

Knowledge and Perceptions of Inflammatory Bowel Disease Relapse Triggers and Probiotic Therapy Among Medical Students and Physicians in Syria

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Abstract

Background: Inflammatory bowel disease requires long-term management, recognition of factors associated with relapse, and careful interpretation of adjunctive treatments. Medical trainees may understand general concepts while remaining uncertain about disease-specific details, including the contrasting association of smoking with Crohn disease and ulcerative colitis and the limited, strain-specific evidence for probiotics. This study assessed knowledge and perceptions of relapse-related factors, the gut microbiome, and probiotic therapy among medical students and physicians.

Methods: A descriptive cross-sectional survey was conducted among 160 participants comprising preclinical medical students, clinical-stage students, and specialist physicians. A structured online questionnaire collected educational characteristics, prior exposure to inflammatory bowel disease, agreement with five possible relapse-related factors, knowledge of smoking, perceived probiotic mechanisms and indications, curriculum coverage, and anticipated prescribing barriers. Frequencies, percentages, means, and Pearson chi-square tests were used. Statistical significance was set at $p < 0.05$.

Results: Gastrointestinal infections received the highest agreement as a relapse-related factor (69.4%; mean 3.71), followed by psychological stress (63.1%; mean 3.67) and medication nonadherence (58.1%; mean 3.52). Only 23.8% correctly identified the contrasting association of smoking with Crohn disease and ulcerative colitis. Half of participants recognized probiotics as adjunctive rather than replacement therapy, whereas 26.3% viewed them as a complete alternative in mild disease. Ulcerative colitis and pouchitis were selected as the best-supported indications by 32.9%. Inadequate curriculum coverage was reported by 75.6%. Academic stage was associated with perceptions of curriculum adequacy ($\chi^2 = 9.90$, $p = 0.042$), but not with self-rated knowledge, recognition of adjunctive use, or correct knowledge of smoking.

Conclusion: Participants showed greater familiarity with broad concepts than with clinically specific distinctions. The largest gaps concerned smoking, evidence-based indications for probiotics, and their position as adjunctive therapy. Focused teaching on IBD relapse prevention, interpretation of microbiome-directed therapies, and appraisal of strain-specific evidence may improve clinical preparedness.

Keywords: Inflammatory Bowel Disease, Clinical Relapse, Probiotics, Gut Microbiome, Medical Students, Medical Education

INTRODUCTION

Inflammatory bowel disease (IBD), principally Crohn disease and ulcerative colitis, follows a relapsing and remitting course and increasingly affects health systems worldwide [1, 2]. Although advances in biologic and small-molecule therapies have expanded treatment options, sustained remission still depends on appropriate maintenance therapy, monitoring, patient education, and recognition of factors that may accompany or precipitate symptom recurrence. Relapse is clinically important because repeated inflammatory activity contributes to corticosteroid exposure, hospitalization, surgery, and loss of quality of life.

The determinants of relapse are heterogeneous. Medication nonadherence is a preventable contributor to poor disease control, while smoking has different associations across the two major forms of IBD. Smoking is associated with a more complicated course in Crohn disease, whereas current smoking has historically shown an inverse association with ulcerative colitis; this epidemiologic observation does not make smoking a treatment and must be communicated without encouraging tobacco use [3-5]. Evidence concerning nonsteroidal anti-inflammatory drugs, antibiotics, diet, infection, and psychological stress is less uniform and depends on exposure, disease phenotype, outcome definition, and study design [3, 6]. Clinicians therefore need both broad awareness and an ability to distinguish strong evidence from plausible or context-dependent associations.

The intestinal microbiome has become central to contemporary explanations of IBD pathogenesis. Dysbiosis, impaired barrier function, altered microbial metabolites, and disturbed immune signaling interact with genetic and environmental factors [7, 8]. This has encouraged interest in probiotics as microbiome-directed interventions. However, probiotic effects are strain-specific and indication-specific. Major guidelines do not support routine probiotic use for Crohn disease and recommend caution in ulcerative colitis outside selected settings or clinical trials, while defined probiotic preparations may be considered for prevention of recurrent pouchitis in selected patients [9-11]. Probiotics should therefore be discussed as possible adjuncts rather than substitutes for established anti-inflammatory or immune-modifying therapy.

Surveys from several countries have found that medical and health-science students often hold positive attitudes toward probiotics but have uneven knowledge of definitions, strain specificity, clinical indications, and safety [12-15]. These gaps matter because future physicians will counsel patients who frequently encounter commercial claims that are broader than the supporting evidence. Evidence from the Syrian medical-education setting remains limited. This study assessed knowledge and perceptions among medical students and physicians concerning IBD relapse-related factors, smoking, the gut microbiome, and probiotics. It also examined whether academic stage and clinical exposure were associated with the measured responses.

Methods

Study Design and Participants

A descriptive-analytical cross-sectional survey was conducted during the 2025-2026 academic year. The study population included medical students in the preclinical stage (Years 1-3), students in the clinical stage (Years 4-6), and specialist physicians. Participants were recruited through convenience sampling, and the final sample comprised 160 respondents. The study was reported with reference to the principles of the STROBE statement for cross-sectional studies [16].

Questionnaire

Data were collected through a structured online questionnaire developed for the study. The instrument assessed educational characteristics, prior exposure to IBD, perceptions of relapse-related factors, knowledge of smoking, the gut microbiome, probiotic mechanisms and indications, curriculum coverage, and anticipated prescribing barriers. The first section recorded academic stage, previous academic study of IBD, and clinical contact with patients with IBD. Five items measured agreement with possible relapse-related factors on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Other items addressed the association of smoking with IBD, self-rated knowledge of probiotics and the microbiome, perceived mechanisms and clinical indications of probiotics, their position as adjunctive or alternative therapy, adequacy of curriculum coverage, and anticipated prescribing barriers. Multiple responses were permitted for mechanism and barrier items. An optional open-ended item invited additional comments. The questionnaire was designed to describe knowledge and perceptions rather than to diagnose competence or produce a validated global knowledge score. Accordingly, individual items and domains were analyzed separately. The answer identifying increased risk in Crohn disease and a possible protective association in ulcerative colitis was treated as the precise response to the smoking item. Recognition of ulcerative colitis and pouchitis was treated as the response most consistent with the comparative evidence presented in the project, and use alongside medication was treated as the appropriate therapeutic position of probiotics.

Statistical Analysis

Categorical variables were summarized as frequencies and percentages. Likert items were coded from 1 to 5 and summarized using arithmetic means and grouped proportions for agreement, neutrality, and disagreement. Pearson chi-square tests examined associations between categorical variables, including academic stage, clinical contact, self-rated knowledge, curriculum assessment, knowledge of smoking, and recognition of probiotics as adjunctive therapy. A two-sided p value below 0.05 was considered statistically significant. Available-case denominators were used for items with missing responses; therefore, denominators vary slightly across tables.

Ethical Considerations

Participation was voluntary. Responses were collected anonymously without personal identifiers, and the information was used only for scientific research. The survey formed part of a graduation research project at the Faculty of Medicine, Al-Sham Private University.

Results

Participant Characteristics

Of the 160 participants, 70 (44.0% of respondents with available academic-stage data) were in the clinical stage, 63 (39.6%) were in the preclinical stage, and 26 (16.4%) were specialist physicians. One participant did not report academic stage. Overall, 121 participants (75.7%) had previously studied IBD either in general or in detail, while 68 (42.5%) reported clinical contact with patients with IBD.

Table 1 Participant Educational Characteristics

Characteristic	Category	n	%
Academic stage (n = 159)	Preclinical Years 1-3	63	39.6
	Clinical Years 4-6	70	44.0
	Specialist physician	26	16.4
Previous academic study of IBD (n = 160)	General overview	63	39.4
	Detailed study	58	36.3
	No previous study	39	24.4
Clinical contact with patients with IBD (n = 160)	Yes	68	42.5
	No	92	57.5

Perceptions of Relapse Related Factors

Agreement was highest for gastrointestinal infections (69.4%; mean 3.71), psychological stress (63.1%; mean 3.67), and medication nonadherence (58.1%; mean 3.52). Approximately half agreed that broad-spectrum antibiotics (50.9%; mean 3.36) and nonsteroidal anti-inflammatory drugs (50.6%; mean 3.32) could contribute to relapse. These responses describe participants' perceptions and should not be interpreted as a ranking of causal strength because evidence for several environmental and medication-related exposures remains mixed.

Table 2 Agreement with Possible Relapse Related Factors

Factor	n	Mean	Agree %	Neutral %	Disagree %
Gastrointestinal infections	160	3.71	69.4	10.6	20.0
Psychological stress	160	3.67	63.1	17.5	19.4
Medication nonadherence	160	3.52	58.1	14.4	27.5
Broad-spectrum antibiotics	159	3.36	50.9	20.8	28.3
Nonsteroidal anti-inflammatory drugs	158	3.32	50.6	23.4	25.9

Knowledge of Smoking and Probiotic Therapy

Only 38 participants (23.8%) identified the contrasting association of smoking with Crohn disease and ulcerative colitis. Most respondents either believed that smoking increased relapse risk in both diseases (44.4%) or selected the reversed relationship (21.9%). Self-rated knowledge of probiotics and the microbiome was excellent in 18.2%, good in 28.3%, moderate in 28.9%, and poor in 24.5% of 159 respondents.

Participants most often selected enhancement of intestinal barrier function (58.1%) as a probiotic mechanism, followed by restoration of microbial balance (41.3%) and modulation of local immune

responses (40.0%). Direct elimination of pathogenic bacteria was selected by 17.5%, and 6.9% considered probiotics ineffective. Because the item allowed multiple answers, these percentages do not sum to 100%. Ulcerative colitis and pouchitis were identified as the best-supported indications by 52 of 158 respondents (32.9%). Half of the sample recognized probiotics as adjunctive therapy used with medication. However, 42 participants (26.3%) considered probiotics a complete alternative in mild cases, and 38 (23.8%) believed they should not be used with immunosuppressive drugs. Curriculum coverage was judged inadequate or incomplete by 121 participants (75.6%). The most frequently anticipated barriers were lack of standardized strains and doses (37.5%) and cost to the patient (37.5%), followed by insufficient evidence (32.5%) and concern about infection in immunosuppressed patients (30.0%).

Table 3 Main Knowledge and Perception Outcomes

Item	Response	n	%
Smoking and IBD (n = 160)	Higher risk in Crohn disease; possible protective association in ulcerative colitis	38	23.8
	Higher risk in both forms	71	44.4
	Reversed relationship	35	21.9
	No proven effect	16	10.0
Best-supported probiotic indication (n = 158)	Ulcerative colitis and pouchitis	52	32.9
	Equally effective in both forms	46	29.1
	Crohn disease only	31	19.6
	Neither form	29	18.4
Therapeutic position (n = 160)	Adjunctive therapy with medication	80	50.0
	Complete alternative in mild cases	42	26.3
	Should not be combined with immunosuppressive drugs	38	23.8
Curriculum coverage (n = 160)	Adequate	39	24.4
	Partial and needs more detail	65	40.6
	Very poor	56	35.0

Associations with Academic Stage and Clinical Exposure

Academic stage was associated with the three-category assessment of curriculum adequacy ($\chi^2 = 9.90$, $df = 4$, $p = 0.042$). The effect should be interpreted cautiously because the analysis was exploratory and involved several comparisons. No statistically significant association was observed between academic stage and self-rated probiotic knowledge, correct knowledge of smoking, or recognition of probiotics as

adjunctive therapy. Clinical contact with patients was not associated with self-rated knowledge. These findings indicate that measured responses did not improve consistently across educational stages in this sample; they do not establish that the curriculum caused the observed gaps.

Table 4 Chi Square Tests of Association

Variables	n	χ^2	df	p value	Interpretation
Curriculum adequacy × academic stage	159	9.90	4	0.042	Significant
Self-rated knowledge × academic stage	158	5.61	6	0.468	Not significant
Self-rated knowledge × clinical contact	159	4.97	3	0.174	Not significant
Adjunctive therapy response × academic stage	159	2.91	2	0.234	Not significant
Clinical contact × academic stage	159	1.13	2	0.568	Not significant
Correct smoking response × academic stage	159	0.68	2	0.711	Not significant

Discussion

This study found a consistent difference between familiarity with general ideas and knowledge of clinical details. Participants readily recognized infections, stress, and nonadherence as relevant to relapse, but fewer recognized the disease-specific association of smoking or the limited clinical role of probiotics. The results therefore identify specific teaching needs rather than a uniform absence of knowledge.

Recognition of medication nonadherence as a relapse-related concern was present in 58.1% of the sample. This proportion leaves room for improvement because maintenance therapy is central to sustained disease control. A recent systematic review found that nonadherence in IBD is shaped by treatment beliefs, adverse effects, access, regimen complexity, mood, and organizational difficulties, with estimates varying markedly according to the measurement method [17]. Education on relapse prevention should connect pharmacology with practical counseling about adherence and barriers to taking long-term medication.

Participants' responses concerning nonsteroidal anti-inflammatory drugs and antibiotics require nuanced interpretation. About half agreed that each could trigger relapse. Published evidence has not established a simple causal relationship applicable to all patients. Earlier reviews found heterogeneous results for nonsteroidal anti-inflammatory drugs, and associations may vary by dose, duration, compound, disease activity, and confounding by the condition for which the drug was taken [3, 6]. Antibiotics can alter the microbiome, but they are also used to treat infection and selected IBD complications. Teaching should therefore avoid categorical rules and explain the quality and limits of the evidence.

The smoking item revealed the clearest disease-specific gap. Only 23.8% selected the precise response, while 44.4% generalized increased risk to both Crohn disease and ulcerative colitis. The harmful effect of smoking in Crohn disease and the inverse epidemiologic association with ulcerative colitis are well described [4, 5]. The educational message must remain clinically safe: smoking should not be recommended for ulcerative colitis, and smoking cessation remains appropriate because of its substantial

overall health benefits. Students need to understand the contrasting association so they can interpret disease history and counsel patients accurately.

Knowledge concerning probiotics showed a similar pattern. More than half recognized enhancement of barrier function, and substantial proportions selected restoration of microbial balance or immune modulation. Yet only 32.9% chose ulcerative colitis and pouchitis as the most evidence-supported option, and only half correctly placed probiotics alongside established therapy. These findings agree with surveys in Pakistan, Indonesia, and Iran, where respondents often expressed favorable attitudes but showed uneven knowledge of clinical indications, product characteristics, and evidence [12-14]. A recent study comparing medical and dietetics students also found low overall knowledge and marked gaps in strain specificity and clinical application [15].

The misconception that probiotics can replace medication deserves attention. Probiotic preparations differ in organisms, combinations, doses, and manufacturing quality; findings for one preparation cannot automatically be applied to another. The 2020 American Gastroenterological Association guideline recommended probiotic use for ulcerative colitis only in the context of a clinical trial and made no recommendation supporting routine use in Crohn disease [9]. For recurrent antibiotic-responsive pouchitis, a later guideline conditionally suggested probiotics for prevention of recurrence, acknowledging low-certainty evidence and the need to consider feasibility and patient preference [10]. These recommendations support teaching probiotics as indication-specific adjuncts rather than a general alternative to immune-modifying treatment.

Randomized trials have reported potential benefits of specific probiotic preparations for inducing or maintaining remission in ulcerative colitis [18, 19]. Nevertheless, the AGA technical review emphasized that the evidence remains heterogeneous and preparation-specific, which precludes generalization across probiotic products [20].

Three quarters of respondents considered curriculum coverage incomplete or very poor. Academic stage was associated with the distribution of curriculum assessments, but measured knowledge did not differ significantly by academic stage or clinical contact. This pattern suggests that progression through training did not produce a clear improvement in the topics captured by this questionnaire. Because the study was cross-sectional and used convenience sampling, it cannot determine how individual knowledge changes over time or attribute the findings to a particular curriculum component. The result nevertheless supports focused integration of microbiome science, evidence appraisal, and patient counseling into gastroenterology and pharmacology teaching.

The study has practical strengths. It included learners at preclinical and clinical stages as well as specialist physicians, and it examined both commonly discussed relapse-related factors and the therapeutic interpretation of probiotics. It also separated self-rated knowledge from responses to specific clinical questions. These features made it possible to identify where confidence and factual precision did not align.

Limitations

Several limitations should guide interpretation. Convenience sampling limits representativeness, and the sampling frame and response rate were unavailable. The questionnaire was developed for this project and was not presented as a fully validated knowledge scale. Some items assessed perceptions of exposures for which the clinical evidence is heterogeneous, and self-rated knowledge may not correspond to objective competence. Multiple-response items did not distinguish partial from complete understanding. The sample contained relatively few specialist physicians, and small amounts of item-level missing data produced

varying denominators. Several exploratory chi-square tests were performed without adjustment for multiple comparisons. Finally, the cross-sectional design cannot establish causality or individual learning across academic stages.

Conclusion

Medical students and physicians in this survey were more familiar with broad concepts related to IBD relapse and probiotic mechanisms than with disease-specific clinical distinctions. Knowledge was particularly limited regarding the contrasting association of smoking with Crohn disease and ulcerative colitis, the evidence-supported indications for probiotics, and their role alongside established therapy. Medical teaching should present relapse-related factors according to the strength of evidence, clarify that probiotic effects are strain-specific and indication-specific, and reinforce that microbiome-directed products do not replace standard IBD treatment. Larger multicenter studies using validated instruments are needed to determine whether these gaps persist across institutions and training levels.

Author Contributions

Sidra Zeinab: Conceptualization, data collection, and manuscript preparation. Rasha Al-Darwish and Safa Al-Hamada: Data collection, literature review, and manuscript revision. Nada Al-Shalabi: Supervision, methodology, and critical review of the manuscript. All authors reviewed and approved the final manuscript.

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Data Availability

The data supporting the findings are available from the corresponding author on reasonable request, subject to institutional and ethical requirements.

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