

THE ASSOCIATION BETWEEN SKIPPING BREAKFAST AND GASTROINTESTINAL SYMPTOMS IN ADULTS: A SCOPING REVIEW

Louisa Chiara Citra Halim¹, Dinda Satya Ranugraha¹, Azola Syafiq Dida¹, Kyarra Alifa Putrina Yardinal¹, Sharon Colfoort¹, Fadiya Asla Halilah², Georgius Moreno Abednego Purba¹, Sulthan Muhamad Muwafaquallah Nurhadi¹, Faza Ibadurrohman Nugraha¹, Khansa Mahira¹, Akhtarania Azizah Fazila Puteri¹, Taufik Hidayatullah¹, Yenni Zuhairini¹

¹Faculty of Medicine, Universitas Padjadjaran, Sumedang – Indonesia

²Faculty of Medicine, Universitas Indonesia, Depok – Indonesia

*corresponding author, contact: yenni@unpad.ac.id

Abstract :

Background: Skipping Breakfast (SB) is an irregular eating habit with a prevalence of 24% to 87% worldwide, emerging evidence suggests that SB may disrupt gut motility, alter gut microbiota, and influence hormonal balance, which can lead to gastrointestinal (GI) symptoms such as dyspepsia, constipation, and abdominal pain. This study aims to investigate the connection between SB and GI symptoms. **Method:** We used SB to define the habit of not eating before 11:00 AM at least three times per week, and was examined in this scoping review following PRISMA2020 guidelines. A systematic search across six databases (PubMed, Science Direct, Scopus, Wiley, ResearchGate, and ProQuest). Inclusion criteria comprised adult studies (2015–2025) on breakfast skipping and gastrointestinal symptoms. **Results:** Of 1,286 records screened, 8 met all criteria, with extracted data covering study characteristics, symptom types, and outcomes. SB is consistently linked to GI symptoms i.e: functional constipation, abdominal pain, bloating. Associations SB with heartburn, gastric acid reflux, diarrhea, and dyspepsia were observed but less consistent. SB is common among young adults, particularly medical students during exam periods, and is associated with increased stress and a higher risk of functional constipation. Reduced meal frequency in SB with dyspepsia may also reduce acid-suppressive therapy effectiveness. However, most studies were cross-sectional and Asian-based, limiting generalizability. **Conclusion:** Consistent evidence links SB with various gastrointestinal symptoms, suggesting a preventive role for regular morning meals, though further research is needed to confirm causality and clarify underlying mechanisms.

Keywords: *abdominal pain, constipation, dyspepsia, gastrointestinal symptoms, skipping breakfast*

Introduction

Skipping breakfast refers to the habit of not consuming any food or drink before 11:00 a.m. during the week.¹ Skipping breakfast has become increasingly common,

especially among young adults, with reported prevalence ranging from 24% to 87%. Breakfast is consistently identified as the most frequently omitted meal compared to lunch or dinner across various age groups. The growing prevalence of skipping

breakfast reflects substantial shifts in meal timing patterns that may have implications for overall health.²

Concurrently, a large multinational study revealed that over 40% of the global population experiences Functional Gastrointestinal Disorders (FGID), a condition that significantly impacts quality of life and increases the burden on healthcare systems.³ FGIDs are a group of conditions characterised by chronic gastrointestinal symptoms including abdominal pain, difficulty swallowing, dyspepsia, diarrhea, constipation, and bloating, without any structural abnormalities detected through conventional medical examinations. These disorders are highly prevalent and are increasingly recognized as being influenced by lifestyle and dietary behaviors.⁴

Irregular eating patterns have been proposed as a potential contributor to gastrointestinal symptoms. In particular, breakfast skipping may influence gastrointestinal physiology through several interconnected pathways. Altered meal timing may disrupt circadian regulation of gastrointestinal motility, attenuate the gastrocolic reflex, alter gut microbial composition, and affect the secretion of hormones such as ghrelin and motilin.⁵⁻⁷ These physiological changes may contribute to symptoms including bloating, constipation, dyspepsia, and abdominal discomfort. However, findings across studies remain inconsistent. Variations in the definition of breakfast skipping, differences

in symptom assessment methods, heterogeneous study populations, and diverse methodological designs complicate interpretation and limit comparability of results.

Despite growing research interest, the literature examining the relationship between skipping breakfast and gastrointestinal symptoms remains fragmented. Studies differ considerably in exposure definitions, outcome measures, conceptual frameworks, and no synthesis has systematically mapped the scope, characteristics, and proposed mechanisms of this association in adult populations.

Given the breadth of the topic and the heterogeneity in exposure definitions, outcome measurements, and study designs, conducting a systematic review or meta-analysis aimed at estimating pooled effects would be premature. Instead, a scoping review methodology is appropriate, as outlined by the Joanna Briggs Institute and the framework proposed by Arksey and O'Malley. This approach is particularly suited to complex areas where concepts are variably defined and study designs are diverse, enabling systematic mapping of existing evidence, clarification of key concepts, and identification of research gaps to better understand the current state of knowledge and guide future research.

The aim of this scoping review is to systematically map and summarize the available evidence regarding the association

between skipping breakfast and gastrointestinal symptoms in adults. Specifically, it addresses the following question: What evidence exists regarding the relationship between breakfast skipping and gastrointestinal symptoms in adults? This review also seeks to clarify how breakfast skipping has been defined and measured, which gastrointestinal outcomes have been examined, and what biological or behavioral mechanisms have been proposed to explain this association.

Method

Methodology

This scoping review was conducted to systematically map the available evidence regarding the association between skipping breakfast and gastrointestinal (GI) symptoms in adult populations. The methodological framework will follow the guidance of the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis. The findings will be reported in accordance with the PRISMA Extension for Scoping Reviews (PRISMA-ScR), published in 2018.⁸

Search Strategy

A comprehensive literature search was conducted across the following electronic bibliographic databases: PubMed, Scopus, ScienceDirect, Wiley Online Library, and ProQuest. These databases were selected to

ensure broad multidisciplinary coverage of biomedical, clinical, nutritional, and public health literature. PubMed and Scopus were included because of their extensive indexing of peer-reviewed biomedical research, while ScienceDirect and Wiley Online Library were used to capture full-text journal articles in nutrition and gastroenterology. ProQuest was included to enhance retrieval of public health and allied health literature. ResearchGate was used solely as a supplementary source to identify potentially relevant articles not indexed in the primary databases and was not treated as a structured bibliographic database. The final search across all databases was conducted on 4 June 2025.

The search strategy combined Medical Subject Headings (MeSH) and free-text keywords related to breakfast skipping and gastrointestinal symptoms using Boolean operators (AND, OR). The complete electronic search strategies for all databases, including applied filters and the number of records retrieved, are presented in Table 1 (appendix).

Eligibility Criteria

Eligibility criteria were defined using the PCC (Population–Concept–Context) framework. The population included adults aged 18 years and older. The concept focused

on skipping breakfast or breakfast omission and its association with gastrointestinal (GI) symptoms. The context encompassed both community and clinical settings without geographic restriction.

The inclusion criteria were: (1) adult participants (≥ 18 years); (2) assessment of skipping breakfast or breakfast omission as an exposure variable; (3) original research study designs, including randomized controlled trials, cohort, case-control, or cross-sectional studies; (4) reporting gastrointestinal outcomes such as dyspepsia, heartburn, diarrhea, constipation, or abdominal pain; and (5) publication between 2015 and 2025.

The exclusion criteria were: (1) studies not available in full text; (2) non-human (animal) studies; (3) studies published in languages other than English; (4) studies focusing exclusively on pediatric populations; and (5) publications classified as case reports, case series, reviews, editorials, or conference abstracts. The restriction to English-language publications and the 10-year publication range was applied to ensure feasibility and to reflect contemporary dietary behavior patterns.

Risk of Bias Assessment

The study selection followed the PRISMA-ScR guidelines. A total of twelve reviewers were involved in the screening process. To ensure methodological consistency, all reviewers received standardized training

prior to screening, including detailed instructions on the PCC framework and predefined inclusion and exclusion criteria. A pilot calibration exercise was conducted on a subset of randomly selected articles to harmonize interpretation and ensure consistent application of eligibility criteria across reviewers.

For the main screening process, the twelve reviewers were organized into six independent screening pairs. Each pair was assigned to specific databases to ensure balanced workload distribution across all information sources. Within each pair, two reviewers independently screened titles and abstracts of the retrieved records according to the predefined eligibility criteria. Articles considered potentially eligible by either reviewer were advanced to full-text assessment. Full-text screening was also conducted independently within each screening pair. Discrepancies at either the title/abstract or full-text stage were first resolved through discussion between the two reviewers. If consensus could not be reached, a designated third senior reviewer acted as an adjudicator to resolve the disagreement and make the final decision.

The study identification process involved predefined keywords and database filters, followed by duplicate removal prior to screening. Full-text articles were excluded if they contained substantial confounding factors, unclear definitions of gastrointestinal

symptoms, or insufficient reporting of gastrointestinal outcomes. Only studies meeting all predefined eligibility criteria were included in the final synthesis. The complete study selection process is illustrated in Figure 1.

Data extracted from eligible studies included: (1) author; (2) year of publication; (3) study population and design; (4) definition of breakfast skipping; (5) method of breakfast assessment; (6) prevalence of breakfast

skipping; (7) gastrointestinal symptoms assessed; and (8) main findings. Extracted data were reviewed and summarized descriptively.

Study Registration

This review was not prospectively registered, as formal registration is not mandatory for scoping reviews.

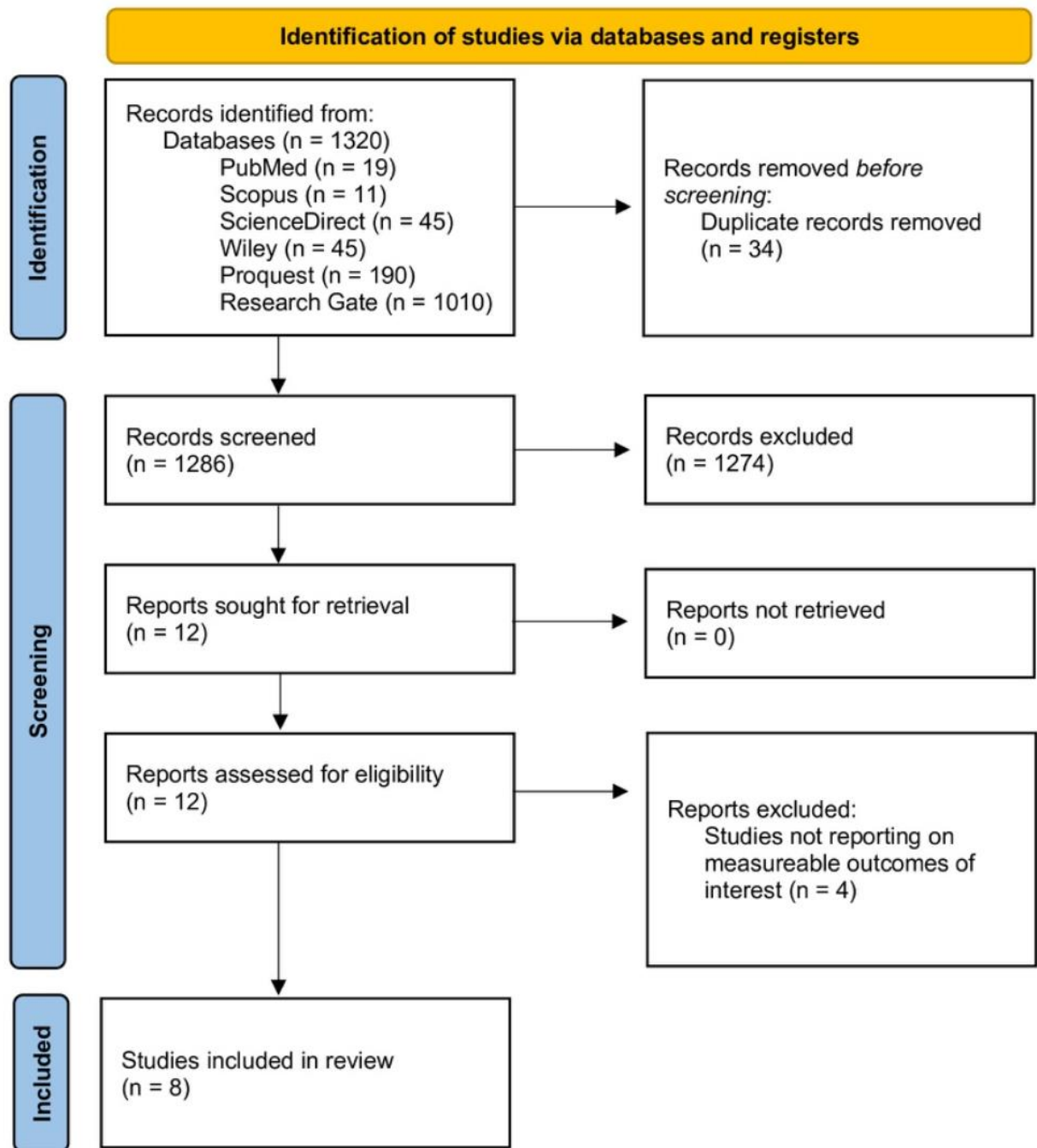


Figure 1. PRISMA Flowchart

Results

Quality Assessment

The quality assessment of the included articles was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, which consist of eight standardised questions designed to evaluate the methodological quality of a study and

identify potential sources of bias in its design, conduct, and analysis. The assessment aimed to determine the extent to which each study adequately addressed risks of bias and adhered to sound methodological principles. Eight reviewers independently carried out the appraisal, and any discrepancies were resolved through

discussion until consensus was reached. Each item on the appraisal checklist was rated as ‘Yes’, ‘No’, or ‘Unclear’. No article was excluded from the quality

assessment. A detailed summary of the quality assessments is presented in **Table 1.** and **Table 2**

| Questions | |
|-----------|--------------------------------------------------------------------------|
| Q1 | Were the criteria for inclusion in the sample clearly defined? |
| Q2 | Were the study subjects and the setting described in detail? |
| Q3 | Was the exposure measured in a valid and reliable way? |
| Q4 | Were objective, standard criteria used for measurement of the condition? |
| Q5 | Were confounding factors identified? |
| Q6 | Were strategies to deal with confounding factors stated |
| Q7 | Were the outcomes measured in a valid and reliable way? |
| Q8 | Was appropriate statistical analysis used? |

Note: JBI, Joanna Briggs Institute

Table 1. Critical Appraisal Questions from the JBI Critical Appraisal Tools

| Author & Year | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 |
|-------------------------|-----|-----|---------|-----|---------|-----|---------|-----|
| Chandkai et al, 2023 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Alireza et al, 2023 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Gunasinghe et al, 2020 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Alduraywish et al, 2023 | Yes | Yes | Yes | Yes | Unclear | No | Yes | Yes |
| Yamamoto S et al, 2022 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Yamamoto Y et al, 2022 | Yes | Yes | Unclear | Yes | Yes | Yes | Unclear | Yes |
| Matsumoto Y et al, 2022 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Ji-Hao Xu et al, 2017 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Table 2. Risk of Bias from Studies Used in the Review



Study Characteristics

Based on the scoping review, a total of Eight studies published between 2015 and 2025 were included in this review. The studies were conducted in Indonesia, Saudi Arabia, China, Japan, Iran, Pakistan, and Sri Lanka. Most used cross-sectional observational designs. Participants were predominantly university students, particularly from health-related faculties. Inclusion criteria generally involved students aged ≥ 18 years who were actively enrolled, while common exclusion criteria included incomplete data or non-consent. The primary focus of the studies was the prevalence of breakfast skipping and its association with GI symptoms, including constipation, abdominal pain, bloating, dyspepsia, diarrhea, and symptoms consistent with gastro-oesophageal reflux disease (GORD). A summary of study characteristics is presented in **Table 3**.

The Association Between Skipping Breakfast and Functional Constipation

Several studies reported an association between breakfast skipping and functional constipation (FC). Yamamoto et al. (2022) identified a link between skipping breakfast and constipation.⁹ According to research by Alduraywish et al. (2023), 66% of medical students skipped breakfast during exam periods, and constipation symptoms were more frequently reported in this group.¹⁰

Matsumoto et al. (2022), defining breakfast skipping as omitting breakfast ≥ 3 times per week, found associations with constipation as well as chronic diarrhea.¹¹ However, definitions of breakfast skipping and constipation varied across studies.

The Association Between Skipping Breakfast and Abdominal Pain

Xu et al. (2017) reported a significant association between breakfast skipping and functional dyspepsia (FD), which includes upper abdominal pain and postprandial discomfort.¹² Similarly, Yamamoto et al. (2022) found that students who skipped breakfast more frequently reported symptoms consistent with FD, including early satiety and postprandial fullness.¹³ Both studies were cross-sectional in design.

The Association Between Skipping Breakfast and Abdominal Bloating

Matsumoto et al. (2022) reported that skipping breakfast at least twice per week was associated with higher prevalence of bloating and diarrhea.¹¹ Xu et al. (2017) also observed that irregular breakfast habits were associated with bloating symptoms.¹² Measurement of bloating was based on self-reported questionnaires in both studies.

The Association Between Skipping Breakfast and Heartburn Syndrome

Irregular eating habits, particularly skipping breakfast, have been linked to a higher risk of heartburn syndrome, a common manifestation of GORD. Milajerdi et al. (2021) found that regular breakfast consumption was associated with lower odds of heartburn symptoms after adjustment for lifestyle variables.¹⁴ Similarly, Gunasinghe et al. (2020) reported that 61% of students skipping breakfast more than three times weekly experienced GORD symptoms, compared to 43% of regular breakfast eaters.¹⁴ Supporting these findings, Chandkai et al. (2023) similarly observed a higher frequency of heartburn among individuals whose first daily meal was delayed until brunch.¹

The Association Between Skipping Breakfast and Functional Dyspepsia

Yamamoto et al. (2022) reported that students with functional dyspepsia were more likely to skip breakfast and/or lunch. The study focused on meal frequency rather than food type.¹³ In a community-based cross-sectional study in China, Xu et al. (2017) reported a functional dyspepsia prevalence of 15.57%.¹² Breakfast skipping was significantly associated with FD and its subtypes, epigastric pain syndrome (EPS) and postprandial distress syndrome (PDS),

according to Rome III criteria. Other factors associated with FD included irregular mealtimes and dietary habits.

Secondary Results

Additional GI symptoms were reported across studies. Yamamoto et al. (2022) and Alduraywish et al. (2023) described constipation-related symptoms including straining, hard stools, incomplete evacuation, anorectal discomfort, and reduced bowel frequency.⁹⁻¹⁰ Gunasinghe et al. (2020) reported bloating, early satiety, and nausea among students with dyspeptic symptoms.¹⁴ Xu et al. (2017) described upper abdominal pain accompanied by postprandial fullness and early satiation.¹² Heartburn and regurgitation were reported in multiple studies assessing GORD symptoms. Across studies, symptom assessment was primarily based on self-reported questionnaires, and diagnostic criteria were not uniformly applied.

Table 3. Characteristics of Included Studies

| Reference (Author, Year) | Study Subject and Methods | Skipping Breakfast Definition | Breakfast Evaluation Method | Prevalence of Breakfast Skippers | The Symptoms Measured | Results |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yamamoto S et al, 2022 ⁹ | Yamamoto S et al., 2022 N = 1000, age 20–69 years, Japan. Cross-sectional study, online self-reported questionnaire, no direct physical measurements (height and weight self-reported). | No specific definition; considered skipping breakfast ≥ 3 times per week | Self reported internet survey | 26.3% of individuals with functional constipation (FC) and 26.1% of non-FC individuals reported skipping breakfast ≥ 3 times per week | Gastrointestinal symptoms assessed with Rome III criteria for functional constipation: straining, hard stools, incomplete evacuation, anorectal obstruction, manual maneuvers, and bowel frequency | Skipping breakfast associated with more severe constipation, insufficient sleep, and frequent laxative use compared to those without FC |
| Gunasinghe et al, 2020 ¹⁵ | N = 1114, aged ≥ 18 years, Sri Lanka. Cross-sectional study, paper-based self-administered questionnaire, distributed in tuition centers. | Frequent lack of breakfast (≥ 3 times per week) | Self-reported question as part of lifestyle survey (method not detailed) | 562 of 1114 students (50.4%) frequently skipped breakfast | Gastrointestinal symptoms assessed using Frequency Scale for Symptoms of GORD (FSSG): reflux (heartburn, regurgitation, burping, throat burning) and dysmotility (bloating, satiety, nausea, food sticking). | 61% of students who skipped breakfast ≥ 3 times/week had GORD symptoms, compared with 43% of non-skippers |
| Alduraywish S et al, 2023 ¹⁰ | N = 297, medical students across all study years, Saudi Arabia. Stratified random sampling, self-administered questionnaire on stress, eating habits, and bowel symptoms. | No specified definition of skipping breakfast S tructured questionna | Structured questionnaire (3 sections: stress, eating habits, bowel symptoms) | The study 66% reported not eating breakfast daily | Abdominal pain, bloating, discomfort, rectal burning/pain, straining, incomplete evacuation, hard stools, reduced bowel frequency | PooSkipping breakfast associated with poor dietary habits, frequent unhealthy snacks (69%), reduced fruit intake, and higher stress levels ($p = 0.007$) |

| | | | | | | |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | ire (3 sections: stress, eating habits, bowel symptoms) | | | | |
| Chandkai VK et al, 2023 ¹ | N=390, Adults aged 18–50 with dyspeptic symptoms ≥2 months, Cross-sectional study Exclusion criteria: Alcohol use, smoking, GI-altering medications, systemic diseases | Breakfast was defined as any food or beverage consumed before 11:00 a.m. regularly in a week. | Self-reported using structured questionnaire on timing of first meal, Group classification: Breakfast group: consumed before 11:00 a.m. regularly Brunch group: delayed first meal (after 11:00 a.m.) | 15.6% of total participants skipped breakfast and instead had brunch, Males: 16.5% Females:14.7% | Included four major upper gastrointestinal symptoms: indigestion, heartburn, regurgitation, and nausea. These symptoms were assessed using the Short-Form Leeds Dyspepsia Questionnaire (SF-LDQ), with a cutoff score of ≥4 indicating clinically significant dyspepsia. | Prevalence of dyspepsia (SF-LDQ score ≥4): 75.1% Brunch group had: Significantly higher dyspeptic symptoms: Indigestion (p=0.025) Heartburn (p=0.003) Regurgitation (p<0.001) Nausea (p<0.001) Multivariable regression showed: Regular breakfast significantly reduced odds of dyspepsia: aOR = 0.10 (95% CI: 0.04–0.28) |
| Milajerdi A et al, 2020 ¹⁴ | N= 4763 adults, Cross-sectional study within the SEPAHAN project; data collected via two-phase self-administered questionnaires: Phase | Based on frequency per week: “never or 1 day/week” considered | One self-administered question: “How frequently do you eat breakfast during a week?” with 4 response | 32.4% of participants reported skipping breakfast (never or only 1 day/week) Others: 16.1% reported 2–4 | Heartburn Syndrome (HBS): Defined as experiencing reflux attack sometimes, often, or always and evaluated using the validated Persian version of the ROME III questionnaire | HBS prevalence was higher in breakfast skippers, compared to daily breakfast eaters, the odds ratio (OR) of HBS was: OR = 1.28 (2–4 days/week) → Not significant |

| | | | | | | |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>1 (demographics, lifestyle, nutrition), Phase 2 (GI symptoms), modified ROME III questionnaire used to assess heartburn Syndrome</p> | <p>breakfast skipping</p> | <p>options: never/1 day, 2–4 days, 5–6 days, every day</p> | <p>days/week 18.7% reported 5–6 days/week 32.7% reported daily breakfast</p> | | <p>OR = 1.32 (5–6 days/week) → Not significant OR = 1.76 (never/1 day) → Significant (p < 0.05) After adjusting for confounders: Skipping breakfast daily was associated with 43% higher odds of HBS OR = 0.57 (95% CI: 0.41–0.80) → Protective effect of daily breakfast</p> |
| <p>Yamamoto Y et al, 2022¹³</p> | <p>N= 8913, Cross-sectional study conducted between 2015–2017 among students at Ehime University, Japan. Out of 10,104 screened, 8,913 were eligible after excluding participants with organic GI disease, regular NSAID/steroid use, or severe symptoms. Functional dyspepsia (FD) was diagnosed</p> | <p>Participants were classified as breakfast skippers if they did not select “breakfast” in response to the question: “Which meals do you</p> | <p>A self-administered online questionnaire asking participants to choose meals they usually eat (breakfast, lunch, dinner, snacks, midnight snacks). Meal frequency was also assessed (1, 2, or 3 meals per day)</p> | <p>24.2% of participants skipped breakfast (only 6,475 of 8,913 ate breakfast regularly = 75.8%).</p> | <p>Functional Dyspepsia (FD), defined according to Rome III criteria: symptoms in the past 6 months including postprandial fullness, early satiety, epigastric pain, and heartburn, without structural disease.</p> | <p>Participants who skipped breakfast had a significantly higher risk of functional dyspepsia. Adjusted Odds Ratio (aOR): 1.60, this means they were 60% more likely to develop FD than those who ate breakfast.</p> |

| | | | | | | |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | based on the Rome III criteria. Self-administered online questionnaires were used. Data analyzed using multiple logistic regression. | usually eat?" | | | | |
| Matsumoto Y et al, 2022 ¹¹ | 9,540 adults (out of 13,668) undergoing health checkups at MedCity21, Japan. cross-sectional study using self-administered questionnaires. | Skipping breakfast ≥ 3 times per week | Self-reported lifestyle questionnaire during medical checkup | 25.3% among diarrhea group vs 14.1% in non-diarrhea group | Gastrointestinal: heartburn, nausea, stomach ache, abdominal bloating/distension; Psychological: stress, fatigue, depression | Skipping breakfast ≥ 3 times/week was independently associated with increased risk of chronic diarrhea (OR: 1.49, CI: 1.12–1.98, $p = 0.006$). Chronic diarrhea was significantly linked with heartburn ($p = 0.030$), nausea ($p = 0.007$), stomach ache ($p < 0.001$), bloating/distension ($p < 0.001$), and stress ($p = 0.015$). Overall prevalence of chronic diarrhea was 3.0%, and more common in younger males, those with alcohol use ≥ 5 days/week, and poor sleep quality. |
| Xu JH et al, 2017 ¹² | 1,304 adult residents in Baotun, Dongguan, | Skipping breakfast | Self-reported frequency in | 19.7% in FD group vs 6.09% in control | Functional Dyspepsia (FD) symptoms per Rome III: upper abdominal pain, upper | Skipping breakfast was significantly associated with |

| | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|-------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| China. Cross-sectional community-based study with questionnaires, physical exams, lab tests, endoscopy, imaging, and Rome III diagnostic criteria for Functional Dyspepsia (FD). | defined as not having any food until after 11:00 AM, at least 3 times/week | dietary habits section of a validated questionnaire | group | abdominal burning, early satiation, postprandial fullness, regurgitation, nausea | FD ($p < 0.001$). Strong associations were found with FD subtypes: EPS (21.31%, $p < 0.001$), PDS (27.27%, $p < 0.001$). FD prevalence was 15.57%. Other co-factors included younger age, irregular mealtimes, dining out, fatty/sweet/spicy |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------|-------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Discussion

Several studies suggest that misalignment between eating patterns and circadian rhythms may influence GI function. Disruption of intestinal rhythmicity has been associated with alterations in motility, secretion, and hormone regulation. Although the specific impact of breakfast skipping remains limited in the literature, irregular meal timing, including omission of the morning meal has been associated with disturbances in GI regulation. Therefore, breakfast skipping may represent a behavioral pattern potentially linked to altered GI function.¹⁶

The GI tract contains peripheral clocks regulated by core clock genes such as Clock, Bmal1, Per, and Cry. Meal timing acts as an important zeitgeber for these peripheral clocks. Altered meal timing has been shown to modify clock gene expression and colonic motility patterns in experimental models. Misalignment between peripheral clocks and the central clock in the suprachiasmatic nucleus may affect coordination of GI processes. Within this framework, breakfast omission could contribute to circadian misalignment. However, current human evidence remains limited and largely observational.¹⁷

Morning food intake normally stimulates the gastrocolic reflex, promoting colonic contractions and supporting bowel movements. In the absence of this stimulus, colonic transit time may be prolonged. Prospective studies in adolescents have reported an association between breakfast skipping and increased risk of constipation. Nevertheless, most available studies are observational, and causal inference cannot be established.^{5,18}

Stress and sleep disturbances may also act as confounding factors. Activation of the hypothalamic–pituitary–adrenal axis and autonomic nervous system has been associated with changes in gut motility and permeability. These mechanisms are frequently discussed in relation to functional GI disorders, but their specific interaction with breakfast omission has not been clearly established.^{20–22}

Breakfast skipping is prevalent among university students, including medical students. Studies conducted in Ghana, Saudi Arabia, and multinational student populations report prevalence ranging from approximately 40% to over 70%.^{23–25} Reported contributing factors include academic workload, irregular sleep patterns, and limited morning time.^{26–27} Poor sleep quality has also been associated with

breakfast skipping behavior.^{28–30} These lifestyle factors should be considered when interpreting associations.

In children and adolescents, systematic reviews consistently report an association between breakfast skipping and overweight or obesity.^{30–31} However, these findings primarily address metabolic outcomes rather than GI symptoms and are largely based on cross-sectional data.

Overall, the available evidence suggests an association between breakfast skipping and various GI symptoms. However, given the predominance of cross-sectional designs and heterogeneous definitions of both breakfast skipping and GI outcomes, conclusions should be interpreted cautiously.

From a clinical perspective, although causality cannot be established, clinicians should be aware that irregular meal patterns may coexist with GI complaints in young adults. Addressing lifestyle factors such as meal timing, sleep hygiene, and stress management may be relevant components of symptom management. However, interventional evidence remains limited.

Limitations

This review has several limitations. First, all included studies were conducted in Asian populations, which limits generalizability to other regions. Second, most included studies used cross-sectional designs, restricting the ability to determine temporal or causal

relationships. Third, substantial heterogeneity was observed in the operational definitions of breakfast skipping and in the measurement of GI symptoms. Some studies relied on self-reported frequency measures without standardized diagnostic criteria, increasing the risk of measurement bias.

Additionally, potential confounding factors, such as sleep quality, psychological stress, dietary composition, physical activity, and underlying GI conditions were not consistently adjusted for across studies. These sources of residual confounding may partially explain the observed associations. Finally, the study populations were predominantly young adults, particularly university students, limiting applicability to middle-aged and older populations.

Conclusions and Recommendation

In conclusion, this scoping review identified eight studies examining the association between breakfast skipping and gastrointestinal symptoms in adults. The findings indicate that breakfast skipping is associated with symptoms such as functional constipation, abdominal pain, bloating, heartburn, diarrhea, and functional dyspepsia.

However, due to the predominance of cross-sectional evidence, heterogeneity in exposure and outcome definitions, and potential confounding bias, a causal relationship

cannot be established. Future longitudinal and interventional studies using standardized definitions of breakfast skipping and validated gastrointestinal assessment tools are needed. Research involving more diverse age groups and geographic populations would further strengthen the evidence base.

Acknowledgement

We would like to express our sincere gratitude to dr. Yenni Zuhairini, M.Gizi, Sp.GK, for her invaluable guidance, continuous support, and constructive feedback throughout the completion of this scoping review. Her expertise and encouragement greatly contributed to the quality of this work. We also thank all members of our research team for their dedication, cooperation, and collective effort during every stage of the study. Our appreciation also goes to the Faculty of Medicine, Universitas Padjadjaran, for providing academic resources and a conducive environment that supported the completion of this project.

Competing Interest

The authors declare that there are no competing interests related to the study.

List Of Abbreviations

EBM: Evidence-Based Medicine
EPS: Epigastric Pain Syndrome
FC: Functional Constipation
FD: Functional Dyspepsia
FGID: Functional Gastrointestinal Disorders
FSSG: Frequency Scale for Symptoms of GORD
GI: Gastrointestinal
GORD: Gastro-oesophageal Reflux Disease
HBS: Heartburn Syndrome
HPA: Hypothalamic-Pituitary Adrenal
JBI: Joanna Briggs Institute
PCC: Population, Concept, Context
PDS: Postprandial Distress Syndrome
PPIs: Proton Pump Inhibitors
RCTs: Randomized Controlled Trials
SB: Skipping Breakfast
SF-LDQ: Short-Form Leeds Dyspepsia Questionnaire

Authors' Contribution

LCCH – led the research project, collecting data, data analysis, and manuscript writing.
DST – collecting data, data analysis, and manuscript writing.
ASD – collecting data, data analysis, and manuscript writing.
KAPY – collecting data, data analysis, and manuscript writing.
SC – collecting data, data analysis, and manuscript writing.
FAH – collecting data, data analysis, and manuscript writing.

GMAP – collecting data, data analysis, and manuscript writing.

SMMN– collecting data, data analysis, and manuscript writing.

FIN – collecting data, data analysis, and manuscript writing.

KM – collecting data, data analysis, and manuscript writing.

AAFP – collecting data, data analysis, and manuscript writing.

TH – collecting data, data analysis, and manuscript writing.

YZ – data analysis and refining the writing.

References

1. Chandkai VK, Karim S, Khan. Correlation of Dyspepsia with the type of First Meal of the Day; Breakfast or Brunch: A Cross-Sectional Study from Karachi Pakistan. Liaquat Natl J Prim Care [Internet]. 2023 [cited 2025 Aug 28]; Available from: <https://journals.lnh.edu.pk/lnjpc/pdf/e077a3d5-1ef7-4d1b-85a0-cd5ceea3b066.pdf>
2. AK M. Skipping Breakfast Everyday Keeps Well-being Away. Journal of Food Science and Nutrition Research. 2018;01(01).
3. Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, Simren M, Tack J, et al. Worldwide Prevalence and Burden of Functional Gastrointestinal Disorders, Results of Rome Foundation Global Study. Gastroenterology. 2021 Jan;160(1):99-114.e3.
4. Fikree A, Byrne P. Management of functional gastrointestinal disorders. Clin Med. 2021 Jan;21(1):44–52.
5. Malone JC, Thavamani A. Physiology, Gastrocolic Reflex. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Aug 28]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK549888/>
6. Graf D, Di Cagno R, Fåk F, Flint HJ, Nyman M, Saarela M, et al. Contribution of diet to the composition of the human gut microbiota. Microb Ecol Health Dis [Internet]. 2015 Feb 4 [cited 2025 Aug 28];26(0). Available from: <http://www.microbecolhealthdis.net/index.php/mehd/article/view/26164>
7. Duboc H, Coffin B, Siproudhis L. Disruption of Circadian Rhythms and Gut Motility. Journal of Clinical Gastroenterology. 2020;54(5):405–14.
8. Tricco AC, Lillie E, Zarin W, O’Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Ann Intern Med. 2018 Oct 2;169(7):467–73.
9. Yamamoto S, Ohashi W, Yamaguchi Y, Inamoto S, Koshino A, Sugiyama T, et al. Background Factors Involved in the Epidemiology of Functional Constipation in the Japanese population: a cross-sectional Study. BioPsychoSocial Medicine. 2022 Mar 10;16(1).
10. Alduraywish S, Alburikan A, Alotaibi M, Alhamoudi A, Aldosari A, Alturki M, et al. Association between academic stress during exam period, dietary behavior and bowel symptoms among medical students in Saudi Arabia. Clin Epidemiol Glob Health. 2023 July;22:101318.
11. Matsumoto Y, Nadatani Y, Otani K, Higashimori A, Ominami M, Fukunaga S, et al. Prevalence and risk factor for chronic diarrhea in participants of a Japanese medical checkup. JGH Open. 2022 Jan;6(1):69–75.
12. Xu JH, Lai Y, Zhuang LP, Huang CZ, Li CQ, Chen QK, et al. Certain Dietary Habits Contribute to the Functional Dyspepsia in South China Rural Area. Med Sci Monit. 2017 Aug 15;23:3942–51.

13. Yamamoto Y, Furukawa S, Watanabe J, Kato A, Kusumoto K, Miyake T, et al. Association Between Eating Behavior, Frequency of Meals, and Functional Dyspepsia in Young Japanese Population. *J Neurogastroenterol Motil.* 2022 July 30;28(3):418–23.
14. Milajerdi A, Bagheri F, Mousavi SM, Hassanzadeh Keshteli A, Saneei P, Esmailzadeh A, et al. Breakfast skipping and prevalence of heartburn syndrome among Iranian adults. *Eat Weight Disord - Stud Anorex Bulim Obes.* 2021 Oct;26(7):2173–81.
15. Gunasinghe D, Gunawardhana C, Halahakoon S, Haneeka A, Hanim N, Hapuarachchi C, et al. Prevalence, associated factors and medication for symptoms related to gastroesophageal reflux disease among 1114 private-tuition students of Anuradhapura, Sri Lanka. *BMC Gastroenterol.* 2020 Dec;20(1):45.
16. Martchenko A, Martchenko SE, Biancolin AD, Brubaker PL. Circadian Rhythms and the Gastrointestinal Tract: Relationship to Metabolism and Gut Hormones. *Endocrinology.* 2020 Dec 1;161(12):bqaa167.
17. Hibberd TJ, Ramsay S, Spencer-Merris P, Dinning PG, Zagorodnyuk VP, Spencer NJ. Circadian rhythms in colonic function. *Front Physiol.* 2023 Aug 30;14:1239278.
18. Voigt RM, Forsyth CB, Keshavarzian A. Circadian rhythms: a regulator of gastrointestinal health and dysfunction. *Expert Rev Gastroenterol Hepatol.* 2019 May 4;13(5):411–24.
19. Yamada M, Sekine M, Tatsuse T, Fujimura Y. Lifestyle, psychological stress, and incidence of adolescent constipation: results from the Toyama birth cohort study. *BMC Public Health.* 2021 Jan 6;21(1):47.
20. De Palma G, Collins SM, Bercik P. The microbiota-gut-brain axis in functional gastrointestinal disorders. *Gut Microbes.* 2014 May;5(3):419–29.
21. Marwaha K, Cain R, Asmis K, Czaplinski K, Holland N, Mayer DCG, et al. Exploring the complex relationship between psychosocial stress and the gut microbiome: implications for inflammation and immune modulation. *J Appl Physiol.* 2025 Feb 1;138(2):518–35.
22. Charalambous EG, Mériaux SB, Guebels P, Muller CP, Leenen FAD, Elwenspoek MMC, et al. The oral microbiome is associated with HPA axis response to a psychosocial stressor. *Sci Rep.* 2024 July 9;14(1):15841.
23. Ackuaku-Dogbe E, Abaidoo B. Breakfast Eating Habits among Medical Students. *Ghana Med J.* 2014 Aug 25;48(2):66.
24. Mirghani HO, Albalawi KS, Alali OY, Albalawi WM, Albalawi KM, Aljohani TR, et al. Breakfast skipping, late dinner intake and chronotype (eveningness-morningness) among medical students in Tabuk City, Saudi Arabia. *Pan Afr Med J [Internet].* 2019 Dec 5 [cited 2025 Oct 28];34. Available from: <http://www.panafrican-med-journal.com/content/article/34/178/full/>
25. Pengpid S, Peltzer K. Prevalence and associated factors of skipping breakfast among university students from 28 countries: a cross-sectional study. *Int J Adolesc Med Health.* 2022 Apr 18;34(2):97–103.
26. Vaibhav S, Thomas S, Palki, Chaudhary N, Kalyani P, Rekha T, et



- al. IJCM_403A: Breakfast Skipping: Proportion and Awareness of its Effects Among Medical Students. *Indian J Community Med.* 2024 Apr;49(Suppl 1):S115–6.
27. Bhoopatkar H, Sharma S, Moir F, Nakatsuji M, Wearn A, Falloon K. Skipping Breakfast is Associated with Shorter Sleep Duration in Medical Students. *Int J Med Stud.* 2024 July 9;12(2):178–84.
28. Kim TW, Jeong JH, Hong SC. The Impact of Sleep and Circadian Disturbance on Hormones and Metabolism. *Int J Endocrinol.* 2015;2015:1–9.
29. Solangi SP, Channa NA, Awan AY, Mugheri MH, Soomro ZH, Noorani L. Does breakfast skipping alter the serum lipids of university students? *BMC Nutr.* 2025 Mar 7;11(1):51.
30. Minari TP, Manzano CF, Yugar LBT, Sedenho-Prado LG, De Azevedo Rubio T, Tácito LHB, et al. The effect of breakfast skipping and sleep disorders on glycemic control, cardiovascular risk, and weight loss in type 2 diabetes. *Clin Nutr ESPEN.* 2025 Feb;65:172–81.
31. Monzani A, Ricotti R, Caputo M, Solito A, Archero F, Bellone S, et al. A Systematic Review of the Association of Skipping Breakfast with Weight and Cardiometabolic Risk Factors in Children and Adolescents. What Should We Better Investigate in the Future? *Nutrients.* 2019 Feb 13;11(2):387.
32. Wang K, Niu Y, Lu Z, Duo B, Effah CY, Guan L. The effect of breakfast on childhood obesity: a systematic review and meta-analysis. *Front Nutr.* 2023 Sept 6;10:1222536.

Appendix

Table 1. Literature searching strategy

| Database | Search Strategy | Hits |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| PubMed | (“Adult”[MeSH Terms] OR adult*[Title/Abstract]) AND (“Breakfast”[MeSH Terms] OR “breakfast skipping”[Title/Abstract] OR “skipping breakfast”[Title/Abstract] OR “breakfast omission”[Title/Abstract]) AND (“Gastrointestinal Diseases”[MeSH Terms] OR dyspepsia[MeSH Terms] OR dyspepsia[Title/Abstract] OR heartburn[MeSH Terms] OR heartburn[Title/Abstract] OR diarrhea[MeSH Terms] OR diarrhea[Title/Abstract] OR constipation[MeSH Terms] OR constipation[Title/Abstract] OR “abdominal pain”[MeSH Terms] OR “abdominal pain”[Title/Abstract] OR stomachache[Title/Abstract]) Filters applied: Publication date (2015–2025); English language; Clinical trials and observational studies; Full-text availability | 19 |
| Scopus | TITLE-ABS-KEY (adult* AND (“skipping breakfast” OR “breakfast omission”) AND (dyspepsia OR heartburn OR diarrhea OR constipation OR abdominal pain)) Filters applied: Publication years (2015–2025); English language; Document type (Article); Open access | 11 |
| ScienceDirect | (“Skipping breakfast”) AND (Heartburn OR Dyspepsia OR Diarrhea OR Constipation OR Stomachache) Filters applied: Publication years (2015–2025); Open access and open archive | 45 |
| Wiley | (Adult) AND (“Skipping breakfast”) AND (Heartburn OR Dyspepsia OR Diarrhea OR Constipation OR Stomachache) Filters applied: Open-access journal articles; Publication years (2015–2025) | 45 |
| Proquest | (Adult) AND (“Skipping breakfast”) AND (Heartburn OR Dyspepsia OR Diarrhea OR Constipation OR Stomachache) Filters applied: Publication years (2015–2025); English language | 190 |
| Research Gate | (Adult) AND (“Skipping breakfast”) AND (Heartburn OR Dyspepsia OR Diarrhea OR Constipation OR Stomachache) | 1010 |

Filters applied: Publication years (2015–2025); English language; Sorted by relevance; Full-text availability
