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Research Article

Ghrelin Levels and Disease Localization in Inflammatory Bowel Disease: A Correlation Study

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Aim: This study aimed to assess the relationship between ghrelin levels and factors such as disease localization, age, sex, disease duration, age at diagnosis, and biochemical parameters in inflammatory bowel disease (IBD).

Materials and Methods: The study included 87 patients (43 males, 44 females) with ulcerative colitis (UC) and Crohn's disease (CD) aged 18–75 years, who applied to gastroenterology outpatient clinic. Exclusion criteria were chronic diseases other than UC and CD. Correlations between plasma ghrelin levels and disease characteristics were analyzed statistically.

Results: The mean patient age was 41.05 years (±11.6), and the mean age at diagnosis was 34.9 years (±11.3). Of the patients, 24 (27.6%) had CD, and 63 (72.4%) had UC. The most common site of involvement was the left colon (35%), while the highest ghrelin level was found in pancolitis cases (5.9176 ng/ml). However, no significant correlation was observed between ghrelin levels and sex, age, age at diagnosis, disease duration, type of IBD, localization of disease or biochemical parameters (C-reactive protein, sedimentation rate, hemoglobin, hematocrit, leukocyte levels).

Conclusion: Ghrelin levels were not indicative of disease localization in IBD patients in remission. However, based on previous research, ghrelin may hold potential as a marker for IBD diagnosis and activation rather than localization.

Keywords: Inflammatory bowel diseases, Ulcerative colitis, Crohn's Disease, Ghrelin

1. INTRODUCTION

Inflammatory Bowel Diseases (IBD) represent a group of chronic inflammatory disorders that can affect various segments and layers of the small and large intestines. Although the exact etiopathogenesis remains incompletely understood, these diseases are believed to result from complex interactions among genetic predisposition, environmental influences, microbial factors, and most notably immune dysregulation.

Key features include a chronic relapsing-remitting course, a genetic susceptibility, the presence of extraintestinal manifestations, and an increased risk of malignancy with long-standing disease.

Ulcerative Colitis (UC) and Crohn's Disease (CD) are the two principal subtypes of IBD, both characterized by localized and systemic inflammation.[1]

Various markers are used for the treatment and follow-up of inflammatory bowel disease. Acute phase reactants (C-reactive protein (CRP) and sedimentation) and fecal calprotectin are laboratory markers that provide information about inflammation and their levels increase in IBD.[2,3] During the course of IBD, the location of intestinal involvement and mucosal healing may change in response to treatment. The most accurate determination of these changes can be achieved by using endoscopic methods.[4] Ghrelin, a peptide hormone, is primarily synthesised in the neuroendocrine cells of the fundus region of the stomach, with similar synthesis occurring in the intestines (duodenum, ileum, cecum and colon). Intestinal diseases, including infection, inflammation, and malignancy, have been shown to alter ghrelin production and secretion.[5] Serum ghrelin levels have been reported to increase in IBDs.[6] While there is evidence to suggest that

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ghrelin may be effective in the development of some gastrointestinal diseases and in the treatment of others, new studies are being conducted to demonstrate the relationship between ghrelin levels and many parameters in IBD. Some researchers have suggested that upregulation of ghrelin may be a mechanism to repair tissue damage following intestinal inflammation, and that the damage may trigger endogenous ghrelin secretion.[7] A prospective clinical trial conducted in China demonstrated a negative correlation between serum ghrelin levels and the development of esophageal and gastric cancers, suggesting a potential role for ghrelin as a marker of changes in the gastric mucosa in cancers of the upper gastrointestinal tract.[8,9] Therefore, further research is required to elucidate the role of ghrelin in gastrointestinal inflammation.

In the present study, we aimed to determine the correlation between the site of disease involvement, age, sex, disease duration, age at diagnosis, biochemical parameters (CRP, sedimentation, hemoglobin, hematocrit, and leukocyte), and serum ghrelin levels.

2. MATERIALS AND METHODS

A total of 87 patients with IBD, including 63 with ulcerative colitis (UC) and 24 with Crohn's disease (CD), aged between 18 and 75 years, who were in clinical remission and admitted to the Gastroenterology Outpatient Clinic of Haseki Training and Research Hospital between 10/10/2015 and 30/12/2015, were included in this study.Patients with chronic diseases other than UC and CD, such as diabetes mellitus, chronic kidney disease, chronic liver disease, chronic obstructive pulmonary disease, chronic liver disease, and chronic obstructive pulmonary disease, as well as those who did not wish to participate in the study, were excluded. The relationships between ghrelin levels and sex, age, disease duration, age at diagnosis, biochemical parameters (CRP, sedimentation, hemoglobin, hematocrit, and leukocyte values), and sites of involvement (terminal ileum, right colon, left colon, pancolitis, and isolated rectum) were evaluated. Blood samples were collected after 12 h of fasting in a seated position to ensure standardization. This procedure was performed after the patients were informed, and a consent form was obtained. Blood samples were collected in a gel tube (BD Vacutainer) and the serum was separated by centrifugation at 4000 rpm for 10 min. CRP levels were determined in the separated sera (unit: mg/L; device: AU2700 Beckman Coulter Analyzer; USA). The determination of total ghrelin was conducted using ELISA immunoassay in the sera obtained on the same day in our laboratory. Concurrently, a complete blood count was performed using an EDTA tube with a Mindray BC-6800 device, and sedimentation was measured with a citrate tube using a Vacuplus-ESR 120 device.

2.1. Statical analysis

IBM SPSS Statistics for Windows, Version 25.0 was used for statistical analysis. The numerical variables were characterized using descriptive statistics, including mean, standard deviation, minimum, maximum, and median. For categorical variables, numbers and percentages were calculated. As the numerical variable did not meet the normal distribution condition in the two independent groups, it was analyzed using the Mann-Whitney U test. As the parametric test condition was not met, the relationships between numerical variables were analyzed using Spearman's correlation analysis. In instances where the mean distribution assumptions were not met, the Kruskal-Wallis test was employed to compare numerical variables across multiple groups, and statistically significant results were defined as those with p-values less than 0.05.

3. RESULTS

A total of 87 patients diagnosed with IBD (43 males and 44 females) were included in the study. The mean patient age was 41.05 years (standard deviation 11.6 years, median 40 years). The mean age at diagnosis was found to be 34.86 years (±11.15) and the mean duration of the disease was 6.3 years (±4.6). Of the patients included in the study, 27.6% (n=24) were diagnosed with CD and 72.4% (n=63) with UC. The distribution of IBDs in our study was analyzed according to the site of involvement. Pancolitis involvement was found in 24.1% of patients, rectum involvement in 14.9%,

terminal ileum involvement in 14.9%, left colon involvement in 35%, and right colon involvement in 8%. The demographic and clinicopathological characteristics of the patients are summarized in Table 1.

Table 1.

Demographic and clinicopathological characteristics of the patients

		N	%
Sex	Male	43	49,4
	Female	44	50,6
Disease Type	UC	63	72,4
	CD	24	27,6
Site of involvement	Terminal ileum	13	14,9
	Pancolitis	21	24,1
	Right colon	7	8
	Left colon	31	35
	Rectum	13	14,9
		Mean±SD	**Min-Max**
Age		41.05±11.6	18-75
Age of diagnosis (years)		34,9±11,3	13-66
Disease duration (years)		6,3±4,6	0-23

UC: Ulcerative colitis, CD: Crohn's disease

Table 2.

Comparison of ghrelin levels according to sex and diagnosis

		Ghrelin (ng/ml)			
		Mean ±SD	**Min-Max**	**Median**	**p**
Sex	Male	5,12±3,68	0,42-12,99	3,26	0,329
	Female	5,77±3,94	1,29-12,91	3,48	
Diagnosis	Crohn's Disease	5,15±3,62	0,42-11,89	3,46	0,683
	Ulcerative Colitis	5,56±3,90	1,29-12,99	3,46	

SD: Standard Deviation, Min-Max: Minimum-Maximum

In the present study, the relationship between various parameters and serum ghrelin level was investigated. Ghrelin levels were analyzed according to sex. The mean values obtained for males and females were 5.12 ± 3.68 ng/ml and 5.77 ± 3.94 ng/ml, respectively. Subsequent

analysis revealed that there was no statistically significant difference in ghrelin levels according to sex (p = 0.329). In addition, no statistically significant difference in ghrelin (ng/ml) levels was identified between the CD and UC diagnosis groups of patients with IBD (p=0.683) (see Table-2). No statistically significant correlation was identified between ghrelin levels and either age at diagnosis or disease duration in patients with IBD (p=0.158 and p=0.884, respectively). Finally, no statistically significant correlation was found between age and ghrelin level (p=0.116). A comparison was made between the inflammatory markers used in the follow-up of IBD and ghrelin levels. The findings revealed no statistically significant correlation between ghrelin (ng/ml) levels and CRP, sedimentation, hemoglobin, hematocrit, or leukocyte values (see Table-3).

Table 3.

Comparison of ghrelin levels according to age of diagnosis, disease duration and biochemical values

	Ghrelin (ng/ml)	
	Rho	**p-value**
Age of diagnosis	-0,153	0,158
Disease duration	-0,016	0,884
CRP	-0,113	0,295
Sedimentation	-0,133	0,218
Hemoglobin	0,026	0,811
Hematocrit	0,002	0,982
Leukocyte	0,083	0,443

CRP: C-reactive protein

The IBD patients in this study were divided into five groups based on the location of inflammation: terminal ileum, left colon, right colon, rectum, and pancolitis. This study revealed no statistically significant variation in ghrelin (ng/ml) levels based on the site of involvement (see Table 4). In order to evaluate whether ghrelin levels vary according to disease localization in IBD patients, the patient cohort was stratified into two groups: those with right colon involvement and those with involvement at other anatomical sites (terminal ileum, left colon, rectum, and pancolitis). The mean serum ghrelin level in patients with right colon involvement was 3.35 ng/ml, compared to 5.63 ng/ml in those with other sites of disease. However, this difference did not reach statistical significance (p = 0.239) (Figure 1).

Table 4.

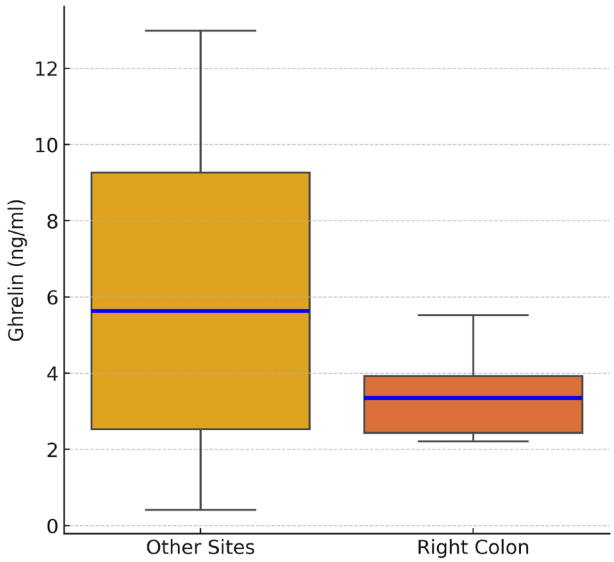
Comparison of ghrelin levels in inflammatory bowel disease according to site of involvement

Site of involvement	**Mean** (ng/ml)	**SD**	**Median**	
Terminal Ileum	5.7661	3.9299	4.78	
Pancolitis	5.9176	3.9567	3.61	p=0,828
Right Colon	3.35	1.2741	2.99	
Left Colon	5.5074	3.9950	3.5	
Rectum	5.372	3.9762	3.26	

SD: Standard Deviation

Figure-1.

Serum ghrelin levels in patients with right colon involvement and other anatomical sites of disease localization. Ghrelin levels are presented as boxplots. The blue horizontal line within each box represents the mean serum ghrelin level for the each group



4. DISCUSSION

In our study, we investigated the relationship between ghrelin levels and site of involvement, biochemical values, sex, age, age at diagnosis, and disease duration in patients with IBD; however, we found no statistically significant difference.

In a study of 58 male and 42 female patients diagnosed with IBD by Karmiris et al., ghrelin levels were found to be higher in males than in females.[10] In our study, no statistically significant differences were found between ghrelin levels and sex. The reason for the difference in ghrelin levels between our study and the study by Karmiris et al. may be the effect of the rate of diagnosis of CD and UC in the patients included in the studies, activity status of the disease, and other factors reported to affect ghrelin levels.

Karmiris et al. reported that there was no correlation between disease duration and ghrelin levels in CD and UC patients.[10] In a study by Kim et al. in 153 patients with active CD, serum ghrelin levels were found to be negatively correlated with patient age and age at diagnosis.[11] In our study, no statistically significant correlation was found between ghrelin levels and age at diagnosis or disease duration.

In our study, there was no statistically significant correlation between ghrelin levels and CRP, erythrocyte sedimentation rate, hemoglobin, hematocrit, and leukocyte levels. In a review by Eissa et al., elevated ghrelin levels were positively correlated with proinflammatory markers, such as tumor necrosis factor (TNF)-α and CRP, in patients with UC and CD. Conversely, they are negatively correlated with insulin-like growth factor (IGF)-I and body weight, indicating a complex interaction between ghrelin and the inflammatory and metabolic pathways in IBD.[12] In the study by Peracchi et al. investigating the relationship between ghrelin levels and TNF-alpha, BMI (body mass index) and CRP in CD and UC patients, it was reported that ghrelin levels were positively correlated with TNF-alpha and CRP in active IBD patients, whereas only BMI was associated with ghrelin in patients in remission. In the same study, similar to our study, ghrelin levels were compared with CRP levels in patients in remission and no significant correlation was found.[13] This suggests that although there may be a positive correlation between CRP and ghrelin levels in IBD patients in the active phase, this correlation was not observed in patients in remission as in our study group.

Ateş et al. reported that ghrelin levels were positively correlated with erythrocyte sedimentation rate, fibrinogen, and CRP and negatively correlated with IGF-1, BMI, and fat mass in patients with CD and UC. In patients in remission, ghrelin levels were positively correlated with CRP, erythrocyte sedimentation rate, and fibrinogen and negatively correlated with IGF-1 and fat mass, and no correlation was found between BMI and ghrelin levels. The correlation was reported to be higher in patients in the active phase than in those in the remission phase.[14]

In our study, no statistically significant difference in ghrelin levels was found between patients with CD and UC in remission. Alexandridis et al. found significantly higher ghrelin levels in patients with active IBD than in those in remission.[15] Ateş et al. found similar ghrelin levels in patients with CD and UC in remission.[14] On the other hand, some studies have reported similar ghrelin levels between patients in remission and healthy controls.[16] Ghrelin levels were reported to be higher in the UC and CD groups than in the healthy control group in a study of 46 UC, 54 CD and 60 healthy controls by Karmiris et al. However, they found that ghrelin levels were similar between UC and CD patients.[10] In a meta-analysis by Kahalji et al. of 1064 patients with IBD (476 UC and 588 CD), ghrelin levels were significantly higher in patients with active IBD than in patients in remission. However, no significant difference in ghrelin levels was found between patients with active IBD and healthy controls, nor between UC and CD separately.[17] Şahin et al. found no significant difference in ghrelin staining in tissue samples between UC patients and healthy controls in a study of 61 UC patients and 15 healthy controls. However, disease activity scores were significantly lower in the group with ghrelin-positive staining in the UC group than in the group with ghrelin-negative staining.[18] These results support our findings and suggest that ghrelin levels may not be a good marker for differentiating IBD types, especially in patients in remission. However, we suggest that ghrelin levels may be associated with active disease in patients with active IBD, who were not included in our study. Further prospective studies should be conducted in this regard.

While the current literature indicates a relationship between ghrelin levels and IBD activity, the specific connection to the site of involvement remains less clear. In our study, no statistically significant difference was found when ghrelin levels were analyzed according to the site of involvement. Karmiris et al. showed that there was no significant correlation between adipokine levels in CD and UC patients when compared according to the site of disease involvement, whereas ghrelin levels were significantly higher in CD patients with ileal involvement compared to CD patients with colonic involvement.[10] In a study conducted by Nishi et al. in patients with CD only, no correlation was found between ghrelin and leptin levels and site.[19] In the present study, we additionally examined whether ghrelin levels varied according to the anatomical localization of disease in IBD patients in remission. Patients with right colon involvement had numerically lower mean ghrelin levels (3.35 ng/ml) compared to those with involvement in other sites (5.63 ng/ml); however, this difference did not reach statistical significance ($p = 0.239$). Although not conclusive, this trend may suggest a potential regional variation in ghrelin secretion or metabolism along the gastrointestinal tract, which warrants further investigation in larger cohorts or during active disease phases. These findings indicate that, although ghrelin levels appear numerically lower in patients with right-sided colonic involvement, this variation is not sufficient to suggest a localization-specific pattern in ghrelin secretion among IBD patients in remission. Larger sample sizes and further stratified analyses, particularly focusing on active disease states, may help elucidate any potential topographic associations.

Studies have shown a link between ghrelin levels and inflammation, with higher levels occurring during active gastrointestinal diseases, especially in IBD. There was also no link between remission levels and those in healthy individuals, as seen in our study. In addition, there was no correlation between ghrelin levels and the site of disease in IBD patients in remission.

5. Conclusion

In conclusion, we found no correlation between the site of disease and ghrelin levels in patients with IBD in remission. When interpreting these data, it is important to keep in mind that ghrelin is influenced by various factors such as inflammation, BMI, fasting status, acute phase reactants, whether the disease is active or in remission, and that results may vary depending on the ghrelin subtype evaluated. We conclude that the effects of ghrelin in IBD can be further clarified with new prospective studies with large sample sizes.

Study Limitations

The limitations of our study include its retrospective and cross-sectional design, a relatively small sample size, the absence of patient evaluation during the active phase of the disease, the lack of assessment of other factors influencing ghrelin levels (such as body mass index (BMI) and dietary intake), the measurement of total ghrelin rather than its active and inactive isoforms, and the absence of ghrelin subtyping.

Article Information Form

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Authors' Contribution

Project administration: S.C.,E.D.,Y.Y.Ü.,Z.E.K.;
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Data curation and formal analysis: S.C.,E.D.;
Software:S.C.;Methodology:S.C.,E.D.,Y.Y.Ü.,
Z.E.K.;İnvestigation:S.C.,E.D.,Y.Y.Ü.,Z.E.K.;
Writing original draft:S.C.,E.D.,Y.Y.Ü.,Z.E.K.;
Writing – review and editing: S.C.,Y.Y.Ü,E.D.

The Declaration of Conflict of Interest/ Common Interest

No conflict of interest or common interest has been declared by authors.

The Declaration of Ethics Committee Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by the Non-Drug Clinical Research Ethics Committee of the Haseki Training and

Research Hospital (date: 05.04.2017, decision no: 475). Written informed consent was obtained from all patients.

Artificial Intelligence Statement

No artificial intelligence tools were used while writing this article.

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