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Annals of Clinical and Analytical Medicine
Original Research

Perceived stress as a significant predictor of gastrointestinal symptom severity in health sciences students

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Abstract

Aim: This study aimed to comprehensively evaluate the association between perceived stress and gastrointestinal (GI) symptoms among students of the Faculty of Health Sciences.

Methods: This cross-sectional study was conducted with 529 students enrolled at a public university in Istanbul, Türkiye. Data were collected using a survey methodology. Analyses were performed using IBM SPSS Statistics 24. Between-group comparisons were conducted using independent samples t-tests, one-way analysis of variance (ANOVA), and Tukey post hoc tests. Relationships and predictive effects between the scales were assessed via Pearson correlation and multiple linear regression analyses. Statistical significance was set at $P < .05$.

Results: The mean age of participants was 21.45 ± 3.17 years (range: 18-50), and 83% were female. The mean scores were 20.00 ± 5.60 for the Perceived Stress Scale (PSS) and 35.55 ± 15.64 for the Gastrointestinal Symptom Rating Scale (GSRS). A positive and significant correlation was observed between perceived stress and GI symptoms ($r = 0.263$, $P < .001$). The multiple linear regression model examining the predictive role of perceived stress on GI symptoms was statistically significant ($R^2 = 0.188$, $F = 5.506$, $P < .001$).

Conclusion: Each one-unit increase in stress was associated with an approximately 0.39-point increase in GI symptoms. Gender, self-rated health, and smoking status were also associated with GI symptom severity. Comprehensive programs targeting stress management, psychosocial support, and healthy lifestyle behaviors may help reduce GI symptoms in this population.

Keywords

perceived stress, gastrointestinal symptoms, health sciences, students

DOI: 10.4328/ACAM.50045 Ann Clin Anal Med 2026;17(11):1167-1171
Received: 21.01.2026 Accepted: 31.03.2026 Published Online: 03.04.2026 Printed: 01.11.2026
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Introduction

Stress is defined as the aggregate of physiological and psychological responses elicited when an organism is exposed to internal or external stressors, potentially leading to a disruption of homeostasis.[1] These responses exert pronounced effects on the gastrointestinal (GI) system, primarily mediated through neural, hormonal, and immune pathways.[2] The interaction between stress and the GI system is largely explained by multiple bidirectional communication pathways operating within the gut-brain axis.[3] Dysregulation of this axis may result in alterations in gastrointestinal motility, increased visceral hypersensitivity, disturbances in secretion, and enhanced intestinal permeability, thereby exacerbating symptom severity. Such mechanisms are considered central to the development and persistence of functional and chronic gastrointestinal disorders.[3,4]

Young adults, particularly university students, are frequently exposed to high levels of psychosocial stress due to academic demands, examinations, and concerns regarding future career prospects.[5] This stress exposure affects not only mental well-being but also various bodily systems. Functional gastrointestinal symptoms encompass a broad clinical spectrum, including abdominal pain, constipation, diarrhea, dyspepsia, and other dysmotility-related complaints. They are commonly observed in functional disorders such as Irritable Bowel Syndrome (IBS).[1] Experimental and clinical studies have demonstrated that chronic stress adversely influences intestinal motility, secretion, and visceral sensitivity, thereby contributing to the emergence and aggravation of GI symptoms.[6]

Previous studies have consistently shown that increasing levels of perceived stress are associated with a significant rise in symptom severity in IBS and related functional gastrointestinal disorders.[7,8] Despite these findings, studies that comprehensively evaluate the relationship between perceived stress and overall GI symptom burden, particularly using multivariable approaches, among students of the faculty of health sciences remain limited. This population constitutes a distinct subgroup with elevated psychosocial stress exposure due to intensive academic curricula and clinical training requirements, which may result in unique patterns of stress experiences and somatic symptomatology.[9] Therefore, the primary aim of the present study was to comprehensively assess the association between perceived stress and GI symptoms, using both total and subscale scores among health sciences students.

The original contribution of this study lies in its simultaneous examination of psychosocial stress alongside sociodemographic and lifestyle-related variables within a multiple regression framework, thereby providing a multidimensional explanation of GI symptomatology in the studied population. The findings are expected to contribute to a more nuanced understanding of the interaction between stress and gastrointestinal symptoms in young adults.

Materials and Methods

Participants

This cross-sectional study was conducted among students enrolled in the Faculty of Health Sciences at a public university in Istanbul, Türkiye (N ≈ 3,500). The sample size was calculated based on a 95% confidence level and a 5% margin of error. According to the sample size formula for a finite population, the minimum required sample size was determined to be 346 participants. Convenience sampling was employed, and the study was carried out in accordance with the ethical principles of the Declaration of Helsinki.

Data were collected between September and November 2025 from 529 students who voluntarily agreed to participate in the study. The final sample size exceeded the minimum calculated requirement.

Questionnaire

Data were collected using a structured questionnaire consisting of three sections.

Personal Information Form

The first section included 10 questions addressing participants' sociodemographic characteristics and lifestyle factors, such as gender, age, height, weight, academic year, perceived academic performance, general health status, family income level, healthy eating habits, and alcohol and cigarette use. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2).

Perceived Stress Scale (PSS)

PSS was developed by Cohen et al. in 1983 to measure the degree to which individuals perceive situations in their lives as stressful.[10] The Turkish adaptation of the scale was conducted by Celik Orucu and Demir in 2009.[11] The PSS has three versions consisting of 14, 10, and 4 items.[11] In the present study, the 10-item version of the PSS was used.

Each item is rated on a 5-point Likert-type scale ranging from 0 ("never") to 4 ("very often"). Four positively worded items are reverse-scored. Total scores range from 0 to 40, with higher scores indicating higher perceived stress levels.[10,11]

Gastrointestinal Symptom Rating Scale (GSRS)

GSRS was developed by Revicki et al. in 1998 to assess individuals' gastrointestinal symptoms experienced during the previous week.[12] The Turkish validity and reliability study was conducted by Turan et al. in 2017.[13]

The GSRS consists of 15 items grouped into five subscales: reflux (2 items), indigestion (4 items), diarrhea (3 items), constipation (3 items), and abdominal pain (3 items). Each item is rated on a 7-point Likert-type scale ranging from 1 ("no discomfort at all") to 7 ("very severe discomfort"). Total scores range from 15 to 105, with higher scores indicating greater severity of gastrointestinal symptoms.[12,13]

Ethical Approval

The study was approved by the Hamidiye Non-Interventional Scientific Research Ethics Committee, University of Health Sciences (Date: 11.09.2025, Decision No: 17/37).

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 24. Normality of the data distribution was assessed by examining skewness and kurtosis values. The skewness and kurtosis values for total scores of the PSS and GSRS were within the range of −1.5 to +1.5, indicating that the data were normally distributed. Internal consistency reliability of the scales was evaluated using Cronbach's alpha coefficient. Differences in scale scores according to sociodemographic characteristics were analyzed using independent samples t-tests for two-group comparisons and one-way analysis of variance (ANOVA) for comparisons involving three or more groups. When a significant difference was detected in ANOVA, Tukey's post hoc test was applied to identify group differences. Pearson correlation analysis was performed to examine the relationships between PSS scores and GSRS total and subscale scores. The effects of perceived stress and statistically significant sociodemographic variables on GSRS total scores were evaluated using multiple linear regression analysis. Dummy coding was applied for categorical variables included in the regression model. A P value of <0.05 was considered statistically significant

in all analyses.

Reporting Guidelines

This study is reported in accordance with the STROBE guidelines.

Results

A total of 529 students were included in the study. The mean age of the participants was 21.45 ± 3.17 years (range: 18-50). The majority of the participants were female (83.0%) and aged between 21 and 23 years (52.6%). Most students had a normal body mass index (66.7%) and perceived their academic performance (72.2%) and general health status (55.4%) as moderate to good.

The score distributions of the PSS and the GSRS, including their subscales, are shown in Table 1. The total PSS score ranged from 2 to 36, with a mean value of 20.00 ± 5.60, demonstrating good internal consistency (Cronbach's α = 0.82). The GSRS total score ranged from 15 to 99, with a mean of 35.55 ± 15.64 (Cronbach's α = 0.89). Mean scores for GSRS subscales were as follows: diarrhea (5.47 ± 3.85), indigestion (10.70 ± 5.21), constipation (6.12 ± 4.23), abdominal pain (8.76 ± 4.34), and reflux (4.48 ± 2.91).

Table 1. Distribution of Participants' Scores on the PSS, the GSRS and Its Subscales

Scale	Min	Max	Mean ± SD	CA
PSS	2	36	20.00 ± 5.60	0.82
GSRS	15	99	35.55 ± 15.64	0.89
Diarrhea	3	21	5.47 ± 3.85	0.88
Indigestion	4	28	10.70 ± 5.21	0.77
Constipation	3	21	6.12 ± 4.23	0.86
Abdominal pain	3	21	8.76 ± 4.34	0.75
Reflux	2	14	4.48 ± 2.91	0.78

PSS, Perceived Stress Scale; GSRS, Gastrointestinal Symptom Rating Scale; SD, Standard deviation; CA, Cronbach's α- internal consistency coefficient

Associations between participants' sociodemographic characteristics and their PSS and GSRS scores were analyzed. Female participants exhibited significantly higher PSS (20.50 ± 5.52) and GSRS total scores (37.14 ± 15.69) compared with males (PSS: 17.55 ± 5.34; GSRS: 27.78 ± 12.89; $P < .001$). Participants aged 21-23 years showed higher scores on both measures compared with those aged 24 years and older. Additionally, third-year students demonstrated markedly higher stress and gastrointestinal symptom scores than students in other academic years ($P < .05$). Participants reporting poor general health had the highest PSS (25.86 ± 5.78) and GSRS total scores (47.33 ± 19.53), with post hoc analyses revealing significant differences between the poor health group and both the moderate and good health groups across all GSRS subscales ($P < .001$). Students with unhealthy dietary habits also exhibited significantly higher PSS (23.62 ± 5.91) and GSRS total scores (42.41 ± 16.67; $P < .001$), indicating an association between dietary patterns and both perceived stress and gastrointestinal symptom burden. Similarly, participants with low family income had higher scores compared with those in middle- and high-income groups ($P < .05$). Regarding substance use, occasional smokers demonstrated significantly higher GSRS total scores compared with non-smokers ($P = .034$), whereas alcohol consumption was not significantly associated with GSRS scores ($P > .05$).

The relationships between perceived stress and gastrointestinal symptoms were examined using Pearson correlation analysis. A positive and statistically significant correlation was found between perceived stress and the GSRS total score ($r = 0.263$, $P < .001$), indicating that higher levels of perceived stress are associated with greater severity of gastrointestinal symptoms. Significant positive correlations were also observed between perceived stress and all GSRS subscales. The strongest association was found for abdominal pain ($r = 0.272$), followed by constipation ($r = 0.214$) and indigestion ($r = 0.201$). Lower but still significant correlations were identified for diarrhea and reflux ($r = 0.144$; all $P < .001$). These findings suggest that perceived stress was associated with multiple gastrointestinal symptom domains.

To examine the predictive role of perceived stress on gastrointestinal symptoms, multiple linear regression analysis was performed. Perceived stress, age (continuous), gender, general health status, family income, smoking status, alcohol consumption, and academic year were entered into the model as independent variables, with categorical variables dummy-coded. The overall regression model was statistically significant ($R^2 = 0.188$, $F = 5.506$, $P < .001$), explaining 18.8% of the total variance in GSRS scores. Perceived stress emerged as a positive and significant predictor of gastrointestinal symptoms ($B = 0.394$, $\beta = 0.141$, $P = .002$), indicating that each one-point increase in PSS score corresponded to an approximate 0.39-point increase in GSRS total score.

Gender also contributed significantly to the model ($B = -8.197$, $\beta = -0.197$, $P < .001$), with male students reporting significantly lower gastrointestinal symptom scores compared with female students. General health status was identified as a strong predictor: students reporting poor general health had significantly higher GSRS scores than those reporting good general health ($B = 15.454$, $\beta = 0.164$, $P < .001$). Similarly, students with moderate general health also exhibited higher GSRS scores compared with the good health reference group ($B = 6.910$, $\beta = 0.218$, $P < .001$).

With respect to smoking behavior, occasional smoking was associated with higher GSRS scores compared with non-smoking ($B = 3.626$, $\beta = 0.085$, $P = .045$), whereas frequent smoking did not reach statistical significance ($P = .297$). Age showed a negative trend but did not achieve statistical significance ($B = -0.393$, $P = .076$). Family income, alcohol consumption, and academic year dummy variables were not significant predictors of gastrointestinal symptoms (all $P > .05$). Overall, these findings indicate that perceived stress and general health status are key factors associated with gastrointestinal symptom severity among health sciences students. In contrast, male gender and non-smoking status are associated with lower symptom levels. The detailed data are provided in Supplementary Tables 1-3.

Discussion

In the present study, perceived stress was positively associated with gastrointestinal symptom severity among health sciences students. These findings are consistent with previous studies reporting moderate to high perceived stress among university students and demonstrating that higher stress levels are associated with increased gastrointestinal complaints, including diarrhea, abdominal pain, and indigestion.[7,8,14] This evidence highlights that academic and psychosocial demands may be associated with psychological and gastrointestinal outcomes in this population.

A significant positive association between perceived stress and gastrointestinal symptoms was observed. Multiple regression analysis indicated that perceived stress scores were a significant

positive predictor of GSRS total scores. This finding aligns with prior research demonstrating the influence of stress on gastrointestinal functioning and symptom severity.[2,15,16] These effects are thought to be mediated via the gut-brain axis, involving complex interactions among neural, hormonal, and immune pathways.[17]

Gender emerged as a significant predictor of gastrointestinal symptom severity, with male participants reporting lower GSRS total scores than females. This result is consistent with epidemiological evidence indicating that women report higher symptom burden in IBS and other functional gastrointestinal disorders compared with men.[18,19] Literature suggests that women are more sensitive to stress-related gastrointestinal symptoms, potentially due to differences in autonomic nervous system functioning and hormonal regulation.[20]

General health status was another significant predictor of GSRS scores. Students with poor or moderate perceived health reported higher gastrointestinal symptom scores compared with those reporting good health. This finding corroborates previous studies demonstrating that individuals with lower self-rated health report more somatic complaints.[14,21] Self-perceived health may amplify the interaction between psychological stress and somatic symptom expression.

Regarding lifestyle factors, occasional smokers reported higher GSRS scores than non-smokers. Smoking has been identified as a lifestyle factor that can influence gastrointestinal function and act as a symptom trigger.[22] It may also interact with psychological stress to exacerbate gastrointestinal complaints.[23] Mechanistically, nicotine can alter gastrointestinal motility and disrupt gut microbiota, thereby increasing visceral sensitivity.[24] The lack of a significant association between frequent smoking and symptom severity suggests that this relationship may be more dependent on the nature of stress-gut interactions than on smoking dose per se.

Other variables that did not reach statistical significance in the model, including age, family income, alcohol consumption, and academic year, did not directly predict gastrointestinal symptoms. Nevertheless, the literature presents mixed findings. For example, some studies report that age may have a moderate effect on stress-related gastrointestinal symptoms, though these results are inconsistent and often explained in a psychosocial context.[8,25]

A major strength of this study is its comprehensive examination of the relationship between perceived stress and gastrointestinal symptoms while controlling for sociodemographic and lifestyle variables using multiple regression modeling. Moreover, the sample size exceeded the minimum calculated requirement.

Limitations

The cross-sectional design limits causal inference between perceived stress and gastrointestinal symptom severity. Data were based on self-reported measures and collected from a single institution, which may affect generalizability. Further longitudinal studies are required to confirm these findings.

Conclusion

In conclusion, perceived stress was identified as an independent and significant factor associated with the severity of gastrointestinal symptoms among health sciences students. In addition, gender, self-rated health, and smoking status were significantly associated with symptom burden. These results suggest that gastrointestinal complaints in university students cannot be fully explained by biological or behavioral factors alone; psychosocial stress and self-perceived health are associated with symptom severity. Accordingly, holistic interventions targeting stress management, psychosocial support, and healthy lifestyle behaviors may be considered in programs aimed at addressing gastrointestinal symptom severity in this population.

Declarations

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent

Written informed consent was obtained from all participants before inclusion in the study.

Data Availability

The datasets used and/or analyzed during the current study are not publicly available due to participant confidentiality, but are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare no conflict of interest.

Funding

None.

Author Contributions (CRediT Taxonomy)

Conceptualization: M.S.
Methodology: M.S., A.A.
Data curation: M.S., A.A.
Formal analysis: M.S., A.A.
Investigation: M.S., A.A.
Writing – original draft: M.S., A.A.
Writing – review & editing: M.S., A.A.
Visualization: M.S., A.A.
Supervision: M.S.

AI Usage Disclosure

The authors declare that no AI-assisted technologies were used.

Abbreviations

ANOVA: Analysis of variance
BMI: Body mass index
GI: Gastrointestinal
GSRS: Gastrointestinal symptom rating scale
IBS: Irritable bowel syndrome
PSS: Perceived stress scale
STROBE: Strengthening the reporting of observational studies in epidemiology
β: Standardized regression coefficient

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How to Cite

Meral Sozen, Ali Arslanoglu. Perceived stress as a significant predictor of gastrointestinal symptom severity in health sciences students. Ann Clin Anal Med 2026;17(11):1167-1171. doi:10.4328/ACAM.50045