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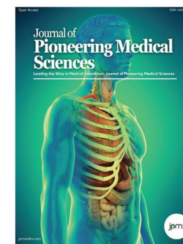

Assessment of the Relation Between Total Dietary Pattern, Total Morisky Medication Adherence and Total Inflammatory Bowel Disease Distress Among Patients with Crohn's Disease in Erbil City

Shamsadeen Abdullah Mohammed[1*] and Ronak Nemat Alla Hussain[2]
[1,2]Department of Nursing, Hawler Medical University, Kurdistan Region, Iraq

Author Designation: [1]Asisstant Lecturer, [2]Assistant Professor

*Corresponding author: Shamsadeen Abdullah Mohammed (e-mail: shamsadeen.mohammed@hmu.edu.krd).

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Abstract **Background:** Crohn's Disease (CD) is a chronic, relapsing inflammatory bowel disease that substantially impairs patients' dietary behaviour, medication adherence and psychological well-being. In Erbil City, Kurdistan Region of Iraq, structured patient-education initiatives targeting these three domains simultaneously remain scarce. **Objectives:** To assess the effects of a structured educational program on dietary pattern adherence, medication adherence and inflammatory bowel disease distress among patients with Crohn's disease attending Rizgary Teaching Hospital, Erbil City. **Methods:** A quasi-experimental, pre-post design was used. Ninety-six adult patients with confirmed CD were recruited by convenience sampling. Data were collected across four time-points: Pre-program (baseline), post 1 (immediately post-intervention), post 2 (one month) and post 3 (three months). Instruments comprised a structured sociodemographic and medical questionnaire, a 21-item Dietary Pattern scale (Cronbach's α = 0.947), the 8-item Morisky Medication Adherence Scale (MMAS-8; α = 0.904) and the 28-item Inflammatory Bowel Disease Distress Scale (IBD-DS; α = 0.973). The educational program consisted of five interactive Arabic-language lectures (35-45 minutes each) delivered over the study period. Data were analysed using descriptive statistics, the Chi-square test, Fisher's Exact Test and Pearson correlation coefficients (SPSS v.25). **Results:** Highly significant improvements were observed across all three domains and all post-intervention phases (p<0.001). Poor dietary pattern declined from 93.8% at baseline to 12.5% at post 3; non-adherence to medication fell from 93.8 to 7.3% and severe IBD distress was eliminated entirely by post 2 (from 74.0 to 0.0%), with 68.8% of patients reporting no distress at post 3. Significant negative correlations were identified between dietary pattern, medication adherence and IBD distress at every assessment phase (p<0.001), indicating that improvements in one domain were systematically associated with improvements in the others. **Conclusion:** A structured educational program was associated with substantial, sustained imrovements in dietary behaviour, medication adherence and psychological distress in patients with Crohn's disease in a resource-limited Middle Eastern setting. Routine integration of nurse-led educational programs into gastroenterology care and controlled trials are needed to confirm causality is recommended.

Key Words Crohn's Disease, Dietary Pattern, Medication Adherence, Inflammatory Bowel Disease Distress, Educational Program, Morisky Scale

INTRODUCTION

Crohn's Disease (CD) is a chronic, immune-mediated Inflammatory Bowel Disease (IBD) that can affect any segment of the gastrointestinal tract from the mouth to the anus, though it most commonly involves the terminal ileum and proximal colon. The disease is histologically characterised by transmural, discontinuous, granulomatous inflammation and follows an unpredictable course of exacerbations and remissions. Cardinal symptoms include abdominal pain, diarrhoea, rectal bleeding, fatigue, weight loss and malnutrition. The chronic inflammatory burden, combined with the systemic sequelae of long-term immunosuppressive therapy, imposes profound physical, psychological and socioeconomic consequences on affected individuals [1].

The global incidence and prevalence of CD have risen markedly over the past three decades, driven by Westernisation of dietary habits, environmental exposures

and heightened diagnostic capacity. Although historically concentrated in high-income Western nations, CD is increasingly recognised in newly industrialised regions of the Middle East, Asia and Africa [2,3]. In the Kurdistan Region of Iraq, epidemiological data remain sparse; however, clinical reports from regional referral centres indicate a growing burden of IBD, often presenting at advanced stages owing to limited awareness, delayed diagnosis and restricted access to gastroenterological services.

The pathogenesis of CD involves a complex interplay of genetic susceptibility, dysregulated immune responses, perturbation of the intestinal microbiota and environmental triggers. Mutations in pattern-recognition receptors most notably NOD2/CARD15 impair mucosal barrier integrity and the innate immune surveillance of luminal bacteria, culminating in an aberrant adaptive T-helper-cell response and sustained intestinal inflammation [4]. Environmental factors, including tobacco smoking, a high-fat, low-fibre dietary pattern, non-steroidal anti-inflammatory drug use and early-life antibiotic exposure, further modulate disease onset, severity and relapse frequency [1].

Dietary pattern is of particular clinical relevance in CD because nutritional status directly affects mucosal healing, immune function and patients' capacity to tolerate treatment. A diet rich in ultra-processed foods and refined sugars promotes pro-inflammatory dysbiosis, whereas Mediterranean-style or specific carbohydrate diets may attenuate luminal antigen load and reduce relapse risk [5]. Despite this, structured dietary counselling is rarely delivered systematically in routine gastroenterological practice in resource-limited settings, leaving the majority of CD patients without evidence-based nutritional guidance.

Medication adherence represents an equally critical determinant of disease outcomes. The established pharmacological armamentarium for CD encompassing 5-aminosalicylates, corticosteroids, thiopurines, methotrexate and biological agents demands consistent long-term use to maintain remission and prevent structural intestinal damage [6]. Yet adherence rates in IBD are consistently reported below 50% in multiple international studies, driven by medication side effects, complex regimens, health-system barriers and inadequate disease literacy [7]. In a resource-limited Middle Eastern context where biologic therapies are not universally accessible, optimising adherence to first- and second-line agents is essential to forestalling disease progression and unnecessary surgical intervention [8].

Psychological distress constitutes the third major domain of patient burden in CD. Fear of relapse, body-image disruption, social isolation, work impairment and uncertainty about prognosis generate anxiety, depression and reduced health-related quality of life in a substantial proportion of patients [9,10]. The IBD-specific distress construct, as operationalised by the Inflammatory Bowel Disease Distress Scale (IBD-DS), encompasses cognitive, emotional and behavioural dimensions that are not captured by generic psychological instruments and therefore require disease-specific assessment [11].

Structured nurse-led educational programs have gained increasing recognition as pragmatic, cost-effective interventions capable of addressing these interrelated domains simultaneously. By systematically enhancing patients' disease knowledge, self-management competencies and coping strategies, such programs can promote adherence to therapeutic regimens, encourage healthier dietary choices and reduce psychological distress through increased perceived control and self-efficacy [12-14]. In resource-limited settings where specialist psychological services are scarce, educational interventions delivered within existing nursing frameworks offer a scalable strategy aligned with the Chronic Care Model's emphasis on informed and activated patients [15].

Despite the global evidence base for patient education in IBD, no published study has simultaneously evaluated the effect of an educational program on all three domains dietary pattern, medication adherence and IBD-specific distress among CD patients in the Kurdistan Region of Iraq. The present investigation was therefore undertaken to address this gap and to generate context-specific evidence to inform gastroenterological nursing practice in Erbil City.

Aim of the Study

This study aimed to assess the effects of a structured educational program on dietary pattern adherence, medication adherence and inflammatory bowel disease distress among patients with Crohn's disease at Rizgary Teaching Hospital, Erbil City and to determine the correlations among these three outcomes at each assessment phase.

Objectives

To assess the effects of a structured nurse-led educational program on dietary pattern adherence, medication adherence and inflammatory bowel disease distress among patients with Crohn's disease and to determine the correlations among these three outcome domains at each assessment phase.

METHODS

Study Design

We hypothesised that participation in a structured educational programme would be significantly associated with improvements in diatery pattern adherence, medication adherence and IBD specific distress scores from baseline to three months post-intervention. a quasi-experimental, pre-post design without a concurrent control group was employed. Outcome data were collected at four time-points: pre-program (baseline), post 1 (immediately following program completion), post 2 (one month post-intervention) and post 3 (three months post-intervention). This

longitudinal, repeated-measures approach allowed evaluation of both immediate and sustained intervention effects.

Study Setting and Period

The study was conducted at the inpatient ward and outpatient clinic of the Liver and Gastrointestinal Diseases Department, Rizgary Teaching Hospital, Erbil City, Kurdistan Region of Iraq. Rizgary Teaching Hospital serves as the principal tertiary-referral gastroenterology centre for Erbil Governorate and its surrounding districts. Data collection spanned a ten-month period from February to November 2025.

Study Population and Eligibility Criteria

A sampling of 192 recorded patients with Crohn's disease, post-hoc G*Power analysis confirmed n = 126 provides >95%>95% power (d = 0.5, alpha = 0.05) (from an initial 126; 20 pilot, 10 withdrawals) patients with a confirmed diagnosis of Crohn's disease was recruited. Eligibility was determined by the following criteria:

- **Inclusion Criteria:** Confirmed CD diagnosis by ileo-colonoscopy with histology; able to communicate verbally in Arabic or Kurdish; willing to provide written informed consent; and accessible for follow-up attendance
- **Exclusion Criteria:** Concurrent gastrointestinal tract malignancy; unconfirmed IBD diagnosis; presence of a bowel stoma; severe psychiatric disorder precluding informed consent and refusal to participate

Educational Intervention

The intervention consisted of five structured, researcher-delivered, kurdish and Arabic-language educational sessions, each lasting 35-45 minutes, conducted individually or in small groups at the hospital. Session content was developed in accordance with current ECCO (European Crohn's and Colitis Organisation) guidelines and adapted for the local sociocultural context. The five sessions covered: (1) The nature, pathophysiology and disease course of Crohn's disease; (2) Evidence-based dietary management, including identification of individual trigger foods, low-residue dietary principles and nutritional supplementation; (3) Psychological support strategies, including stress-reduction techniques and peer-support resources; (4) Medication adherence rationale, regimen simplification, side-effect management and the consequences of non-adherence and (5) Integrated personalised self-management planning. Each session was accompanied by a purpose-designed kurdish language educational booklet covering all five topics. Sessions were delivered by the primary investigator and participants were encouraged to ask questions throughout.

Data Collection Instruments

Data were collected using a five-part structured instrument:

- **Part I-Sociodemographic data:** Age, sex, educational level, occupation and residence
- **Part II-Medical history:** Body Mass Index (BMI), smoking status, presence of comorbid chronic disease, family history of IBD, disease duration and predominant symptoms
- **Part III-Dietary Pattern scale:** A validated, 21-item scale rated on a four-point Likert scale (0-4; total range 0-84). Scores were classified as poor (≤50%), average (50 to <75%) or good (≥75%). Cronbach's α = 0.947
- **Part IV-Morisky Medication Adherence Scale (MMAS-8):** An internationally validated, 8-item self-report scale (total range 0-32) categorised as non-adherent (<50%) or adherent (≥50%). Cronbach's α = 0.904
- **Part V-IBD Distress Scale (IBD-DS):** A 28-item disease-specific distress measure (total range 0-168) classified as no distress (≤25%), mild (26-50%), moderate (51-75%) or severe (>75%). Cronbach's α = 0.973 [11]. All three instruments demonstrated excellent internal consistency in the study sample

Face-to-face structured interviews were conducted by the primary investigator to ensure completeness and to minimise literacy-related non-response bias. Prior to the main study, a pilot test was conducted on 10 patients not included in the final sample; minor wording adjustments were made to two dietary-pattern items to improve cultural clarity.

Statistical Analysis

This manuscript was prepared and reported in accordance with the TREND Statement for non-randomised intervention studies [16]. Post-hoc power analysis (G*Power 3.1): for d = 0.5, alpha = 0.05, power = 0.80, minimum n = 54 required; enrolled n = 96 provides power >0.95. Effect sizes (Cohen's d) and 95% confidence intervals are reported for all primary comparisons. Binary logistic regression identified sociodemographic predictors of adherence and dietary outcomes at post 3. Data were entered and analysed using IBM SPSS Statistics, version 25. Descriptive statistics frequency, percentage, mean and Standard Deviation (SD) were computed for all variables. The Chi-square test and Fisher's Exact Test were used to compare categorical proportions across assessment phases. The strength and direction of associations among dietary pattern, medication adherence and IBD distress were quantified using Pearson's correlation coefficient (r). Statistical significance was set at $p<0.05$; a threshold of $p<0.001$ was considered highly significant.

Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing, Hawler Medical University (Approval No. 2424; 22/08/2024). Written informed consent was obtained from each participant prior to enrolment. Participants were assured of the voluntary nature of their participation and their right to withdraw at any time without consequence to their clinical care. All data were anonymised and stored securely; access was restricted to the research team. The study was conducted in accordance with

the Declaration of Helsinki. Participants identified with severe IBD distress (IBD-DS >75%) at any assessment phase were referred to the treating gastroenterologist for psychosocial support. This referral pathway was pre-established and approved by the Research Ethics Committee prior to data collection.

RESULTS

Sociodemographic and Clinical Characteristics

A total of 96 patients with Crohn's disease were enrolled and completed all four assessment phases; 10 withdrown were recorded, the concurrent improvements are pre-post association; natural remission, regression to the mean and the Hawthorne effect cannot be excluded. Complete retention (attrition = 0%) is attributed to face-to-face collection at scheduled clinical appointments and the investigator's direct patient relationship. Demographic characteristics are presented in Table 1. The mean age was 32.21±12.14 years, with the largest age group being those under 25 years (35.4%), reflecting the well-recognised peak onset of CD in early adulthood. The sample was predominantly male (57.3%), consistent with regional epidemiological patterns. Secondary education was the most common educational level (45.8%) and 69.8% of participants resided in urban areas. Employment distribution was approximately equal across paid work, self-employment and student status (22.9% each), with 12.5% homemakers and 14.6% unemployed. The vast majority had no comorbid chronic disease (93.7%), 75.0% were non-smokers and 51.0% reported a disease duration of fewer than five years. The most frequently reported symptoms were abdominal pain (90.0%) and lethargy (88.5%).

Table 1: Frequency Distribution of Studied Patients Regarding Their Sociodemographic Characteristics (n = 96)

Demographic Characteristics	No.	%
Age		
<25	34	35.42
25 to <35	29	30.21
35 to <45	18	18.75
45+	15	15.63
Min-Max	15-74	
Mean±SD	32.21±12.14	
Sex		
Male	55	57.29
Female	41	42.71
Education		
Illiterate	9	9.38
Able to read and write	10	10.42
Basic education	22	22.92
Preparatory education	8	8.33
Secondary education	44	45.83
Higher education	3	3.13
Marital Status		
Married	41	42.71
Divorced	2	2.08
Single	53	55.21
Occupation		
Paid work	22	22.92
Self-employed	22	22.92
Non-paid work (volunteer)	3	3.13
Student	22	22.92
Keep in house/homemaker	12	12.50
Unemployed (health reason)	1	1.04
Unemployed (other reason)	14	14.58
Residence		
Urban	67	69.79
Rural	4	4.17
Suburban	25	26.04

Dietary Pattern Across Program Phases

Table 2 presents dietary pattern scores across the four assessment phases. At baseline, 93.8% of patients had a poor dietary pattern, underscoring the profound nutritional knowledge deficit in this population. This proportion declined sharply to 78.1% at post 1, 32.3% at post 2 and 12.5% at post 3. Correspondingly, the proportion of patients with a good dietary pattern rose from 1.0% at baseline to 39.6% at post 3. The proportion in the average category peaked at post 2 (59.4%), reflecting an intermediate stage of sustained behavioural change. Chi-square analysis confirmed that the differences across phases were highly statistically significant ($p<0.001$).

Medication Adherence Across Program Phases

Table 3 presents medication adherence data. At baseline, 93.8% of patients were non-adherent to their prescribed medication regimens a critically high proportion that mirrors the treatment burden associated with CD. Following the educational intervention, non-adherence fell to 53.1% at post 1, 19.8% at post 2 and 7.3% at post 3. The proportion of adherent patients correspondingly rose from 6.2% at baseline to 46.9, 80.2 and 92.7% at posts 1, 2 and 3, respectively. The improvements across all phases were highly statistically significant ($p<0.001$).

IBD Distress Across Program Phases

Table 4 presents IBD-DS scores across assessment phases. At baseline, 74.0% of patients experienced severe distress and 26.0% moderate distress, with no patient reporting mild or no distress. This profile reflects the substantial psychological burden associated with CD in the absence of structured support. By post 1, severe distress had fallen to 12.5% and was entirely absent at post 2 and post 3. By post 3, 68.8% of patients reported no distress. All phase-by-phase differences were highly statistically significant ($p<0.001$).

Correlation Among Dietary Pattern, Medication Adherence and IBD Distress

Table 5 presents Pearson correlation coefficients among the three primary outcome variables at each assessment phase. At baseline, significant negative correlations were observed between dietary pattern and medication adherence ($r = -0.521$, $p<0.001$) and between dietary pattern and IBD distress ($r = -0.349$, $p<0.001$), while a positive correlation was found between medication adherence and IBD

Table 2: Dietary Pattern Among Studied Patients Through Program Phases (N = 96)

Dietary Pattern	Pre	Post 1	Post 2	Post 3
Poor (≤50%)	93.8%	78.1%	32.3%	12.5%
Average (50 to <75%)	5.2%	19.8%	59.4%	47.9%
Good (≥75%)	1.0%	2.1%	8.3%	39.6%

p<0.001 (Chi-square test across all phases)

Table 3: Medication Adherence (MMAS-8) Among Studied Patients Through Program Phases (N = 96)

Medication Adherence (MMAS-8)	Pre	Post 1	Post 2	Post 3
Non-adherent (<50%)	93.8%	53.1%	19.8%	7.3%
Adherent (≥50%)	6.2%	46.9%	80.2%	92.7%

p<0.001 (Chi-square test across all phases)

Table 4: IBD Distress Scale (IBD-DS) Among Studied Patients Through Program Phases (N = 96)

IBD Distress Level (IBD-DS)	Pre	Post 1	Post 2	Post 3
No distress (≤25%)	0.0%	2.1%	10.4%	68.8%
Mild (26-50%)	0.0%	18.8%	54.2%	31.3%
Moderate (51-75%)	26.0%	66.7%	35.4%	0.0%
Severe (>75%)	74.0%	12.5%	0.0%	0.0%

p<0.001 (Chi-square test across all phases)

Table 5: Pearson Correlation Matrix: Dietary Pattern, Medication Adherence and IBD Distress Through Program Phases

Phase	Variable	Dietary Pattern (r)	Medication Adherence (r)	IBD Distress (r)
Pre	Dietary Pattern	1	-0.521**	-0.349**
	Med. Adherence	-0.521**	1	0.402**
	IBD Distress	-0.349**	0.402**	1
Post 1	Dietary Pattern	1	-0.620**	-0.518**
	Med. Adherence	-0.620**	1	-
Post 2	Dietary Pattern	1	-0.718**	-0.621**
	Med. Adherence	-0.718**	1	-
Post 3	Dietary Pattern	1	-0.716**	-0.446**
	Med. Adherence	-0.716**	1	-

**Correlation is significant at the 0.001 level (2-tailed), IBD: Inflammatory Bowel Disease, Med. Adherence = Medication Adherence

distress (r = 0.402, p<0.001). The negative dietary pattern-adherence and dietary pattern-distress correlations strengthened progressively across phases, reaching r = -0.716 and r = -0.446, respectively, at post 3. These findings indicate that patients who adopted healthier dietary patterns tended to achieve greater medication adherence and lower psychological distress and that these associations became more pronounced as the program progressed. All correlations were highly statistically significant (p<0.001) at every assessment phase.

DISCUSSION

This study evaluated the impact of a structured nurse-led educational program on three interrelated domains of Crohn's disease management dietary pattern, medication adherence and IBD-specific psychological distress in a cohort of 96 patients attending a regional referral hospital in Erbil City, Kurdistan Region of Iraq. Highly significant improvements were demonstrated across all three domains and all post-intervention assessment phases and robust negative correlations were identified among the outcomes, confirming their mutual interdependence. The discussion that follows contextualises these findings within the existing international evidence base and addresses their theoretical and practical implications.

Sociodemographic Characteristics

The mean age of 32.21±12.14 years and the male predominance (57.3%) in the study sample are consistent with the recognised bimodal age distribution of CD with a primary peak in the second to fourth decades and with the modest male preponderance reported in several Middle Eastern cohorts [16]. The majority of participants had secondary-level education and resided in urban areas, which may reflect the referral pattern of Rizgary Teaching Hospital and the concentration of IBD patients in urban centres with greater healthcare access. These findings are broadly concordant with Ibrahim *et al.* [17], who reported a comparable age distribution and educational profile in a comparable Iraqi nursing study sample and with Gomes *et al.* [18], who similarly noted urban over-representation in a Brazilian IBD centre.

In contrast, Elbadry *et al.* [16], in a large Egyptian multicentre study, identified a predominantly rural sample with a slightly older mean age (35.1±12.5 years), reflecting the more geographically dispersed IBD referral network in Egypt. The predominance of students and employed individuals in the present sample underscores the productive-age burden of CD and highlights the economic implications of inadequate disease management in a young working population.

Effect of the Educational Program on Dietary Pattern

The dramatic reduction in poor dietary pattern from 93.8% at baseline to 12.5% at post 3 represents the most salient nutritional finding of this study. The magnitude of this change, sustained three months post-intervention, suggests that the educational program successfully activated durable

behavioural modification rather than merely transient knowledge acquisition. This interpretation aligns with the Health Belief Model, which posits that perceived susceptibility to disease complications and perceived benefits of action interact to produce sustained behavioural change when targeted psychoeducational inputs lower perceived barriers [8].

Specific dietary content identification of individual trigger foods, principles of low-residue nutrition during flares and the anti-inflammatory potential of dietary fibre and omega-3 fatty acids in remission gave participants actionable, personalised guidance. Guida *et al.* [5] similarly reported that IBD patients who received structured dietary counselling demonstrated significantly improved dietary self-management and could accurately identify foods associated with symptom aggravation. Ahmed and Hassan [19] found comparable improvements in dietary adherence following an instructional program among IBD patients in Iraq, lending regional corroboration to the present findings. The progressive improvement from post 1 to post 3 with the largest gains occurring between post 1 and post 2 suggests that dietary change requires time to consolidate and that continued reinforcement through the written educational booklet may have sustained behaviour change beyond the immediate post-program period.

Effect of the Educational Program on Medication Adherence

The near-complete reversal of non-adherence from 93.8 to 7.3% at three months is a clinically remarkable finding with significant implications for disease management in Erbil. The baseline non-adherence rate, while alarming, is not atypical for IBD populations in resource-limited settings and reflects the compounding effects of long medication duration, complex regimens, perceived medication burden, side effects and limited structured follow-up [7,20].

The educational program addressed these barriers directly by providing patients with a clear mechanistic rationale for each medication, a simplified personalised dosing schedule, practical strategies for managing common side effects and explicit information about the consequences of treatment discontinuation, including the risk of surgical intervention. Gohil *et al.* [7], in a systematic review of adherence interventions in IBD, identified education-based approaches as among the most consistently effective, particularly when combined with written materials-an approach mirrored in the present study. Amiesimaka *et al.* [20] reported an increase in high medication adherence from 30.9 to 78.2% following a targeted adherence intervention in IBD, a trajectory broadly similar to the present findings and Chapman *et al.* [21] demonstrated that personalised adherence support for maintenance therapy in CD produced lasting improvements at six-month follow-up. Shabaan *et al.* [22] similarly demonstrated that structured educational instructions significantly improved disease knowledge in UC patients, supporting the role of nurse-led education in enhancing self-management capacity. The progressive gains across post 1, 2 and 3 suggest that adherence consolidation occurs gradually, supporting the value of longitudinal reinforcement rather than single-session education.

Effect of the Educational Program on IBD Distress

The complete elimination of severe IBD distress by post 2 and the shift of the modal distress category from 'severe' to 'no distress' by post 3, represent the most clinically meaningful psychological finding of the study. At baseline, the psychosocial profile of the sample was severely burdened, with all patients reporting at least moderate distress a finding consistent with the known psychological sequelae of CD in settings where structured psychosocial support is unavailable [9,10].

The educational program's inclusion of dedicated sessions on psychological support, stress-reduction techniques and peer-support signposting addressed the cognitive and emotional dimensions of distress through knowledge acquisition and perceived control mechanisms central to stress-inoculation and self-efficacy theory [12]. Berding *et al.* [12] demonstrated in a prospective randomised controlled trial that an educational intervention significantly reduced emotional distress and improved coping self-efficacy in IBD patients, with large effect sizes at six months. Belei *et al.* [9] and Black *et al.* [10] further confirmed the bidirectional relationship between psychological stress and IBD disease activity, implying that distress reduction may itself contribute to clinical remission and reduced relapse frequency a potential downstream benefit not assessed in the present study but warranting future investigation.

Correlational Analysis

The significant negative correlations between dietary pattern and both medication adherence and IBD distress evident at baseline and strengthening progressively across post-intervention phases confirm that these three domains do not operate independently but form a mutually reinforcing triad of self-management behaviour. A patient who internalises disease-specific dietary knowledge is likely to develop greater overall health literacy and motivation, which carries over into more consistent medication-taking and lower psychological distress through reduced symptom burden and enhanced perceived control. These findings are consistent with Blunck *et al.* [11], Ali Ibrahim *et al.* [3] and Mekky *et al.* [23], all of whom reported significant intercorrelations among self-management behaviours and psychological outcomes in IBD populations. Mosli *et al.* [24] additionally demonstrated that multimorbidity in IBD patients driven in part by inadequate disease management potentiates psychological burden, suggesting that the dietary and adherence improvements observed in the present study may have a secondary protective effect on longer-term psychological health. The contrasting finding by Mules *et al.* [25], who reported no significant relationship between psychological activity scores and disease outcomes may reflect differences in instrument sensitivity, sample characteristics or the absence of an active educational component.

Sociodemographic Correlates

Sex was significantly associated with medication adherence during the remission phase ($p<0.05$), with female patients tending to demonstrate higher adherence a finding consistent with Mekky et al. [23] and Alkaraawi and Kadhim [26], who reported that female gender is a positive predictor of medication adherence in IBD. Educational level was significantly associated with dietary pattern and IBD distress ($p<0.001$): higher education was associated with better dietary behaviour and lower distress at post 3, suggesting that health literacy facilitates programme uptake and behaviour change. These findings are supported by Dibley *et al.* [11] and Ali Ibrahim *et al.* [15]. Age, occupation and area of residence were not significantly associated with the primary outcomes in this study, which may reflect the relative homogeneity of the sample or the equalising effect of the educational intervention across subgroups.

Strengths and Limitations

This study makes an original contribution by simultaneously assessing three clinically interrelated domains of CD self-management in a Middle Eastern population using internationally validated, disease-specific instruments with excellent reliability. The dietary recommendations made in the educational sessions including anti-inflammatory foods, low-residue options and nutritional supplements must be contextualised within the economic realities of patients in Erbil City. Many participants were students or unemployed and cost barriers to recommended foods represent a significant implementation challenge. Culturally adapted, locally available and affordable dietary substitutes should be incorporated into future educational materials The longitudinal four-phase design captures temporal trends in behaviour change that cross-sectional approaches cannot and the low of dropouts strengthens internal validity.

Important limitations must be acknowledged. The single-centre, convenience-sampling design restricts the generalisability of findings beyond comparable hospital-based settings. The absence of a concurrent randomised control group means that temporal trends cannot be definitively attributed to the intervention; natural disease course, regression to the mean and Hawthorne effects cannot be entirely excluded. The three-month follow-up period, while meaningful, does not capture long-term behaviour change and the self-report nature of all instruments introduces social desirability and recall bias. Future studies should employ randomised controlled designs with longer follow-up periods and multi-centre sampling to generate higher-level evidence for the effectiveness of nurse-led educational programs in CD management in Iraq.

CONCLUSIONS

In this preliminary quasi-experimental study without a concurrent control group, a structured, nurse-delivered educational program produced highly significant, progressive and sustained improvements in dietary pattern adherence, medication adherence and IBD-specific psychological distress among patients with Crohn's disease in Erbil City, Kurdistan Region of Iraq. Highly significant negative correlations among all three outcome domains at every assessment phase confirm the interconnected nature of self-management behaviour in this disease. These findings provide compelling evidence that integrating structured patient education into routine gastroenterological nursing care can substantially enhance the self-management capacity and well-being of CD patients in resource limited settings.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

- Structured educational programs addressing dietary pattern, medication adherence and psychological distress should be routinely integrated into the standard nursing care protocol of all gastroenterology departments in Erbil City and across the Kurdistan Region
- Purpose-designed, bilingual (Arabic and Kurdish) patient education booklets covering disease pathophysiology, dietary management, medication adherence strategies and psychological coping should be made available to all newly diagnosed IBD patients
- Dedicated training for gastroenterology nurses in IBD-specific patient education techniques should be incorporated into continuing professional development curricula at Hawler Medical University and affiliated teaching hospitals
- Future research should employ randomised controlled trial designs with multi-centre sampling, longer follow-up periods (≥12 months) and objective clinical outcome measures including disease activity indices, colonoscopic remission rates and biomarkers of inflammation to confirm and extend the findings of the present study

Ethical Approval and Consent to Participate

This manuscript was prepared and reported in accordance with the TREND Statement for non-randomised evaluations [27]; a completed checklist is available from the corresponding author on request. Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing, Hawler Medical University (Approval No. 2424; 22/08/2024). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrolment.

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