

## ORIGINAL ARTICLE

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## Evaluation of pre-endoscopic anxiety and its relationship with gastric pathologies and bowel cleansing quality

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### Abstract

Pre-procedural anxiety may influence gastrointestinal symptom perception, bowel preparation quality, and overall endoscopic outcomes. We aimed to investigate the relationship between anxiety severity, gastric histopathological findings, and bowel preparation quality in patients undergoing endoscopic procedures. A total of 101 patients undergoing upper gastrointestinal endoscopy, colonoscopy, or combined procedures were included in this study. Anxiety levels were assessed using the Beck Anxiety Inventory (BAI) and categorized as minimal, mild, moderate, or severe. Bowel preparation quality was evaluated using the Boston Bowel Preparation Scale (BBPS). Histopathological findings from gastric biopsies were analyzed and compared with BAI scores. Demographic characteristics, prior endoscopy history, and the adequacy of pre-procedural information were also recorded. BBPS scores did not differ significantly according to demographic variables, type of endoscopic procedure, prior endoscopy history, or adequacy of information provided (all  $p > 0.05$ ). However, a statistically significant difference in BBPS scores was observed among anxiety severity groups ( $\chi^2 = 8.327$ ,  $p = 0.040$ ). Post hoc analysis demonstrated that patients with mild anxiety had significantly poorer bowel preparation compared with those with minimal anxiety ( $p = 0.024$ ) and severe anxiety ( $p = 0.015$ ). No significant differences were observed between the moderate anxiety group and other anxiety categories. Mean BBPS scores were 6.10 for minimal anxiety, 4.15 for mild anxiety, 6.67 for moderate anxiety, and 7.50 for severe anxiety. Anxiety severity showed a significant negative correlation with gastric inflammation scores, whereas no significant associations were found with other histopathological parameters. Mild anxiety was associated with significantly poorer bowel preparation quality, suggesting a non-linear relationship between anxiety severity and bowel cleansing adequacy. Identification and management of pre-procedural anxiety—particularly mild anxiety—may improve bowel preparation quality and overall procedural outcomes. Structured patient education and targeted anxiety-reduction strategies may enhance diagnostic accuracy and patient satisfaction. Further prospective studies are warranted to confirm these findings.

**Keywords:** Anxiety, endoscopy, bowel preparation, boston bowel preparation scale

### Introduction

Gastrointestinal (GI) disorders represent a major global health burden and encompass a wide range of symptoms, including bloating, heartburn, and other functional or structural complaints experienced by patients [1]. Gastroscopy and colonoscopy are essential endoscopic procedures widely used for the screening, diagnosis, and treatment of gastrointestinal diseases [2]. Although endoscopy is a routine and indispensable tool in modern gastroenterology, patients often harbor negative

perceptions and experience significant anxiety prior to the procedure [3].

Previous studies have demonstrated that anticipatory anxiety is common among patients undergoing gastrointestinal endoscopy [4]. Anxiety related to invasive medical procedures affects not only patients' psychological well-being but may also influence procedural efficacy and clinical outcomes [5]. Although endoscopic procedures are minimally invasive, they have been found to be associated with increased anxiety in patients [6].

### CITATION

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Studies have shown that inadequate bowel cleansing is more common in communities with low health literacy [7–8].

The success of colonoscopy is closely linked to the quality of bowel preparation. Evidence from diverse populations indicates that inadequate bowel cleansing remains a major limitation affecting diagnostic accuracy and procedural safety [9]. Effective bowel preparation is critical for optimal mucosal visualization and has a direct impact on adenoma detection rates and overall clinical outcomes [10]. Previous research has explored the influence of demographic and clinical factors—such as age, sex, body mass index, adherence to preparation protocols, and psychological status—on bowel preparation quality [11]. However, the relationship between anxiety severity and bowel cleansing quality remains insufficiently elucidated.

Gastritis is another prevalent and clinically important gastrointestinal condition [12]. Psychological stress and anxiety have been associated with various gastrointestinal disturbances and may contribute to the development or exacerbation of gastric inflammation, independent of other known risk factors [13]. Despite this association, limited data are available regarding the simultaneous evaluation of anxiety severity, gastric histopathological findings, and bowel preparation quality in patients undergoing endoscopic procedures.

In this study, we aimed to address these gaps by assessing pre-procedural anxiety levels using the Beck Anxiety Inventory (BAI) and examining their association with demographic characteristics, prior endoscopy experience, and the adequacy and duration of procedural information. More importantly, we sought to investigate the relationship between anxiety severity, gastric pathology findings, and bowel preparation quality. To our knowledge, this study is among the few that simultaneously evaluate anxiety levels, gastric histopathology, and bowel cleansing quality, thereby providing a more comprehensive perspective on the clinical implications of pre-procedural anxiety in endoscopic practice.

Material and Methods

Ethical approval for this study was obtained from the Zonguldak Bülent Ecevit University Local Ethics Committee (approval no: 2024/17, date: 02 October 2024). The study was conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice guidelines.

This prospective study included patients who presented to the Endoscopy Unit of Kastamonu Training and Research Hospital for endoscopic procedures between October 15, 2024, and December 15, 2024. All endoscopic procedures were performed under standardized moderate sedation. A combination of midazolam and propofol was used for sedation in all patients. Midazolam was administered as an initial bolus dose of 0.05 mg/kg, followed by a continuous infusion of 0.05 mg/kg/h, with dose titration as needed. Propofol was administered as a

bolus dose of 1 mg/kg, followed by a continuous infusion of 2.5 mg/kg/h, with further titration according to clinical response.

Pre-procedural anxiety levels were assessed using BAI , which was administered to all patients before the procedure (Table 1). The BAI consists of 21 items, each scored from 0 to 3, yielding a total score ranging from 0 to 63. Anxiety severity was categorized as follows: 0–7 points, minimal anxiety; 8–15 points, mild anxiety; 16–25 points, moderate anxiety; and ≥26 points, severe anxiety [14].

Table 1. Beck Anxiety Inventory [14]

| Sypmtoms                    | Not at all | Mildly, but it didn't bother me much | Moderately – it wasn't pleasant at times | Severely – it bothered me a lot |
|-----------------------------|------------|--------------------------------------|------------------------------------------|---------------------------------|
| Numbness or tingling        | 0          | 1                                    | 2                                        | 3                               |
| Feeling hot                 | 0          | 1                                    | 2                                        | 3                               |
| Wobbliness in legs          | 0          | 1                                    | 2                                        | 3                               |
| Unable to relax             | 0          | 1                                    | 2                                        | 3                               |
| Fear of the worst happening | 0          | 1                                    | 2                                        | 3                               |
| Dizzy or lightheaded        | 0          | 1                                    | 2                                        | 3                               |
| Heart pounding/racing       | 0          | 1                                    | 2                                        | 3                               |
| Unsteady                    | 0          | 1                                    | 2                                        | 3                               |
| Terrified or afraid         | 0          | 1                                    | 2                                        | 3                               |
| Nervous                     | 0          | 1                                    | 2                                        | 3                               |
| Feeling of choking          | 0          | 1                                    | 2                                        | 3                               |
| Hands trembling             | 0          | 1                                    | 2                                        | 3                               |
| Shaky/unsteady              | 0          | 1                                    | 2                                        | 3                               |
| Fear of losing control      | 0          | 1                                    | 2                                        | 3                               |
| Difficulty in breathing     | 0          | 1                                    | 2                                        | 3                               |
| Fear of dying               | 0          | 1                                    | 2                                        | 3                               |
| Scared                      | 0          | 1                                    | 2                                        | 3                               |
| Indigestion                 | 0          | 1                                    | 2                                        | 3                               |
| Faint/lightheaded           | 0          | 1                                    | 2                                        | 3                               |
| Face flushed                | 0          | 1                                    | 2                                        | 3                               |
| Hot/cold sweats             | 0          | 1                                    | 2                                        | 3                               |
| Column sum                  |            |                                      |                                          |                                 |

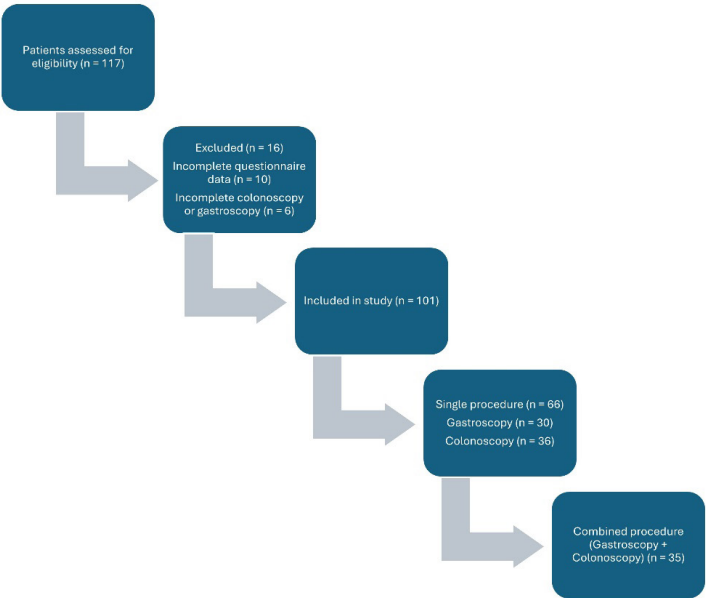
The questionnaire also collected demographic and clinical information, including age, comorbidities assessed using the Charlson Comorbidity Index, marital status (married, single, widowed), education level (no formal education, primary school, secondary school, high school, higher education), perceived economic status (low, medium, high), adequacy of pre-procedural information (sufficient/insufficient), adequacy of the duration of information provided (sufficient/insufficient), and prior history of endoscopy. All data were recorded in written form.

Bowel preparation quality was assessed during colonoscopy using the Boston Bowel Preparation Scale (BBPS). [15]. According to the BBPS, cleansing of the ascending, transverse, and descending colon segments was scored from 0 to 3, resulting in a total score ranging from 0 to 9.

Histopathological results were obtained from gastric biopsy specimens, and findings related to activity, chronic inflammation, intestinal metaplasia, and *Helicobacter pylori* infection were

recorded. Patients undergoing endoscopy for the direct diagnosis of malignancy, emergency procedures, those with speech disorders, bedridden patients, and patients with incomplete data were excluded from the study.

Patients with incomplete questionnaire data (n = 10) and those with incomplete colonoscopy or gastroscopy procedures (n = 5) were excluded. A total of 101 patients were included in the final analysis. The study flow diagram is presented in Figure 1.



**Figure 1.** Flow diagram of patient selection, exclusion criteria, and allocation to study groups

**Statistical Analysis**

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed using the Shapiro–Wilk and Kolmogorov–Smirnov tests. Variables with a normal distribution were analyzed using independent-samples *t* tests, whereas non-normally distributed variables were analyzed using the Kruskal–Wallis test. When a significant difference was detected, Dunn’s post hoc test was applied for pairwise comparisons.

Spearman’s rank correlation analysis was used to evaluate associations between continuous and ordinal variables.

A multivariable regression analysis was not performed due to the limited sample size and the unequal distribution of patients across anxiety severity subgroups, which would have increased the risk of model overfitting and reduced the reliability of the regression estimates—particularly in the moderate and severe anxiety groups. Therefore, univariate and non-parametric analyses were considered methodologically more appropriate for the present dataset.

All statistical tests were two-tailed, and a *p* value of <0.05 was considered statistically significant.

**Results**

Initially, 150 patients were included in the study. Patients with incomplete personal data or unanswered questions in the questionnaire were excluded, and the study was conducted with 101 patients. First, patients who underwent endoscopy were divided into 3 groups: Group 1: those who underwent gastroscopy (Group G) 30 patients (29.7%); Group 2: those who underwent colonoscopy (Group K) 36 patients (35.6%); and Group 3: those who underwent both gastroscopy and colonoscopy (Group G+K) 35 patients (34.7%). 33 (32.7%) of the patients were male and 68 (67.3%) were female (Table 2). The average age was higher in those who underwent both procedures compared to those who underwent colonoscopy, and was lowest in the gastroscopy group (*p* = 0.005).

When patients were asked whether they received pre-procedure information and whether the information given was sufficient, over 85% in all groups stated that they received information, and over 80% stated that the information given was sufficient. No statistically significant difference was found in terms of information provided between the procedures. 48.5% of patients stated that they had previously undergone an endoscopic procedure (Table 2).

**Table 2.** Distribution of demographic data and endoscopy information data among groups

| Variable                             |                | Group G (n = 30) | Group K (n = 36) | Group G+K (n = 35) | Total (N = 101) | p-value      |
|--------------------------------------|----------------|------------------|------------------|--------------------|-----------------|--------------|
| Age, Mean $\pm$ SD                   |                | 48.2 $\pm$ 16.4  | 57.2 $\pm$ 13.4  | 60.2 $\pm$ 10.0    | —               | <b>0.005</b> |
| Sex                                  | Male           | 10 (33.3%)       | 10 (27.8%)       | 13 (37.1%)         | 33 (32.7%)      | <b>0.702</b> |
|                                      | Female         | 20 (66.7%)       | 26 (72.2%)       | 22 (62.9%)         | 68 (67.3%)      |              |
| Marital status                       | Single         | 9 (30.0%)        | 4 (11.1%)        | 0 (0.0%)           | 13 (12.9%)      | <b>0.024</b> |
|                                      | Married        | 18 (60.0%)       | 27 (75.0%)       | 30 (85.7%)         | 75 (74.3%)      |              |
|                                      | Widowed        | 3 (10.0%)        | 5 (13.9%)        | 5 (14.3%)          | 13 (12.9%)      |              |
| Education level                      | None           | 0 (0.0%)         | 4 (11.1%)        | 1 (2.9%)           | 5 (5.0%)        | <b>0.650</b> |
|                                      | Primary school | 19 (63.3%)       | 20 (55.6%)       | 24 (68.6%)         | 63 (62.4%)      |              |
|                                      | High school    | 7 (23.3%)        | 7 (19.4%)        | 7 (20.0%)          | 21 (20.8%)      |              |
|                                      | University     | 4 (13.3%)        | 5 (13.9%)        | 3 (8.6%)           | 12 (11.9%)      |              |
| Economic status                      | Poor           | 7 (23.3%)        | 1 (2.8%)         | 3 (8.6%)           | 11 (10.9%)      | <b>0.022</b> |
|                                      | Moderate       | 16 (53.3%)       | 20 (55.6%)       | 26 (74.3%)         | 62 (61.4%)      |              |
|                                      | Good           | 7 (23.3%)        | 14 (38.9%)       | 5 (14.3%)          | 26 (25.7%)      |              |
|                                      | Very good      | 0 (0.0%)         | 1 (2.8%)         | 1 (2.9%)           | 2 (2.0%)        |              |
| Employment status                    | Employed       | 9 (30.0%)        | 7 (19.4%)        | 9 (25.7%)          | 25 (24.8%)      | <b>0.608</b> |
|                                      | Unemployed     | 21 (70.0%)       | 29 (80.6%)       | 26 (74.3%)         | 76 (75.2%)      |              |
| Was sufficient information provided? | Yes            | 26 (86.7%)       | 31 (86.1%)       | 33 (94.3%)         | 90 (89.1%)      | <b>0.480</b> |
|                                      | No             | 4 (13.3%)        | 5 (13.9%)        | 2 (5.7%)           | 11 (10.9%)      |              |
| Was information duration adequate?   | Yes            | 25 (83.3%)       | 31 (86.1%)       | 30 (85.7%)         | 86 (85.1%)      | <b>0.945</b> |
|                                      | No             | 5 (16.7%)        | 5 (13.9%)        | 5 (14.3%)          | 15 (14.9%)      |              |
| Previous endoscopy                   | Yes            | 12 (40.0%)       | 18 (50.0%)       | 19 (54.3%)         | 49 (48.5%)      | <b>0.508</b> |
|                                      | No             | 18 (60.0%)       | 18 (50.0%)       | 16 (45.7%)         | 52 (51.5%)      |              |

Although the mean BAI was higher in patients who reported not receiving or insufficient information, no statistically significant difference was found between endoscopy history ( $p = 0.968$ ), receiving or not receiving information ( $p = 0.355$ ), and information adequacy ( $p = 0.292$ ).

According to the Spearman correlation test, BAI were significantly higher in female patients than in male patients ( $p =$

0.000). No statistically significant correlation was found between anxiety level and age or comorbid diseases (Table 3).

A Spearman correlation test was performed between Beck score and gastric findings. There was no significant relationship between gastric activation, *H. pylori*, and intestinal metaplasia; however, a statistically significant negative correlation was found between gastric inflammation and Beck score ( $p = 0.010$ ) (Table 3).

**Table 3.** Correlation of data with the BAI

| Variable                          | Test           | Correlation coefficient (r) | p-value          | Interpretation                    |
|-----------------------------------|----------------|-----------------------------|------------------|-----------------------------------|
| Boston bowel preparation score    | Spearman's rho | -0.037                      | 0.759            | No significant correlation        |
| Gastric biopsy activity score     | Spearman's rho | -0.071                      | 0.575            | No significant correlation        |
| Gastric biopsy inflammation score | Spearman's rho | -0.318                      | <b>0.010</b>     | Significant, negative correlation |
| Intestinal metaplasia             | Spearman's rho | -0.104                      | 0.411            | No significant correlation        |
| <i>H. pylori</i> positivity       | Spearman's rho | -0.098                      | 0.438            | No significant correlation        |
| Age                               | Spearman's rho | -0.135                      | 0.178            | No significant correlation        |
| Sex (male = 1, female = 2)        | Spearman's rho | +0.370                      | <b>&lt;0.001</b> | Significant, positive correlation |
| Comorbidity level                 | Spearman's rho | +0.058                      | 0.562            | No significant correlation        |

BAI were statistically significantly higher in patients undergoing single-procedure surgery compared to those undergoing double-procedure surgery ( $p = 0.015$ ). No significant difference was found between those who underwent gastroscopy and those who underwent colonoscopy ( $p > 0.05$ ) (Table 4).

**Table 4.** Distribution of BAI according to different variables

| Variable                                 | Groups                     | Mean Beck score | SD    | n  | p-value |
|------------------------------------------|----------------------------|-----------------|-------|----|---------|
| Planned procedure                        | Gastroscopy                | 10.30           | 9.92  | 30 | 0.015   |
|                                          | Colonoscopy                | 8.17            | 10.57 | 36 |         |
|                                          | Single procedures combined | 9.13            | 10.25 | 66 |         |
|                                          | Double procedure           | 5.20            | 5.66  | 35 |         |
| Previous endoscopy                       | Yes                        | 7.73            | 9.57  | 49 | 0.968   |
|                                          | No                         | 7.81            | 8.72  | 52 |         |
| Was the information duration sufficient? | Yes                        | 7.37            | 8.90  | 86 | 0.348   |
|                                          | No                         | 10.07           | 10.17 | 15 |         |
| Was adequate information provided?       | Yes                        | 7.48            | 8.79  | 90 | 0.355   |
|                                          | No                         | 10.18           | 11.51 | 11 |         |

There is a negative correlation between the BAI and the BBPS; those with high anxiety levels have lower bowel cleansing, but this correlation is not statistically significant ( $p > 0.05$ ).

According to the BAI, scores between 0-7 were defined as minimal, 8-15 as mild, 16-25 as moderate, and 26-63 as severe. When comparing the groups, Kruskal-Wallis analysis showed a significant difference in bowel scores between Beck Anxiety groups ( $p = 0.040$ ). Dunn’s post-hoc analysis indicated that this difference was more pronounced between Minimal-Mild ( $p = 0.024$ ) and Mild-Severe ( $p = 0.015$ ) pairs (Table 5). However, there was no statistically significant difference in bowel cleansing scores based on the amount and duration of information provided regarding BBPS, nor was there a significant difference between men and women in bowel cleansing ( $p > 0.05$ ).

**Table 5.** Mean BBPS values of Beck Depression groups and intergroup differences

| Group               | N       | Mean ± SD   |
|---------------------|---------|-------------|
| Minimal             | 48      | 6.10 ± 2.29 |
| Mild                | 13      | 4.15 ± 2.88 |
| Moderate            | 6       | 6.67 ± 1.21 |
| Severe              | 4       | 7.50 ± 1.00 |
| Total               | 71      | 5.87 ± 2.42 |
| Comparison          | Z value | p-value     |
| Minimal vs Mild     | 2.26    | 0.024       |
| Minimal vs Moderate | 0.35    | 0.725       |
| Minimal vs Severe   | 1.32    | 0.188       |
| Mild vs Moderate    | 1.74    | 0.081       |
| Mild vs Severe      | 2.44    | 0.015       |
| Moderate vs Severe  | 0.83    | 0.409       |

Discussion

Pre-procedural anxiety is a common phenomenon among patients scheduled for endoscopic procedures and is frequently manifested as fear and worry before the intervention [16]. In our study, patients undergoing a single endoscopic procedure exhibited significantly higher anxiety levels than those undergoing combined (double) procedures ( $p = 0.015$ ). This finding contrasts with the results reported by Albayrak et al., who observed higher anxiety levels among patients scheduled for dual procedures [5]. This discrepancy may be explained by differences in patient populations, clinical settings, or pre-procedural counseling practices.

Among demographic factors, female sex was significantly associated with higher pre-procedural anxiety levels ( $p < 0.001$ ), a finding consistent with previous reports in the literature. Ünal et al. similarly demonstrated that female patients experience higher anxiety before upper gastrointestinal endoscopy [17]. In contrast, age, comorbidity burden, marital status, perceived economic status, and education level were not significantly associated with anxiety levels in our cohort.

Several studies have suggested that insufficient or inadequate pre-procedural information increases anxiety, whereas appropriate patient education may reduce stress levels [3,6]. In the present study, although patients who perceived the information provided—and its duration—as sufficient tended to have lower anxiety levels, this difference did not reach statistical significance. This may be attributable to the fact that all patients in our clinic routinely receive standardized information before endoscopy, potentially minimizing variability between groups. Similarly, prior experience with endoscopy did not significantly influence anxiety levels, suggesting that previous exposure alone may not be sufficient to reduce pre-procedural stress.

Adequate bowel cleansing is essential for effective colonoscopy and optimal detection of pathological findings. Identifying factors associated with poor bowel preparation is therefore crucial for improving procedural quality [18]. To our knowledge, this study is among the first to evaluate the relationship between anxiety severity and bowel cleansing quality as measured by the BBPS. We observed a statistically significant difference in BBPS scores among BAI groups ( $p = 0.040$ ). Notably, patients with mild anxiety had significantly poorer bowel preparation compared with those with minimal or severe anxiety. This non-linear association suggests that mild anxiety may reflect suboptimal adaptation or reduced compliance with preparation instructions, whereas patients with very low or very high anxiety levels may exhibit greater attentiveness or caution. Nevertheless, these findings should be interpreted cautiously and warrant confirmation in larger prospective studies.

Psychological distress has been shown to influence gastrointestinal physiology, and individuals with elevated anxiety levels may develop or exacerbate gastritis [19]. Conversely, gastritis itself has been identified as an independent risk factor for anxiety disorders. In our study, no significant association was observed between anxiety levels and gastric biopsy findings related to activity, intestinal metaplasia, or *Helicobacter pylori* infection. However, chronic inflammation scores were negatively correlated with BAI scores. One possible explanation is that patients with chronic inflammatory changes may have adapted to their condition over time, resulting in lower anxiety levels, whereas those with more acute inflammatory findings may experience greater distress. Further studies with larger sample sizes are needed to clarify this relationship.

### Strengths and Limitations

The primary limitation of this study is the relatively small sample size, particularly in the moderate and severe anxiety subgroups, which may have limited statistical power and the reliability of post hoc comparisons. In addition, anxiety was assessed using the BAI, a self-reported instrument that may not fully capture the actual emotional state of patients at the time of the procedure. Consequently, the findings should be interpreted as exploratory and hypothesis-generating rather than definitive.

Despite these limitations, the study has several strengths. It is one of the few studies to comprehensively evaluate pre-endoscopy anxiety and its associations with both bowel preparation quality and gastric histopathology. To our knowledge, this is the first study to simultaneously investigate the relationship between anxiety severity, BBPS scores, and gastric biopsy findings in patients undergoing endoscopic procedures.

### Conclusion

Patients undergoing endoscopic procedures commonly experience pre-procedural anxiety. In this study, higher anxiety levels were observed among patients undergoing a single procedure and among female patients. Chronic gastric

inflammation was associated with lower anxiety levels, whereas age, comorbidities, perceived adequacy of information, and prior endoscopy experience did not significantly influence anxiety. Notably, patients with mild anxiety demonstrated poorer bowel preparation compared with those with minimal or severe anxiety, suggesting a non-linear relationship between anxiety severity and bowel cleansing quality. Larger prospective studies are required to validate these findings and to further elucidate the clinical implications of pre-procedural anxiety in endoscopy practice.

### Ethical Approval

The ethical approval for this study was obtained from the Zonguldak Bülent Ecevit University local ethics committee with number 2024/17 dated 02/10/2024.

### Patient Consent

Written informed consent was obtained from all participants prior to enrollment in the study.

### Conflict of Interest

The authors confirm the absence of any conflicts associated with this work.

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