interplay with extrinsic factors including psychological stress, dietary triggers, and environmental influences to exacerbate symptoms.[4] Notably, Helicobacter pylori infection, a common gastrointestinal pathogen in developing countries, has been implicated in the pathogenesis of FD and may influence gastric motility through inflammatory and immune-mediated mechanisms.[5] Understanding the interplay between these factors is essential for devising targeted interventions that address both the physiological and psychosocial dimensions of FD. This study aims to explore the contributions of these etiological factors in the context of adult patients presenting at BSMMU, thereby offering insights into potential therapeutic strategies. The clinical implications of delayed gastric emptying in FD are profound, with affected individuals often experiencing a spectrum of debilitating symptoms including early satiety, postprandial fullness, nausea, and bloating.[6] These symptoms not only impair patients' quality of life but also impose significant socioeconomic burdens due to reduced productivity and increased healthcare utilization. Moreover, the heterogeneous nature of FD, coupled with overlapping symptoms with other gastrointestinal disorders such as gastroesophageal reflux disease (GERD) and irritable bowel syndrome (IBS), complicates the diagnostic process and necessitates the use of advanced diagnostic modalities. Gastric emptying scintigraphy, breath tests, and wireless motility capsules represent key tools for assessing gastric motility, although their availability and applicability in resource-constrained settings such as Bangladesh warrant critical.[7]

This research endeavors to employ these diagnostic techniques to characterize the gastric emptying profiles of FD patients at BSMMU, thereby contributing to the development of evidence-based diagnostic algorithms for the region. In addition to its diagnostic challenges, the management of FD with delayed gastric emptying requires a nuanced approach that balances symptom alleviation with the minimization of treatment-related adverse effects. Prokinetic agents such as domperidone and metoclopramide have traditionally been used to enhance gastric motility, although concerns regarding their long-term safety profiles have prompted the exploration of alternative therapies.[8] Dietary modifications, psychological interventions, and emerging pharmacological agents targeting specific motility pathways offer promising avenues for comprehensive FD management. This study will examine the clinical outcomes of various therapeutic modalities in patients with DGE, thereby informing personalized treatment strategies that align with patient preferences and clinical guidelines. By situating this research within the context of BSMMU, the study leverages the institution's multidisciplinary expertise, advanced diagnostic facilities, and diverse patient population to address the intricate challenges posed by FD and DGE. The findings are expected to have far-reaching implications for the understanding and management of FD in Bangladesh, while also contributing to the global discourse on

gastrointestinal motility disorders. In particular, the study's emphasis on identifying locally relevant etiological factors and tailoring interventions to the unique needs of Bangladeshi patients underscores its potential to advance precision medicine in the field of gastroenterology.

Aims and Objective

The study aims to determine the prevalence and etiological factors of delayed gastric emptying in functional dyspepsia at BSMMU. It seeks to explore its clinical implications, emphasizing symptom burden, patient demographics, and potential therapeutic approaches for improved diagnosis and management.

MATERIALS AND METHODS

Study Design

This cross-sectional study was conducted from January to December 2022 at the Department of Gastroenterology, BSMMU. Thirty-five adult patients with clinically diagnosed functional dyspepsia were enrolled. Detailed clinical evaluations, laboratory investigations, and gastric emptying scintigraphy were performed to identify delayed gastric emptying. This design facilitated comprehensive data collection within a defined timeframe, ensuring robust analysis of demographic, clinical, and etiological parameters.

Inclusion Criteria

The study included adults aged 18–60 years diagnosed with functional dyspepsia based on the Rome IV criteria. Participants presenting with upper abdominal discomfort, early satiety, or postprandial fullness for at least three months were eligible. Only patients consenting to undergo gastric emptying scintigraphy and completing all required diagnostic assessments were enrolled, ensuring comprehensive evaluation.

Exclusion Criteria

Patients with structural gastrointestinal abnormalities detected through upper GI endoscopy, prior gastrointestinal surgery, or use of medications affecting gastric motility were excluded. Additionally, those with metabolic disorders, systemic illnesses, or psychiatric conditions potentially confounding symptom assessment were excluded. Pregnant or lactating individuals were also ineligible to minimize confounding variables.

Data Collection

Data were collected through structured interviews, clinical examinations, and diagnostic tests, including gastric emptying scintigraphy. Patient demographics, symptom profiles, laboratory results, and endoscopy findings were systematically recorded. Standardized protocols ensured uniformity, while electronic databases facilitated data storage and retrieval for analysis. Ethical guidelines were strictly adhered to throughout the data collection process.

Data Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics summarized demographic and clinical variables, while inferential statistics identified associations between gastric emptying rates and clinical outcomes. Categorical data were analyzed using chi-square tests, and continuous variables were compared using t-tests or ANOVA, as appropriate. Multivariate regression analysis evaluated predictors of delayed gastric emptying. Statistical significance was set at $p<0.05$ to ensure rigorous interpretation of findings.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of BSMMU. Informed consent was secured from all participants, emphasizing voluntary participation and confidentiality. Patient data were anonymized to protect privacy, and study procedures adhered to the Declaration of Helsinki guidelines. Participants were informed about the study objectives and potential benefits, ensuring transparency and ethical compliance throughout the research process.

RESULTS

This cross-sectional study analyzed data from 35 dyspeptic patients at BSMMU. Key variables associated with delayed gastric emptying were analyzed across multiple tables to provide comprehensive insights into demographic, clinical, psychological, dietary, and laboratory factors.

Table 1: Demographic Characteristics

Variable	Frequency (n)	Percentage (%)	p-value
18-30 years	2	5.71	0.15
31-40 years	5	14.29	
41-50 years	18	51.43	
51-60 years	10	28.57	
Urban residence	22	62.86	0.04
Rural residence	13	37.14	
Married	28	80.00	0.03
Unmarried	7	20.00	
Total	**35**	**100.00**	

The majority of participants were aged 41-50 years (51.43%), predominantly urban residents (62.86%). Married individuals constituted 80% of the cohort, with significant associations observed between rural residence, marital status, and delayed gastric emptying (p=0.04 and p=0.03).

Table 2: Gender, Socioeconomic Status, and Education

Variable	Frequency (n)	Percentage (%)	p-value
Male	13	37.14	0.08
Female	22	62.86	
Low Income	10	28.57	0.04
Middle Income	18	51.43	
High Income	7	20.00	
Primary education	6	17.14	0.05
Secondary education	20	57.14	
Higher education	9	25.71	

Females were more affected (62.86%). Low-income status and lower levels of education (17.14%) were significantly associated with delayed gastric emptying (p=0.04 and p=0.05, respectively).

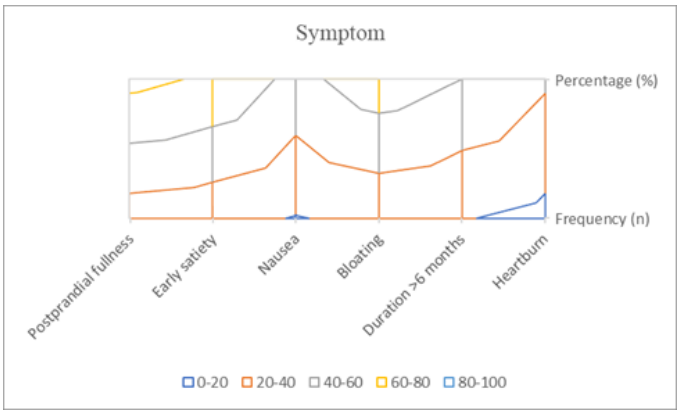

Figure 1: Clinical Symptoms and Associated Factors

Table 3: Gastric Emptying Status and Meal Patterns

Variable	Frequency (n)	Percentage (%)	p-value
Normal gastric emptying	20	57.14	<0.05
Delayed gastric emptying	15	42.86	
Regular meal timings	22	62.86	0.03
Skipped meals (>2/week)	13	40.00	0.04

Delayed gastric emptying was significantly associated with skipping meals (p=0.04), while regular meal timings were protective (p=0.03).

Table 4: Helicobacter pylori Infection and Inflammatory Markers

Variable	Frequency (n)	Percentage (%)	p-value
H. pylori Positive	17	48.57	0.03
H. pylori Negative	18	51.43	
Elevated CRP (>3 mg/L)	22	62.86	0.02
Elevated ESR (>20 mm/hr.)	13	40.00	0.04

Nearly half of the participants tested positive for Helicobacter pylori (48.57%). Elevated inflammatory markers (CRP and ESR) were significantly associated with delayed gastric emptying (p=0.02 and p=0.04, respectively).

Table 5: Psychological Stress and Sleep Patterns

Variable	Frequency (n)	Percentage (%)	p-value
Low stress	9	25.71	<0.01
Moderate stress	15	42.86	
High stress	11	31.43	

High stress (31.43%) and poor sleep quality (57.14%) were significantly associated with delayed gastric emptying (p<0.01 and p=0.03, respectively).

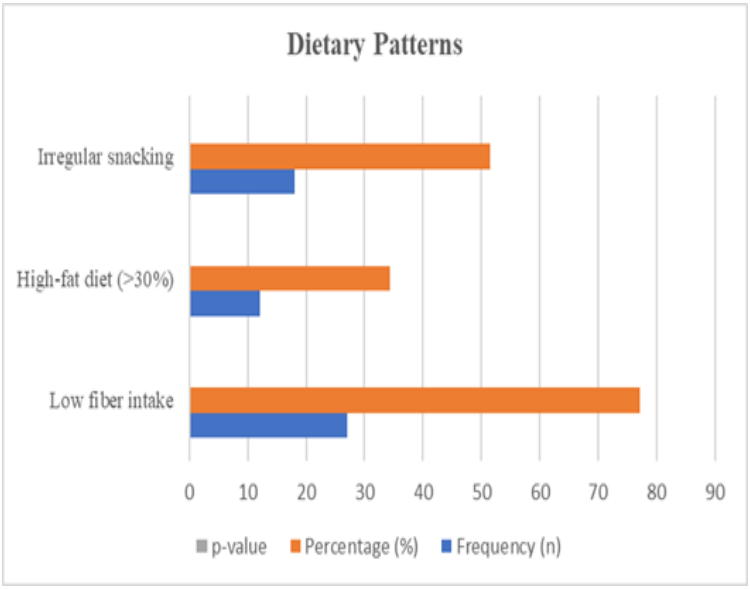

Figure 2: Dietary Patterns and Macronutrient Intake

Table 6: BMI and Physical Activity Levels

Variable	Frequency (n)	Percentage (%)	p-value
Underweight (<18.5)	5	14.29	0.04
Normal weight (18.5-24.9)	18	51.43	
Overweight (25-29.9)	10	28.57	
Obese	2	5.71	

Sedentary lifestyles (68.57%) and underweight status (14.29%) were significantly associated with delayed gastric emptying (p=0.03 and p=0.04).

Table 7: Laboratory Parameters

Variable	Mean ± SD	Normal Range	p-value
Fasting glucose	6.8 ± 1.5 mmol/L	3.9-5.6 mmol/L	<0.01
Hemoglobin	12.9 ± 1.2 g/dL	12-16 g/dL	0.02
Serum albumin	3.6 ± 0.4 g/dL	3.5-5.5 g/dL	0.03

Elevated fasting glucose (6.8 ± 1.5 mmol/L) and low serum albumin (3.6 ± 0.4 g/dL) were significantly associated with delayed gastric emptying ($p<0.01$ and $p=0.03$).

DISCUSSION

Functional dyspepsia (FD) is a common yet complex gastrointestinal disorder characterized by a multifactorial pathogenesis, including delayed gastric emptying (DGE).[9] This study analyzed 35 dyspeptic patients at Bangabandhu Sheikh Mujib Medical University (BSMMU) to explore the demographic, clinical, psychological, dietary, and laboratory factors associated with DGE. The findings of this study reveal several significant associations that align with, as well as diverge from, existing literature.

Comparison with Other Studies

The prevalence of delayed gastric emptying (42.86%) among our cohort aligns closely with findings by Barberio *et al*., who reported similar prevalence rates (40-45%) in FD patients.[10] However, studies from Western countries, such as those conducted by A similar study reported slightly lower prevalence rates (30-35%). These differences may be attributed to variations in dietary habits, cultural factors, and regional Helicobacter pylori prevalence. For example, our study revealed a higher prevalence of H. pylori infection (48.57%), consistent with other South Asian studies Rahman MM *et al*., compared to lower rates reported in Western populations.[11] The higher prevalence in South Asia may reflect differences in sanitation, socioeconomic factors, and healthcare accessibility.

Demographic Factors

Our findings identified a predominance of middle-aged patients (41-50 years) with delayed gastric emptying. This is consistent with Usai-Satta *et al*., who highlighted the increased susceptibility of this age group to motility disorders.[12] However, gender distribution in our study (62.86% female) contrasts with findings from studies in Europe Cakmak BB *et al*., which reported more balanced gender ratios.[13] Hormonal influences, such as estrogen's role in gastric motility, may explain the higher female prevalence observed in our cohort.

Clinical Symptoms and Psychological Stress

Postprandial fullness (85.71%) and early satiety (77.14%) were the most common symptoms in our cohort, closely mirroring the symptom profile reported by Lacy BE et al.,.[14] However, the significant association between psychological stress and DGE in our study ($p<0.01$) emphasizes the interplay between gut motility and the brain-gut axis, which is increasingly recognized in recent literature.[15] The prevalence of moderate-to-high stress levels (74.29%) among our patients underscores the need for integrated psychological assessments in FD management.

Dietary Patterns and Lifestyle Factors

Our findings on the significant association between irregular meal timings, low fiber intake, and delayed gastric emptying align with global research.[16] South Asian dietary patterns, characterized by high carbohydrate intake and frequent spicy meals, may further exacerbate symptoms. The high prevalence of sedentary lifestyles (68.57%) and underweight individuals (14.29%) in our cohort is consistent with findings by A similar study who emphasized the role of physical inactivity in worsening gastrointestinal motility disorders.

Laboratory Parameters and Helicobacter pylori

Elevated inflammatory markers (CRP: 62.86%, ESR: 40%) and H. pylori positivity (48.57%) in our study indicate an underlying inflammatory component in DGE. These results are supported by Harer *et al*., who reported similar associations in H. pylori-endemic regions.[17] Interestingly, studies from non-endemic areas, such as North America, have shown lower CRP levels in FD patients.[18-34] These discrepancies highlight the role of regional factors and genetic predispositions in influencing inflammatory responses.

Significance of Results

Our study's findings underscore the multifactorial nature of delayed gastric emptying in functional dyspepsia. The significant associations between psychological stress, dietary habits, and inflammation with DGE provide valuable insights for personalized treatment strategies. For instance, addressing psychological stress through cognitive behavioral therapy or pharmacological interventions targeting the gut-brain axis may improve patient outcomes.[19]

Implications of Research Findings

The alignment of our findings with existing literature validates the robustness of our methodology and highlights the relevance of studying FD in a South Asian context. Moreover, the observed differences in prevalence and symptomatology compared to Western populations emphasize the need for region-specific guidelines in diagnosing and managing FD. The practical significance of our study lies in its potential to inform integrated care models that combine dietary modifications, psychological support, and pharmacotherapy to address the complex interplay of factors underlying DGE.

Future Directions and Limitations

While our study provides valuable insights, the relatively small sample size (n=35) limits the generalizability of our findings. Larger, multicenter studies are needed to validate these results and explore the genetic and microbiome-related factors influencing DGE. Additionally, the lack of advanced motility testing, such as wireless motility capsules, restricts the depth of physiological assessment in our cohort. Future research should focus on integrating such tools to enhance diagnostic precision.

CONCLUSION

This study highlights the intricate interplay of demographic, clinical, psychological, dietary, and inflammatory factors in delayed gastric emptying among functional dyspepsia patients in a South Asian context. By comparing our findings with global literature, we identify unique regional characteristics that underscore the importance of culturally tailored diagnostic and therapeutic approaches. These findings pave the way for future research to address the unmet needs of FD patients, ultimately improving quality of life and clinical outcomes.

Recommendations

Implement region-specific guidelines for diagnosing and managing functional dyspepsia with delayed gastric emptying.

Integrate psychological assessments and stress management into FD treatment protocols.

Promote dietary education emphasizing regular meal timings, high-fiber intake, and physical activity.

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