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Factors associated with inflammatory bowel disease control among IBD patients in Palestine (2023–2024): A cross-sectional study

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ABSTRACT

Background: Inflammatory bowel disease (IBD) is a chronic inflammatory condition that impacts many aspects of patients' lives and requires proper control to improve health outcomes. This study aimed to assess perceived IBD control and identify factors associated with it.

Methods: An interview-based questionnaire was used to collect data related to sociodemographic, lifestyle, IBD-related information, and anthropometrics among 116 IBD patients. The inflammatory bowel disease control questionnaire was used to evaluate IBD control, the general health questionnaire-12 (GHQ-12) was used to assess general psychological distress, and the malnutrition universal screening tool (MUST) was used for malnutrition screening.

Results: The mean age of the study participants was 36.4 ± 13.8 years, the mean time since being diagnosed with IBD was 6.2 ± 6.6 years, and the mean IBD-control score was 10.8 ± 4.8. Better IBD control ($p < 0.05$) was significantly associated with living with a spouse, having a higher educational level, being a non-current smoker, not having sleeping problems, not having changes in sleep duration after being diagnosed, being more physically active or having the same level of physical activity compared to before diagnosis, and being well-nourished. In addition, longer disease duration, higher midarm, calf, and hip circumferences, increased muscle mass, handgrip strength, peak flow rate, and GHQ score were all significantly correlated with IBD control score. In multivariate analysis only the GHQ-12 score and the principal component representing muscle mass and body size were found to be statistically significant.

Conclusions: Psychological well-being and favorable body composition were independently associated with better perceived disease control among individuals with IBD. These findings necessitate the importance of psychological screening and nutritional or functional assessments into IBD management to enhance self-management and improve patients' overall disease experience.

Introduction

Inflammatory bowel disease (IBD) is a relapsing and remitting condition characterized by a chronic inflammatory state of the gastrointestinal tract [1,2]. IBD is represented by two idiopathic phenotypes: ulcerative colitis (UC) and Crohn's disease (CD), each of which can impact all areas of patients' lives, including school, work, family, and social life. The incidence and prevalence of IBD are increasing worldwide [3], whereas the highest prevalence of IBD has been reported in Europe and North America. In Asia and the Middle East, the estimated annual incidence of ulcerative colitis is 6.3 per 100,000 person-years and 5.0 per 100,000 person-years for Crohn's disease [4]. Both UC and CD may occur in adolescents and adults and affect men and women equally, and their symptoms are very similar despite some differences [5]. Some of the symptoms include diarrhea, abdominal pain, rectal bleeding, and weight loss. In addition, CD can cause pain, fever, and bleeding in severe cases. It affects any part of the digestive tract, including the mouth, esophagus, stomach, or the entire layers of the intestine, while UC affects the mucosal layers of the colon and is associated with blood in stool, severe pain, and rectal bleeding, which are

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more common in UC [5].

IBD patients are highly susceptible to being malnourished due to nutrients malabsorption, impaired digestion, and increased nutrient loss, namely micronutrient deficiencies including vitamins A, B1, B6, B12, and D and various minerals such as iron and zinc [6], which have been found to be associated with more complicated health issues. For instance, it has been found that low folate, vitamin B6, and B12 levels in IBD patients are attributed to elevated levels of the pro-inflammatory mediator homocysteine, a predictor of comorbidities and associated with disease severity among IBD patients [7]. However, malnutrition is considered the major leading cause of increased muscle catabolism, muscle loss and dysfunction, i.e., sarcopenia, among IBD patients, which results in altered body composition, impaired physical performance, and poor clinical outcomes [8]. These factors may not act independently, but they often influence each other, creating a cycle that exacerbates disease burden and complicates management.

Inflammatory bowel disease is associated with significant psychosocial burden [9]. It is negatively affects patients' social-daily functioning and impacts their psychological and social well-being [10], work productivity, health-related quality of life, emotional and mental health. Moreover, IBD symptoms like bleeding, cramps, and fatigue have been associated with social and interpersonal interaction impairments [11]. It is documented that mental health issues, including anxiety and depression, are prevalent among IBD patients due to the chronic nature of the disease [9].

In recent year, the care of IBD patients has dramatically improved, and management strategies have evolved to prevent disease progression and provide better long-term clinical outcomes [12]. The developed therapies include conventional treatments that control symptoms through pharmacotherapy, such as aminosalicylates, corticosteroids, immunomodulators, and biologics. Moreover, new therapeutic strategies involve small molecules, apheresis therapy, improved intestinal microecology, cell therapy, and exosome therapy. Furthermore, therapeutic approaches include patient education about diet and psychology, which appears to be beneficial for IBD management and control [13]. Numerous studies have shown that aspects of management, including multidisciplinary care and patient engagement and adherence to IBD therapy, contribute positively to outcomes in IBD patients, particularly improved disease course, fewer hospitalizations and emergency visits, and better quality of life (QoL) [14].

In the present study, we aimed to investigate and provide insight into IBD management among IBD patients by analyzing patients control after being diagnosed and identifying which risk factors are influenced their IBD control level.

Methods and Materials

Study design and population

A cross-sectional design was utilized in the present study. The sample was recruited from the outpatient clinics at An-Najah National University Hospital (NNUH), the private clinics at Nablus City, and Ministry of Health hospitals at Nablus, Tulkarm, and Ramallah.

The Khamis and Kepler (2010) formula for multiple linear regression analysis with continuous predictors was used to determine the sample size [15]. The final formula, where k represents the number of predictors, is $n = 20 + 5\,k$. Given that there were 18 predictors in this study, a minimum sample size of 110 patients was required.

Patients were selected by convenient sampling, and participants who were included in this study were patients diagnosed with IBD and are aged at least 18 years old. Exclusion criteria included patients who were unable to perform the physical function test, refused to consent to join the study, and had previously been diagnosed with any mental or psychological disorder. No eligible patients were excluded or omitted after giving informed consent.

Ethical consideration

The study protocol was approved by the Internal Review Board (IRB) Committee at AN-Najah National University, which had a reference number of stu.MRC-118–4-3–23. In addition, permission and approval were obtained from the Palestinian Ministry of Health, while written consent was obtained from each participant. This study was conducted in accordance with the Declaration of Helsinki.

Data collection and research tools

Data were collected from November 2023 to February 2024 through face-to-face interviews using a structured paper-based questionnaire by trained researchers. Wording and response options of each questionnaire were standardized to preserve integrity and validity. However, the questionnaire, including the translated part and the author-generated part, was checked for content validity by experts in the field prior to data collection.

A six-part questionnaire was developed. The first part collected sociodemographic data, while the second part focused on lifestyle-related data, including smoking status (originally smoker, ex-smoker, and nonsmoker, but recorded as "current smokers" and "current non-smokers" by combining ex-smokers and never smokers), sleeping, and physical activity. The third part includes IBD-related questions, including time and age of diagnosis, symptoms, follow-ups, and possible comorbidities. Parts from four to six contained the inflammatory bowel disease control questionnaire, the general health questionnaire-12 (GHQ-12), and the malnutrition universal screening tool (MUST). The interview ended with functional status assessment, anthropometric measurements, and collection of blood samples for homocysteine level measurement.

IBD control questionnaire

The Inflammatory Bowel Disease Control Questionnaire (IBD-Control) was developed to measure 'disease control from the patient perspective.' The questionnaire provides a simple summary score of health status as perceived by patients and includes a validated set of screening questions designed to highlight concerns in physical, social, psychological, and treatment domains, which can inform patient-centric consultations and help quantify therapeutic deficits [16]. It is a rapid, validated, and reliable (Cronbach's alpha = 0.85) tool used to determine the severity of IBD symptoms. The IBD control questionnaire comprises 13 items plus a visual analogue scale (0–100); each item has three response options, scored zero for the least favorable reply, one point for the intermediate or indeterminate reply, and two points for the most favorable reply. The IBD-Control-8 sub-score is calculated by summing scores for eight questions, including Q1a and Q1b, which are scored 0 for "No," 1 for "Not sure," and 2 for "Yes," in addition to Q3a to Q3f, which are scored as 0 for "Yes," 1 for "Not sure," and 2 for "No" (**Supplementary material 1**). The total score results in a range of 0–16 (0 = worst control), with a higher score indicating better IBD control [17]. In this study, the IBD control questionnaire was used in the Arabic version after forward–backward translation by bilingual specialists (**Supplementary material 2**), with reference to the original questionnaire [17]. In addition, Cronbach's α was 0.875 overall for all 13 question items and 0.847 for the sub-score of eight questions (IBD-Control-8).

General health questionnaire-12 (GHQ-12)

The general health questionnaire is a 12-item validated and reliable tool for general screening to measure minor psychological distress [18]. The Arabic version of GHQ-12 was used in this study, which has a Cronbach alpha of 0.86 [19]. Likert scoring was used for the rating scale in this study, which ranged from 0 to 3, where zero represents the

healthiest and 3 represents poor health/illness, and the total score could range from 0 to 36 [20]. Following Petkovska MS et al., a score greater than 16 was classified as having mental distress [21].

Malnutrition universal screening tool (MUST)

Malnutrition screening was performed using the Arabic version of the validated and reliable MUST [22], which is a five-step tool used to identify adults who are malnourished or at risk of malnutrition [23].

Functional status assessment

Functional status of participants was assessed using a Jamar dynamometer for handgrip strength. The Jamar dynamometer can record grip strength and is considered the gold standard for measuring muscle strength due to its reliability and precision [24]. Peak expirometry flow (PEF) was used to evaluate muscle strength as well. PEF is a key indicator of lung functions; it reflects the depth of the preceding breath, airway caliber, muscle strength, and voluntary effort. Generally, a peak flow rate below 200 L/min indicates severe obstruction for most adults younger than 65 [25].

Muscle mass and anthropometric measurements

Bioelectric impedance analysis (BIA) was used for skeletal muscle mass assessment via In Body device. BIA is used to estimate muscle mass at the clinical and research levels due to its portability and correlation with the reference methods [26]. Anthropometric data, including height, weight, calf circumference, waist circumference, and midarm circumference, were also measured, and the average reading was recorded. Body mass index (BMI) was calculated by dividing weight by height squared.

Homocysteine level measurements

The pro-inflammatory marker homocysteine was identified as a possible predictor of comorbidities in patients with IBD and may play a role in the pathophysiology of the disease [7]. Therefore, blood samples were obtained from the study participants by a registered laboratory technician and were transferred to An-Najah National University Hospital, where they were stored and analyzed. Serum homocysteine was measured by the enzyme-linked immunosorbent assay (ELISA) method.

Statistical analysis

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS22). Quantitative variables were presented as mean ± standard deviation (SD), and median with interquartile range (IQR) was reported to reflect central tendency and dispersion, given the non-normal distribution of IBD control score. Qualitative variables were presented as frequency and percentage. Normality of continuous variables was assessed using the Shapiro-Wilk test. For the univariate analysis, the relationship between dependent and independent variables was evaluated using the Mann-Whitney *U* test, the Kruskal-Wallis test, the Jonckheere-Terpstra test, and the Spearman's correlation coefficient test, where appropriate.

A multiple linear regression model was conducted to explore independent predictors of IBD control, which had been previously used in a validation study by Bodger and colleagues to identify predictors of IBD control [17]. Variables included in the multivariate regression model were primarily selected based on statistical significance ($p < 0.05$) from univariate analyses, with methodological considerations applied for continuous variables, for which their linearity with IBD control score was assessed, and quadratic terms were included where non-linearity was suspected. To prevent multicollinearity among closely related variables, a correlation matrix was created for all continuous variables (**Supplementary material 3**), and principal component analysis was used to summarize these factors (**Supplementary material 4**). For categorical variables, predictors with significant associations were evaluated using chi-square tests to avoid overlapping variables. Given the relatively small sample size, a post hoc sensitivity analysis was performed, indicating that the study was adequately powered to detect effects explaining approximately 20 % of the variance in IBD control scores, while smaller effects or interactions may not have reached significance.

The level of significance was set at $p < 0.05$. Coefficients were reported with their 95 % confidence intervals (CI).

Table 1
Sociodemographic and lifestyle characteristics of IBD patients in Palestine (2023–2024).

Characteristics (N = 116)		N (%), mean ± SD
Age		36.4 ± 13.8 (18–67)
Family member number		5.3 ± 1.7 (1–12)
Sex	Male	71 (61.2)
	Female	45 (38.8)
Marital status	Single	43 (37.1)
	Married	69 (59.5)
	Other	4 (3.4)
Living status	Alone	3 (2.6)
	With family	53 (45.7)
	With spouse	60 (51.7)
Educational level	Illiterate	3 (2.6)
	School level	52 (44.8)
	University level	61 (52.6)
Employment status	Employed	65 (56.0)
	Unemployed	51 (44.0)
Smoking status	Smoker	35 (30.2)
	Ex-smoker	16 (13.8)
	Nonsmoker	64 (55.2)
Duration of sleep	Less than 6 h	23 (19.8)
	6–8 h	84 (72.4)
	More than 8 h	9 (7.8)
Sleeping problem after diagnosis	Yes	39 (33.6)
	No	77 (66.4)
Changes in sleep duration after diagnosis	Decreased	33 (28.4)
	The same	63 (54.3)
	Increased	20 (17.2)
Physical activity compared to before diagnosis	Less active	67 (57.8)
	The same	38 (32.8)
	More active	11 (9.5)
Doing exercise before diagnosis	Yes	36 (31.0)
	No	80 (69.0)
Doing exercise after diagnosis	Yes	17 (14.7)
	No	99 (85.3)

Values are presented as mean ± SD or number (%).

Results

Patients sociodemographic and lifestyle characteristics

Table 1 described the sociodemographic and lifestyle characteristics of the included patients. The mean age of study participants was 36.4 ± 13.8 (18–67) years old, with more than half (61.2 %) were male and 59.5 % were married. Most patients were nonsmokers (55.2 %) and slept between 6 and 8 h (72.4 %). Regarding changes in their lifestyle after diagnosis with IBD, patients reported that their sleeping duration remained the same (54.3 %), while 28.4 % reported that their sleeping duration decreased, and 57.8 % reported that their physical activity declined after diagnosis.

Ibd-related data

Most patients in this study were diagnosed with Crohn's disease (64 (55.2 %)), while 52 (44.8 %) patients were diagnosed with ulcerative

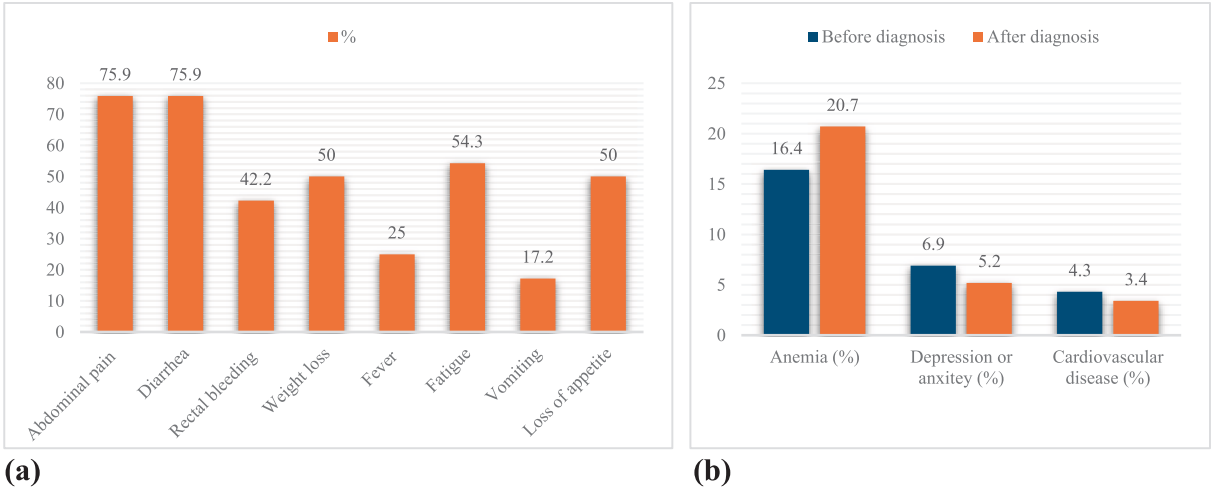

Fig. 1. (a) IBD symptoms presented in %. (b) Medical problems before and after diagnosis.

Table 2
Anthropometric, functional status, and clinical characteristics of IBD patients in Palestine (2023–2024).

Characteristics	Mean ± SD (min–max)
BMI (kg/m^2)	24.3 ± 4.7 (12.2–40.8)
Midarm circumference (cm)	30.7 ± 5.6 (18–48)
Calf circumference (cm)	35.0 ± 5.3 (15–49)
Waist circumference (cm)	81.8 ± 13.8 (30–112)
Hip circumference (cm)	82.1 ± 18.9 (14–128)
Waist hip ratio	1.0 ± 0.3 (0.7–2.2)
Muscle mass (kg)	22.4 ± 9.6 (0.2–4)
Hand grip strength (kg)	28.9 ± 15.1 (0–90)
Peak flow rate (L/min)	334.4 ± 102 (60–540)
Homocysteine blood level (μmol/L)	11.9 ± 3.5 (5.5–26)
GHQ score	12.6 ± 5.3 (5–28)

Abbreviations: BMI: body mass index; GHQ score: general health questionnaire score.

colitis. The mean age at diagnosis was 29.7 ± 11.5 (4–60) years, and the mean time since IBD was first diagnosed was 6.2 ± 6.6 (0.03–30) years. Among participants, 86.2 % followed up on their diseases regularly, with a minority (8.6 %) who chose surgical procedures as a treatment. In addition, 55.2 % of patients had to stop at least one type of food after diagnosis. Regarding IBD symptoms, abdominal pain and diarrhea were the most frequently reported symptoms, with a percentage of 75.9 % for each, as presented in Fig. 1a. Moreover, the proportion of patients diagnosed with anemia increased from 17.2 % before diagnosis to 20.7 % after diagnosis, as illustrated in Fig. 1b.

Clinical, functional and nutritional characteristics

The findings of this study revealed that the mean muscle mass of included patients was 22.4 ± 9.6 kg/m^2 and the homocysteine level was 11.9 ± 3.5, divided into low (25.0 %), intermediate (38.8 %), and high (22.4 %). The peak flow rate was 334.4 ± 102 L/min, while handgrip strength was 28.9 ± 15.1 kg. Regarding mental health status, 30 (25.9 %) of the participants had a GHQ score > 16, while the mean GHQ score was 12.6 ± 5.3, as shown in Table 2.

Anthropometric readings (Table 2) indicated that the mean value of BMI was 24.3 ± 4.7 kg/m^2, which was categorized according to Fig. 2a, and the waist-hip ratio among participants was 1.0 ± 0.3, with 80.2 % of participants presenting a high WH ratio, 16.4 % a medium WH ratio, and 3.4 % a low WH ratio. Using MUST, 72 (62.1 %) of patients were well-nourished or at low risk of malnutrition, and 43 (37.1 %) were malnourished or at medium to high risk of malnutrition, as detailed in Fig. 2b.

IBD control and its relationship with study variables

The IBD control score was 10.8 ± 4.8 (0–16). Univariate analysis

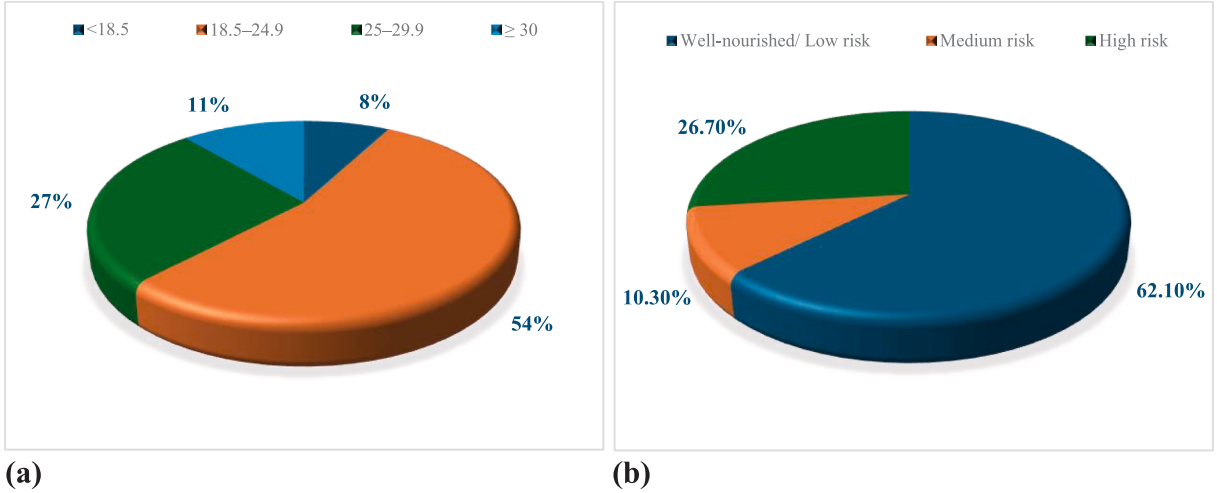

Fig. 2. (a) BMI classification. (b) Malnutrition risk according to the MUST.

Table 3
The relationship between IBD control score and categorical study variables among IBD patients in Palestine (2023–2024).

Characteristics		Median (IQR)	*P*-value
Sex	Male	12.0 (8.0)	0.332[a]
	Female	12.0 (8.0)	
Marital status	Single	10.0 (9.0)	0.439[b]
	Married	12.0 (8.5)	
	Other	10.0 (5.5)	
Living status	With family	10.0 (8.0)	0.038[a]*
	With spouse	14.0 (8.0)	
Educational level	School level	9.0 (8.0)	0.015[a]*
	University level	14.0 (8.0)	
Employment status	Employed	12.0 (9.0)	0.424[a]
	Unemployed	12.0 (6.0)	
Smoking status	Current smoker	10.0 (8.0)	0.005[a]*
	Current nonsmoker	14.0 (5.0)	
Duration of sleep	Less than 6 h	14.0 (7.0)	0.098[c]
	6–8 h	12.0 (9.0)	
	More than 8 h	8.0 (8.5)	
Sleeping problem after diagnosis	Yes	8.0 (10.0)	<0.001[a]*
	No	14.0 (8.0)	
Changes in sleep duration after diagnosis	Decreased	9.0 (10.0)	0.016[b]*
	The same	14.0 (8.0)	
	Increased	9.0 (10.25)	
Physical activity compared to before diagnosis	Less active	10.0 (8.0)	0.003[c]*
	The same	14.0 (6.25)	
	More active	14.0 (8.0)	
Doing exercise before diagnosis	Yes	12.0 (10.0)	0.478[a]
	No	12.0 (8.0)	
Doing exercise after diagnosis	Yes	14.0 (6.0)	0.077[a]
	No	12.0 (8.0)	
Type of IBD	Chron's disease	12.0 (8.0)	0.177[a]
	Ulcerative colitis	11.0 (8.75)	
Regular follow-up	Yes	12.0 (8.0)	0.786[a]
	No	11.5 (9.75)	
Abdominal pain	Yes	12.0 (8.0)	0.522[a]
	No	10.0 (9.0)	
Diarrhea	Yes	12.0 (9.0)	0.875[a]
	No	11.0 (8.75)	
Fatigue	Yes	12.0 (10.0)	0.631[a]
	No	12.0 (7.5)	
Loss of appetite	Yes	11.5 (8.25)	0.182[a]
	No	12.0 (8.0)	
Weight loss	Yes	12.0 (7.50)	0.241[a]
	No	14.0 (8.25)	
Malnutrition	Well-nourished	14.0 (8.0)	0.005[a]*
	Malnourished or at risk	9.0 (8.0)	

*: Significant at P ≤ 0.05, ≤0.01, or ≤ 0.001. Abbreviations; IQR: Interquartile range. Note: Participants who reported living alone (n = 3) or being illiterate (n = 3) were excluded from the "living status" and "educational level" analysis due to small subgroup size. Smoking status was recategorized into two groups for analysis: current smokers and current non-smokers (including ex-smokers and never smokers).

[a] Mann-Whitney *U* test.
[b] Kruskal-Wallis test.
[c] Jonckheere-Terpstra test.

revealed that living with a spouse ($p = 0.038$), university level ($p = 0.015$), being a current nonsmoker ($p = 0.005$), not having sleeping problems ($p < 0.001$), not having changes in sleep duration after being diagnosed ($p = 0.016$), being more physically active or having the same level of physical activity compared to before diagnosis ($p = 0.003$), and being well-nourished ($p = 0.005$) were significantly associated with a higher IBD control score, as presented in Table 3.

The IBD control scores were compared to the continuous variables among study participants in a correlation test (Table 4). Years since diagnosis ($p < 0.01$), midarm, calf, and hip circumferences ($p < 0.01$), muscle mass ($p < 0.01$), handgrip strength ($p < 0.01$), peak flow rate ($p < 0.01$), and GHQ score ($p < 0.01$) were all significantly linked with IBD control score.

The prediction of the IBD control score based on significant factors or

Table 4
Spearman's correlation coefficients of IBD control among IBD patients in Palestine (2023–2024).

Characteristics	Spearman's rho	*P*-value	95 % confidence intervales (lower–upper)
Age	0.181	0.052	−0.007–0.356
Age at diagnosis	0.149	0.112	−0.040–0.327
Years since diagnosis	0.300**	0.001	0.119–0.461
Family members number	−0.104	0.266	−0.286–0.085
BMI (kg/m^2)	0.101	0.238	−0.089–0.283
Midarm circumference (cm)	0.298**	0.001	0.117–0.460
Calf circumference (cm)	0.273**	0.003	0.090–0.438
Waist circumference (cm)	0.204	0.028	0.017–0.377
Hip circumference (cm)	0.235**	0.011	0.050–0.405
Waist hip ratio	−0.099	0.288	−0.282–0.090
Muscle mass (kg)	0.391**	<0.001	0.220–0.539
Handgrip strength (kg)	0.298**	0.001	0.117–0.460
Peak flow rate (L/min)	0.253**	0.006	0.069–0.421
Homocysteine blood level (μmol/L)	0.155	0.125	−0.049–0.346
GHQ score	−0.412**	<0.001	−0.557–−0.243

Abbreviations; BMI, body mass index; GHQ score, general health questionnaire score. **: Correlation is significant at P ≤ 0.01.Note: Years since diagnosis = number of years from the date of initial IBD diagnosis to the date of interview.

Table 5
Relationship between IBD control and study variables among IBD patients in Palestine (2023–2024) – a multivariate analysis.

Factors	Beta (95 % CI)	B	*P*-value
Living status	−0.069 (−2.429–1.080)	−0.675	0.447
Educational level	0.107 (−0.554–2.644)	1.045	0.198
Current smoking status	−0.130 (−3.176–0.419)	−1.378	0.131
Years of diagnosis	0.336 (−0.113–0.606)	0.246	0.177
Years of diagnosis squared	−0.105 (−0.018–0.011)	−0.003	0.665
Sleeping problem after diagnosis	−0.155 (−3.406–0.241)	−1.583	0.088
Physical activity compared to before diagnosis	0.108 (−0.638–2.762)	1.062	0.218
MUST score category	−0.017 (−1.989–1.643)	−0.173	0.850
GHQ score	−1.124 (−1.909–−0.123)	−1.016	0.026*
GHQ score squared	0.903 (−0.002–0.055)	0.027	0.065
Principal component 1	0.184 (0.021–1.754)	0.888	0.045*
Principal component 2	0.121 (−0.239–1.419)	0.590	0.161

*$p < 0.05$ using multiple linear regression. Principal Component 1 includes high loadings for hip, calf, mid-upper arm circumference, and muscle mass (interpreted as muscle mass and anthropometrics). Principal Component 2 includes handgrip strength and peak flow (interpreted as functional strength). Physical activity level compared to before diagnosis is grouped into two categories (decreased and increased/the same).

factors with $p < 0.05$ was evaluated using multiple linear regression. However, given the significant relationship between 'sleeping problem' and 'change in sleep duration' (Chi-square = 20.71, $p < 0.001$), and based on its stronger association with IBD control score in the univariate analysis ($p < 0.001$), only 'sleeping problem after diagnosis' was included in the multivariable regression model to avoid multicollinearity and maintain model clarity. The model was statistically significant ($p < 0.001$), with R^2 equal to 0.413. The significant predictors of better IBD control included lower GHQ score ($\beta = -1.124$, $p = 0.026$) and higher body size/muscle mass represented by principal component 1 ($\beta = 0.184$, $p = 0.045$). Quadratic terms for continuous variables (GHQ and disease duration) were tested to explore non-linear

associations but were not statistically significant, as presented in Table 5.

Discussion

This study provided important insights into the factors associated with the perceived IBD control in individuals with inflammatory bowel disease, as measured by the IBD-control score. The average level of IBD control indicated relatively intermediate to good disease management among study participants. Our multivariate analysis revealed that higher psychological distress, indicated by GHQ score, was associated with lower perceived control. In addition, increased muscle mass and anthropometric measurements were associated with better perceived control. These findings are consistent with a possible relationship between mental health and perceived disease control, as well as a possible association between disease control and body composition.

In this study, the GHQ score showed a significant negative correlation with perceived IBD control in both univariate and multivariate analysis, indicating that better psychological health (lower GHQ score) was associated with better disease control. This finding aligned with an earlier systematic review that reported associations between both depression and anxiety and increased IBD activity, higher relapse, and greater health care utilization [27]. Similarly, another study reported a significant negative correlation between psychological distress, measured using GHQ-12, and quality of life among IBD patients, with somatic symptoms, anxiety, depression, loss of confidence, and social dysfunction all being associated with lower patients well-being [4]. Furthermore, in an IBD outpatient sample, multiple regression analysis controlled for many clinical variables and showed that psychological distress was one of the strongest independent predictors of reduced quality of life [28]. Notably, these findings are consistent with a growing body of evidence demonstrating associations between psychological factors and IBD progression and its impact on the course of IBD [29].

In the current study, a higher IBD-control score was significantly and positively correlated with larger midarm, calf, and hip circumferences, as well as increased muscle mass. These findings remained significant in the multivariate analysis, indicating that better body composition was associated with improved patient-perceived disease control. This was consistent with prior findings reporting that patients with active IBD exhibited reduced fat mass, lower fat-free mass, and higher rates of sarcopenia compared to those in clinical remission and healthy individuals. These alterations were associated with poorer prognosis [30], more complications, and higher disease severity [31]. Accordingly, maintaining adequate muscle mass and healthy anthropometrics was associated with healthier clinical outcomes and reflected an association with the patient's capability of coping with the burden of IBD.

Interestingly, after adjustment, disease perceived control was not independently associated with living status, educational level, smoking status, sleeping problems, physical activity, disease duration, or malnutrition risk. This was somewhat unexpected, particularly for physical activity, which has a favorable influence on promoting a milder disease course and is recommended as a crucial part of clinical management of patients with IBD [32]. Similarly, the multivariate analysis did not maintain the significance of smoking, despite its reported association with increased IBD burden [33,34]. The lack of significance in our model might have been due to sample size or statistical power, as well as the complex interplay between these factors and other variables included in the adjusted model.

This study has some limitations. First, the nature of cross-sectional studies limited identifying cause-effect relationships. Second, as the study relied on self-reported data collected through face-to-face interviews, this made it prone to recall bias and social desirability bias. Another reason for potential recall bias was the variability in the recall periods, whereas IBD control asked about the last two months and other author-generated questions asked about the period after diagnosis. Third, the relatively small sample size may have reduced the statistical power to detect some expected associations, as well as potential interactions or nonlinear relationships. A post hoc sensitivity analysis indicated that, with 116 participants, the study could reliably detect effects explaining approximately 20 % of the variance in IBD-control scores, while smaller effects might not have reached significance. Finally, there was the potential selection bias and the effect of the potential confounding variables. Future studies with larger sample size could use automatic variable selection methods like stepwise regression to find other important factors related to IBD control. In addition, future studies could assess muscle mass as a percentage of total body mass to provide more size-adjusted insights.

To conclude, this study underscored the significant role of psychological well-being and better body composition with patients' perceived disease control. These factors could be considered in personalized treatment plans to support better coping strategies among IBD patients. These findings highlight the need for mental health assessment and, when needed, appropriate treatment among IBD patients and targeted interventions that address underlying causes such as malabsorption to maintain adequate muscle mass and body measurements alongside nutritional and physical activity support, which may be linked to enhanced patients' perceived disease control, patient-reported outcomes, and overall well-being. Further research examining IBD control is warranted for better understanding of the multifaceted nature of IBD.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajg.2025.09.012.

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