# ORIGINAL RESEARCH—CLINICAL

Food-Related Quality of Life Is Impaired in Latinx and Non-Latinx Patients With Inflammatory Bowel Disease

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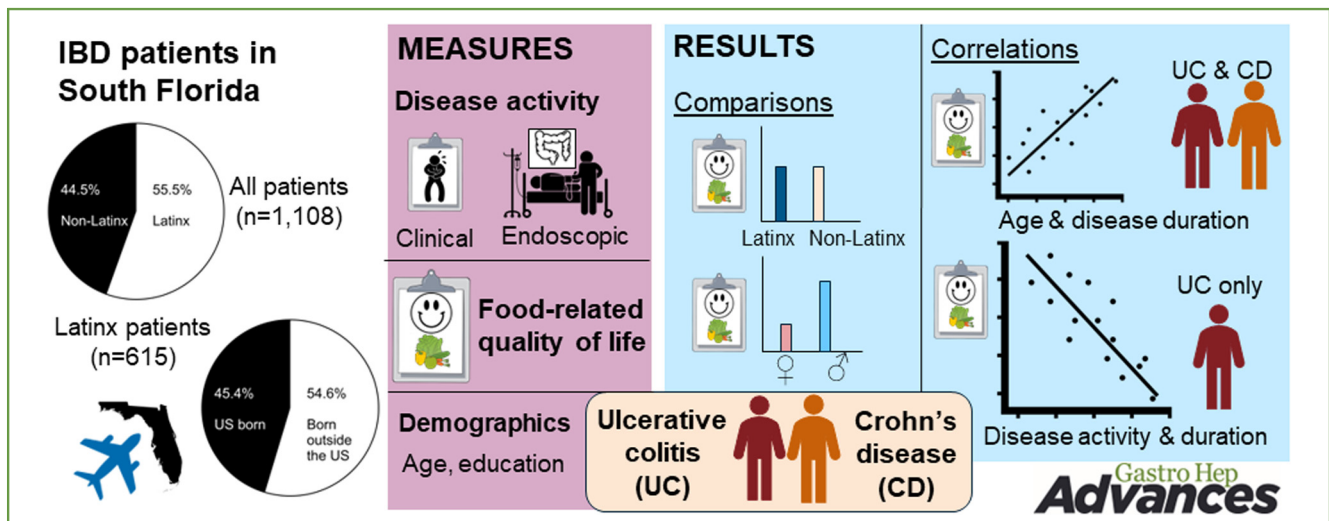
BACKGROUND AND AIMS: Anxiety over food choices and symptoms related to food consumption diminish quality of life (QoL) in inflammatory bowel disease (IBD) patients. However, the specific factors that impact QoL among IBD patients remain unclear. In this study, we analyzed the relationships of demographic and disease factors with food-related QoL (FRQoL) in a large, diverse US cohort of IBD patients. **METHODS:** In this cross-sectional analysis of 1108 IBD patients aged ≥18 years, we measured FRQoL with the 29-item Food-Related Quality of Life Questionnaire (FR-QoL-29) and disease activity with the Harvey-Bradshaw index in Crohn's disease (CD) patients or the Simple Clinical Colitis Activity Index in ulcerative colitis (UC) patients. Latinx immigrants completed a Spanish translation of the FR-QoL-29. A subset of patients had colonoscopy and inflammatory marker data available. We used univariate, multivariate, and subgroup analyses to examine the factors that influence FRQoL. **RESULTS:** In our cohort, 55% of IBD patients self-identified as Latinx. Latinx and non-Latinx patients had similar FR-QoL-29 scores. Female patients had significantly lower FRQoL than male patients ($P = .001$). Increasing age and IBD duration correlated with higher FRQoL ($P < .0001$). In UC patients, higher Simple Clinical Colitis Activity Index scores ($P < .0001$), higher Mayo scores ($P = .0009$), and longer disease duration ($P = .03$) predicted significantly lower FRQoL. Disease activity and FRQoL were not significantly related in CD patients. **CONCLUSION:** This is the largest study to date to examine FRQoL in American IBD patients, and the first to include Latinx patients. Disease-related factors had a greater impact on FRQoL than ethnicity. Clinical and endoscopic disease activity had a more detrimental impact on FRQoL in UC than in CD. Diet intervention studies are needed to alleviate symptoms and improve FRQoL in the IBD population.

Keywords: Food-Related Quality of Life; FR-QoL-29; Ulcerative Colitis; Crohn's Disease; Latinx

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Most current article

Introduction

Inflammatory bowel disease (IBD) has a high prevalence in the Western world, and the incidence of this disease is rising in developing countries,[1] particularly those in Latin America.[2] Management of IBD is complex and often requires providers to be well versed in treatment options as well as the psychosocial impacts of these diseases on the quality of life (QoL) of patients.[3,4]

Studies on psychosocial impacts of IBD and their effect on patients' QoL have demonstrated that mental health significantly influences hospitalization rates and response to biologics.[3,4] Recently, researchers have explored social determinants of health, finding that they can improve or worsen patient outcomes, such as disease activity, number of hospitalizations, and postoperative complications; thus, socioeconomic and demographic factors such as food security, financial constraints, and the ability to afford care should be assessed to predict patient outcomes. For example, the US, Latinx patients with IBD may have worse outcomes due to social disparities given the high prevalence of social disparities, especially food insecurity, among Latinx patients.[5,6]

Food choices and diet have been linked to the risk of IBD[7] and to flares of the disease.[8,9] A diet that is high in animal fat and animal meat has been associated with an increased risk of ulcerative colitis (UC), while a diet low in fiber has been associated with the development of Crohn's disease (CD).[9,10] Patients with IBD often avoid foods that they perceive as aggravating symptoms, in addition to seeking dietary counseling from healthcare providers.[7,11] Food has an important psychosocial influence: food enjoyment serves as a source of pleasure, meals facilitate social interactions with family and friends, and food choices reflect social or cultural belonging. Deprivation of food due to unavailability, cost, healthcare provider advice, or disease can negatively impact the QoL of patients.[12] Thus, exploring the relationship between food and QoL (eg, identifying specific foods that improve or worsen symptoms) and implementing interventions along with diet changes can improve the overall care of patients with IBD.

The psychosocial impact of food and the enjoyment derived from eating and drinking are encompassed by the term "food-related quality of life" (FRQoL). The 29-item Food-Related Quality of Life Questionnaire (FR-QoL-29) is a 29-item questionnaire that was designed to measure FRQoL specifically in people with IBD. Higher scores reflect better QoL.[13] Impairments in FRQoL have been reported in people with IBD in the United Kingdom,[8,12] Australia,[13] Turkey,[14] and New Zealand,[15] with mean scores considerably lower than those of healthy volunteers.[16] There are 3 major issues regarding evidence of impaired FRQoL (as measured with the FR-QoL-29) in patients with IBD. First, some studies have shown that impaired FRQoL is linked to symptoms and disease activity;[8,12] however, IBD symptoms and disease activity were measured using subjective scoring indices rather than objective markers. Second, only 1 study has measured FRQoL among patients with IBD in the United

States, including only 95 patients.[17] Third, no studies have applied the FR-QoL-29 in Latinx populations. Cultural differences in diet and the perceived importance of food as therapy may lead to important differences in the FRQoL of Latinx patients, especially those who have immigrated from Latin America to the United States.

Therefore, the aims of our study are (1) to measure FRQoL in a diverse, Latinx cohort of patients with IBD living in the United States and (2) to investigate factors that may impact FRQoL, such as disease activity, ethnicity, and country of birth. We also aimed to validate a Spanish version of the FR-QoL-29. Our results demonstrate that IBD type and clinical manifestations have a greater impact on the FRQoL of patients than ethnicity or country of origin. Our findings further demonstrate that the FR-QoL-29 captures the same experience in Latinx patients with IBD and encourage wider use of the FR-QoL-29 in Spanish-speaking patients.

Methods

Patient Recruitment and Study Design

This cross-sectional study recruited patients with IBD from 2 specialist units in Miami, Florida: the Crohn's and Colitis Center of the University of Miami and GastroHealth, a private gastroenterology clinic. Patients were recruited from 2018 to 2021 and asked to complete the FR-QoL-29 as part of the data collected for the "University of Miami IBD Center Clinical Phenotype Database and Tissue Repository." All patients provided informed consent before participating. The study was approved by the University of Miami Institutional Review Board (IRB20081100). Patients completed the FR-QoL-29 upon first agreeing to contribute to our biorepository and during their follow-up visits.

The inclusion criteria for the present study were as follows: aged ≥18 years, had completed the FR-QoL-29 at least once, and had a confirmed diagnosis of IBD (either CD or UC), with either active or quiescent disease. The diagnosis of IBD was confirmed according to American College of Gastroenterology guidelines[18,19] by review of medical charts including notes as well as laboratory, endoscopic, and histologic assessments. The exclusion criteria were as follows: unable to provide informed consent, unable to read and complete the questionnaires, or receiving enteral nutrition.

Sociodemographic and Clinical Variables

At the time of enrollment, patients completed a questionnaire that collected sociodemographic information (age, sex, ethnicity, smoking status, educational attainment, country of birth, and years since immigration). These data were stored in REDCap (https://www.project-redcap.org/). If participants spoke only Spanish, they were provided with a Spanish version of the sociodemographic and other questionnaires. Clinical data were also collected on the history of bowel resection surgeries, IBD medications, and body mass index of patients. For patients with UC, disease extent and the Simple Clinical Colitis Activity Index (SCCAI) were recorded. For patients with CD, Montreal classification and the Harvey-Bradshaw index (HBI) were recorded. The HBI and the SCCAI served as subjective measures of disease activity and were recorded prospectively during clinic visits.

Laboratory and endoscopic data were collected by reviewing patients' electronic health records. Complete blood count, complete metabolic panel, C-reactive protein (CRP) levels, and iron study data (including iron, ferritin, and vitamin D levels) were recorded if these measurements were performed within 3 months of FR-QoL-29 completion (before or after). Objective measures of disease activity included fecal calprotectin levels (if measured within 1 month of FR-QoL-29 completion) and endoscopic assessments (if performed within 6 months of FR-QoL-29 completion). We extracted the Simple Endoscopic Score for Crohn's Disease (SESCD) for patients with CD and the endoscopic Mayo score for patients with UC patients from the endoscopy reports (Provation).

Food-Related Quality of Life Questionnaire

The FR-QoL-29 is a validated tool that consists of 29 items rated on a Likert scale from 1 to 5 (1 = *strongly agree*, 2 = *agree*, 3 = *neither agree nor disagree*, 4 = *disagree*, and 5 = *strongly disagree*). The total score, calculated by summing all item scores, ranges from 29 to 145, with higher scores indicating better FRQoL. Healthy individuals have a mean FR-QoL-29 total score of 123.[16] The FR-QoL-29 was based on qualitative interviews focusing on the psychosocial aspects of eating and drinking in patients with IBD and is used to detect poor FRQoL.[16]

A Spanish version of the FR-QoL-29 was developed in the present study by a native Spanish-speaking physician certified for translating medical terms into Spanish. The validity of the Spanish version (FR-QoL-29-Spanish) was assessed by comparing FR-QoL-29-English scores of Latinx patients who spoke English with FR-QoL-29-Spanish scores of Latinx patients who were native Spanish speakers. We assessed the validity of the FR-QoL-29-Spanish using the FACTOR procedure in SAS version 9.4 (SAS Institute Inc, Cary, NC) after conducting Bartlett's test of sphericity and the Kaiser-Meyer-Olkin test of sampling adequacy to ensure that the test assumptions were met. These methods were previously used to assess the validity of a Turkish version of the FR-QoL-29.[14]

Statistical Analysis

Statistical analyses were performed using SAS. Levels of sociodemographic variables were grouped to create dichotomous categorical values for analyses. If patients had more than 1 value for a parameter, the value used was the one closest to the date of FR-QoL-29 completion.

Univariate analyses (Student's *t*-tests and Pearson's correlations) were performed to examine relationships of sociodemographic variables and IBD clinical characteristics with FR-QoL-29 total scores. Bonferroni correction was applied to adjust for multiple comparisons.

Multivariable linear regression analysis was used to identify independent factors associated with FR-QoL-29 total scores (the continuous outcome variable). UC and CD patients were analyzed separately. All sociodemographic and clinical variables were introduced into the model with FR-QoL-29 total scores as the outcome variable. Dummy variables were created for categorical variables. Each regression analysis conducted had at least 10 to 15 participants per variable analyzed. *P* values <.05 were considered statistically significant. R^2 values were used to evaluate the total variance in FR-QoL-29 scores among IBD patients explained by all the independent variables in our models.

Subgroup analyses (Pearson's correlation analyses with Bonferroni correction) were carried out to examine the relationships of laboratory parameters and endoscopic scores with FR-QoL-29 scores. If the percentage of missing data was less than 6% of the total, the analyses were not altered, and complete cases were used. If no more than 10% of data was missing, we used simple imputation to perform the analyses.[20] If there were large amounts of missing data (more than 10%), we performed subgroup analysis. All subgroup analyses involved analyses conducted solely within CD or UC patients.

Results

More than Half of Patients with IBD in South Florida Identify as Latinx

A total of 1108 patients were included in the study. The mean age of all participants was 39.8 years (standard deviation [SD]: 15.6), and there were 549 (49.6%) men. More patients had CD (n = 637, 57.5%) than UC (n = 460, 41.5%). A few patients had indeterminate colitis (n = 11, 1%). Most patients were White (n = 967, 87.3%); 58 patients (5.2%) self-identified as Black. More than half of the patients (n = 615, 55.5%) identified as Latinx, of whom 336 (54.6%) were born outside the United States and had spent a mean of 26.4 years in the United States (SD: 14.9). The mean age at immigration to the United States was 20 years (SD: 13.6). The prevalence of UC was far higher in Latinx patients than in non-Latinx patients (*P* < .00001). Further details regarding the demographic and clinical characteristics of participants are shown in Table 1.

Spanish and English Versions of the FR-QoL-29 Yield Similar Results

As we aimed to validate the FR-QoL-29-Spanish, we first compared data from participants who completed the questionnaire in Spanish (n = 97, 9.2% of all participants) with data from participants who completed the questionnaire in English (n = 961, 90.8%). The 2 groups did not significantly differ in FR-QoL-29 total scores (English: 81.1 [SD: 28] vs Spanish: 81.5 [SD: 32.2]; *P* = .9).

Next, we conducted Bartlett's test of sphericity and the Kaiser-Meyer-Olkin test of sampling adequacy to assess the suitability of these data for factor analysis. We assessed internal consistency with Cronbach's alpha coefficient; the raw result was 0.97 and the standardized result was 0.97. These results further confirmed the lack of difference between answers on the FR-QoL-29 provided in Spanish vs English. Thus, in subsequent analyses, we pooled FR-QoL-29 scores regardless of the language in which it was completed.

Age, Sex, Disease Duration, and SCCAI Values are Associated With FRQoL Among Patients With IBD

We investigated factors that may predict FRQoL among IBD patients. First, we conducted univariate analyses to identify simple associations of sociodemographic and clinical variables with FR-QoL-29 scores. Women had

Table 1. Patient Demographic Characteristics by IBD Type

Variables	All (N = 1108)	CD (N = 637)	UC (N = 460)	IC (N = 11)
Age, mean (SD)	39.8 (15.6)	37.6 (14.8)	42.5 (16.1)	48.1 (16.5)
Age at diagnosis, mean (SD)	28.2 (14.4)	25 (12.8)	32.5 (15.3)	34.5 (13)
Duration of disease, mean (SD)	11.5 (11)	12.5 (11.8)	10 (9.7)	13.5 (11.8)
Female sex	559 (50.5)	314 (56.2)	238 (42.6)	7 (63.6)
BMI (kg/m^2), mean (SD)	25.7 (5.6)	25.4 (5.3)	26 (6)	26.6 (6.3)
Race				
White	967 (87.3)	553 (86.8)	403 (87.6)	11 (100)
Black	58 (5.2)	44 (6.9)	14 (3)	0
Asian	16 (1.4)	6 (1)	10 (2.2)	0
Multiracial	46 (4.2)	23 (3.6)	23 (5)	0
Native American	1 (0.1)	0 (0)	1 (0.2)	0
Did not answer	20 (1.8)	11 (1.7)	9 (2)	0
Ethnicity				
Latinx	615 (55.5)	347 (54.5)	263 (57.2)	5 (45.5)
Non-Latinx	493 (44.5)	290 (45.5)	197 (42.8)	6 (54.5)
Smoking status				
Never	862 (79.4)	510 (81.3)	345 (76.8)	7 (63.6)
Current	50 (4.6)	39 (6.2)	11 (2.5)	0
Former	174 (16)	78 (12.4)	93 (20.7)	4 (36.4)
Educational attainment				
Less than high school	44 (4)	29 (4.6)	15 (3.3)	0
High school	331 (30)	195 (30.8)	136 (29.6)	0
Technical school	19 (1.7)	10 (1.6)	9 (2)	11 (100)
College	615 (55.7)	347 (54.7)	257 (55.9)	0
Advanced degree	54 (4.9)	25 (3.9)	29 (6.3)	0
CD: Disease location				
Ileal (L1)	–	224 (35.4)	–	–
Colonic (L2)	–	97 (15.3)	–	–
Ileocolonic (L3)	–	305 (48.2)	–	–
CD: Montreal classification				
Inflammatory (B1)	–	358 (56.6)	–	–
Stricturing (B2)	–	174 (27.5)	–	–
Penetrating (B3)	–	97 (15.3)	–	–
CD: Disease activity				
HBI, mean (95% CI)	–	5.4 (2.1–8.7)	–	–
UC: Disease extent				
Proctitis (E1)	–	–	24 (5.2)	–
Left-sided (E2)	–	–	130 (28.3)	–
Pancolitis (E3)	–	–	15 (3.3)	–
UC: Disease activity				
SCCAI, mean (95% CI)	–	–	2.9 (2.6–3.2)	–
History of surgeries				
Small bowel resection	230 (21)	213 (92.6)	15 (6.5)	0
Large bowel resection	–	51 (23.9)	2 (13.3)	1 (9.1)
Ileocolonic resection	–	30 (14)	10 (66.7)	1 (9.1)
Perianal fistula only	–	119 (55.9)	1 (6.7)	0
Ileostomy only	–	3 (1.4)	–	1 (9.1)

Values are presented as the count (N) and percentage unless otherwise specified. Note that all levels of a category may not sum to the group sample size due to missing data.

BMI, body mass index; CD, Crohn's disease, IBD, inflammatory bowel disease; IC, indeterminate colitis; SCCAI, Simple Clinical Colitis Activity Index; UC, ulcerative colitis.

significantly lower FR-QoL-29 scores (79.1, 95% confidence interval [CI]: 76.7–81.5) than men (84.7, 95% CI: 82.3–87.1) (P = .001). Additionally, patients visiting the private clinic (GastroHealth) had higher FR-QoL-29 scores (87.5, 95% CI: 84.2–90.7) than patients visiting the public clinic (University of Miami) (80.4, 95% CI: 77.7–83.1) (P = .0009). At baseline, there were no significant differences in FR-QoL-29 scores between CD and UC patients, between Latinx and non-Latinx patients, or between foreign-born and US-born patients. Similarly, smoking status, educational attainment, and history of surgery were not associated with FR-QoL-29 scores (Table 2). However, age (r = 0.12, P < .0001) and

Table 2. Clinic and Sex Influence FR-QoL-29 Scores

Comparison	FR-QoL-29 score Mean (95% CI)	P value
CD (n = 637) vs UC (n = 460)[a]	81.8 (79.6–83.9) 82.0 (79.2–84.7)	.9
University of Miami (n = 765) vs GastroHealth (n = 343)	80.4 (77.7–83.1) 87.5 (84.2–90.7)	**.0009**
Female (n = 559) vs male (n = 549)	79.1 (76. 7–81.5) 84.7 (82.3–87.1)	**.001**
Foreign born (n = 423) vs US born (n = 685)	81.8 (78.9–84.6) 81.9 (79.8–84)	.9
Latinx (n = 615) vs non-Latinx (n = 493)	81.6 (79.3–83.9) 82.1 (79.5–84.7)	.8
College or above (n = 669) vs High school or below (n = 375)	81.8 (79.6–83.9) 81.2 (78.3–84.1)	.8
Surgery (n = 230) vs no surgery (n = 878)	80.0 (76.5–83.6) 82.3 (80.3–84.2)	.3
Nonsmokers vs smokers	81.9 (79.9–83.8) 82.9 (79.1–86.7)	.6

Comparisons of FR-QoL-29 scores between levels of categorical variables are shown, with P values derived from Student's t-tests. Significant values are indicated in bold. Sample sizes reflect the number of participants with available data for each variable.
CD, Crohn's disease; FR-QoL-29, 29-item Food-Related Quality of Life Questionnaire; UC, ulcerative colitis.
[a]The 11 patients with indeterminate colitis were not included in this comparison.

IBD duration (r = 0.17, $P < .0001$) were positively associated with FR-QoL-29 scores; in other words, older age and longer duration since diagnosis with IBD were associated with improved FRQoL.

Second, we conducted correlation analyses to examine the impact of clinical manifestations of disease activity on FRQoL. We performed these analyses separately for each type of disease (UC and CD) as the validated subjective measures of disease activity differ for the 2 IBD types (HBI and SCCAI, respectively). SCCAI values had a stronger negative correlation with FR-QoL-29 scores (r = −0.44, $P < .0001$) than HBI values (r = −0.08, $P = .03$) (Table 3).

Table 3. Age, Disease Duration, and UC Activity Are Correlated With FR-QoL-29 Scores

Variables	R	P value
Age (n = 1108)	**0.12**	**<.0001**
Age at diagnosis (n = 1108)	0.01	.71
Duration of disease (n = 1108)	**0.16**	**<.0001**
BMI (n = 1099)	0.06	.02
UC: Disease extent (n = 459)	−0.1	.02
CD: HBI (n = 598)	−0.08	.03
UC: SCCAI (n = 424)	**−0.44**	**<.0001**

Correlations of continuous and ordinal variables with FR-QoL-29 scores are shown. Significant values are indicated in bold. Sample sizes reflect the number of participants with available data for each variable.
BMI, body mass index; CD, Crohn's disease; HBI, Harvey-Bradshaw index; SCCAI, Simple Clinical Colitis Activity Index; UC, ulcerative colitis.

Given the significant findings of univariate analyses, we applied multivariable regression analyses to better assess the independence of these relationships. We constructed 2 multivariable regression models: 1 for UC patients and 1 for CD patients. In UC patients, FR-QoL-29 scores had a significant negative association with SCCAI values ($\beta = −4.35$, $P < .0001$) and significant positive associations with left-sided disease ($\beta = 7.09$, $P = .02$) and disease duration ($\beta = 0.41$, $P = .01$) (Figure 1). Patients with left-sided UC had an FR-QoL-29 score that was 7.09 points higher than that of patients with extensive UC.

In CD patients, FR-QoL-29 scores were positively associated with disease duration ($\beta = 0.39$, $P = .003$) and male sex ($\beta = 8.39$, $P < .001$) (Figure 2). Notably, no subjective or objective measures of disease activity were significantly associated with FR-QoL-29 scores. These results suggest that UC symptoms have a greater impact on FRQoL than CD symptoms.

Endoscopic Scores are Associated with FRQoL in UC but not in CD

Finally, we examined objective markers of disease activity in the subgroup of patients with available laboratory or endoscopic data. First, we analyzed inflammatory markers (CRP and fecal calprotectin) as well as surrogate indicators of disease activity (platelet count, hemoglobin, iron, ferritin, vitamin D, white blood cells, and albumin). In CD patients, FR-QoL-29 scores were significantly associated with hemoglobin (r = 0.24, $P < .0001$), platelets (r = −0.25, $P < .0001$), and iron levels (r = 0.2, $P = .001$). CRP and fecal calprotectin had a negative association with FR-QoL-29
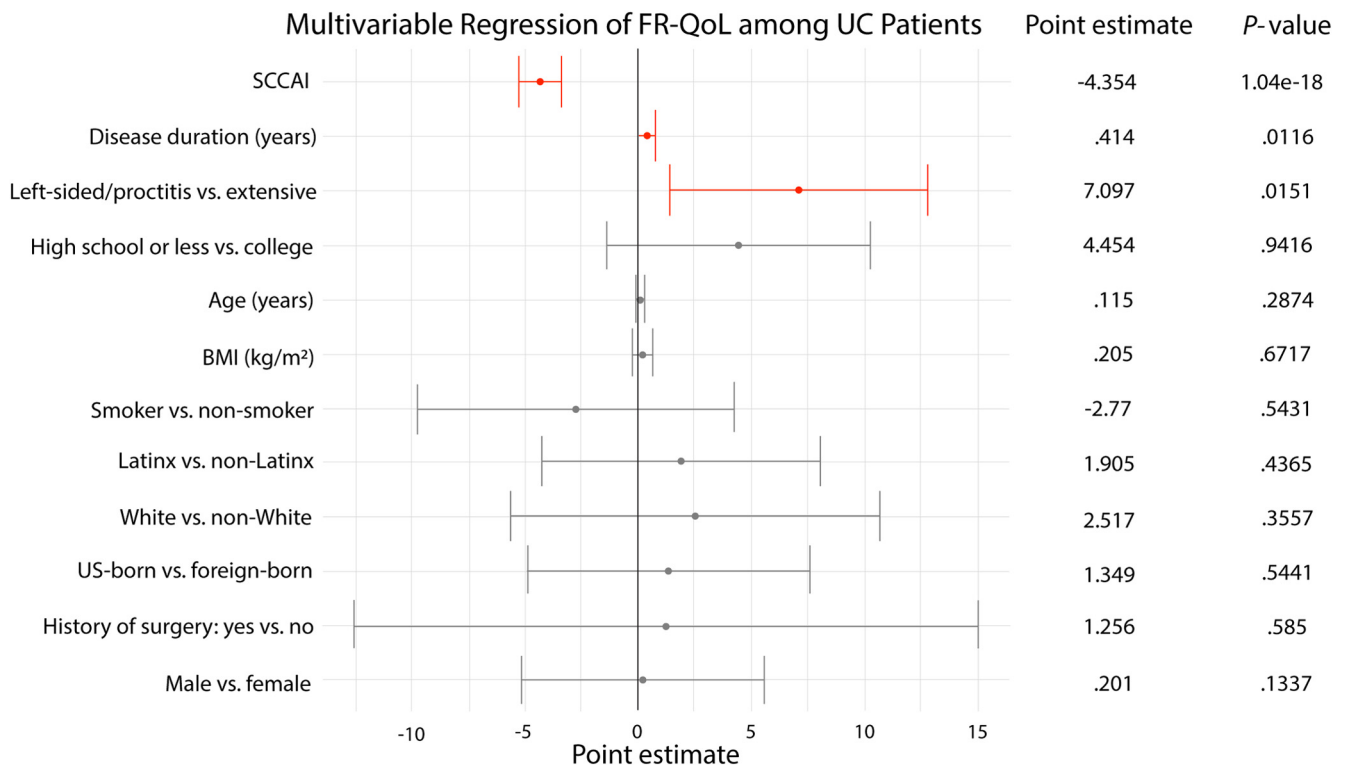
Figure 1. SCCAI, disease duration, and disease extent significantly predict FRQoL in UC patients (n = 379). Multivariable regression analysis results are shown as point estimates and *P* values for each variable; significant predictors are shown in red. The model explained 22% of the variability in FR-QoL-29 scores among patients with UC. Data from patients with IC were excluded from this analysis. BMI, body mass index; FR-QoL-29, 29-item Food-Related Quality of Life Questionnaire; SCCAI, Simple Clinical Colitis Activity Index; UC, ulcerative colitis.

scores that approached significance (Table 4). In UC patients, FR-QoL-29 scores were only associated with platelet count (r = −0.22, P = .001).

Second, we analyzed endoscopy findings from colonoscopies performed within 6 months of FR-QoL-29 completion. These data were available for 182 UC patients and 205 CD patients. We conducted a multivariate analysis comparing each level of disease classification to all other levels for a given variable (eg, Montreal B1 patients were compared to all non-B1 patients). In UC patients, the endoscopic Mayo score was negatively correlated with FR-QoL-29 scores (r = −0.25, P = .0009) (Table 4). However, in CD patients, there was no significant correlation between SESCD and FR-QoL-29 scores (r = −0.05, P = .47) (Table 4). These data corroborate the results of the subjective measures and demonstrate that active inflammation impacts FRQoL in UC patients more than in CD patients.

Discussion

In people with IBD, FRQoL is highly important[7]; however, few studies of FRQoL have been conducted in the United States, and none have been conducted in Latinx and/or Spanish-speaking populations. Moreover, the relationship between FR-QoL-29 scores and objective markers of disease activity has not been evaluated. In the present investigation,

we conducted a large cross-sectional study of FRQoL in a unique cohort of IBD patients who were mainly Latinx and had a high proportion of immigrants. We showed that FR-QoL-29 scores of IBD patients did not differ if they completed a Spanish version of the instrument instead of the English version, suggesting that our translated version is valid for use in Spanish-speaking patients. Although many of the patients who identified themselves as Latinx spoke English as well as Spanish, a sizeable proportion of the Latinx population (8.8%) was not comfortable speaking or reading in English. Indeed, 21.3% of the 400 immigrants included in the study felt more comfortable completing the questionnaire in Spanish. We did not find any differences in FRQoL between Latinx and non-Latinx patients regardless of immigration status. These data support the use of the FR-QoL-29 in patients who identify as Latinx and/or primarily speak Spanish; this instrument could be useful for clinicians who see patients who do not feel comfortable reading or speaking English.

The mean FR-QoL-29 total scores in the present study are similar to those in previous studies in IBD patients;[8,12–14] as expected, they are lower than those from healthy individuals.[16] The mean FR-QoL-29 score of our patients was 81.9 (SD: 28.9), which is below the threshold thought to reflect normal FRQoL (FR-QoL-29 score of 123).[13] Our results also suggest that ethnicity and
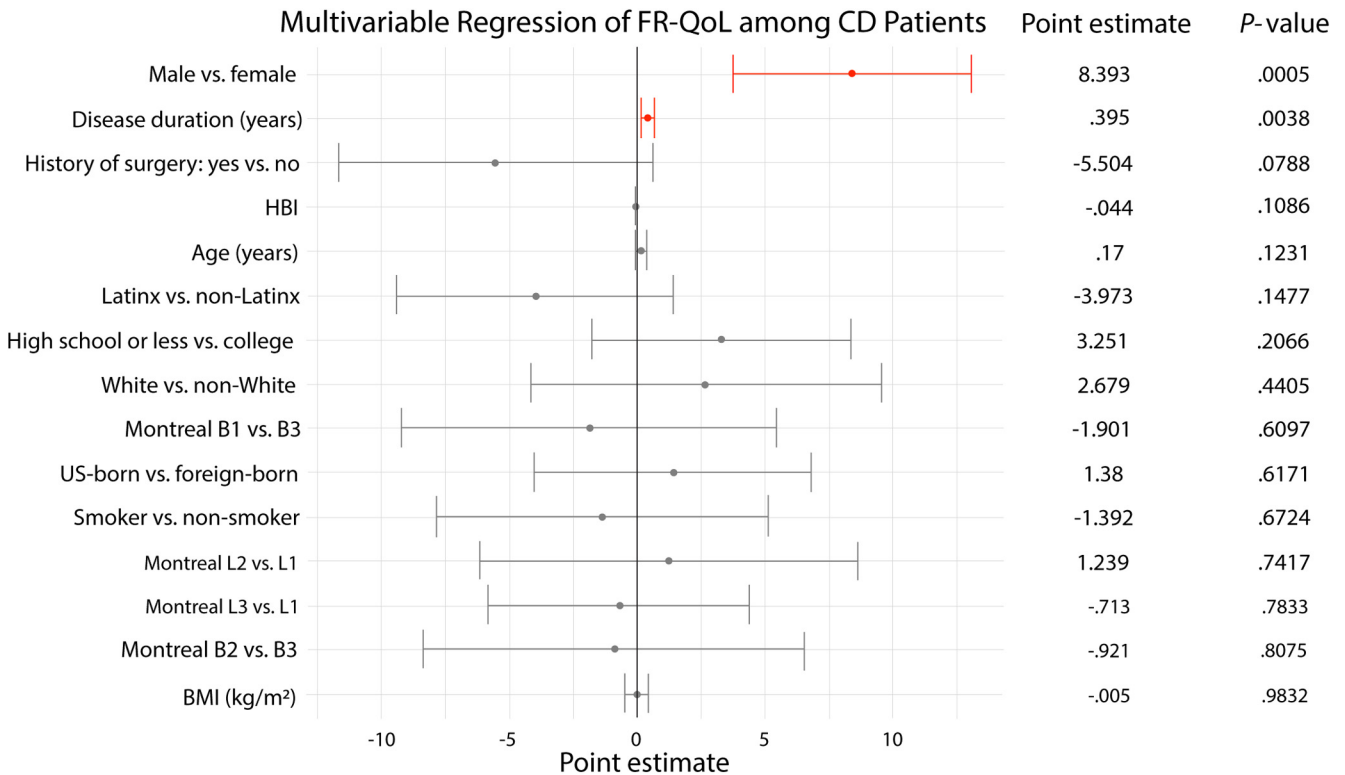
Figure 2. Sex and disease duration significantly predict FRQoL in CD patients (n = 529). Multivariable regression analysis results are shown as point estimates and *P* values for each variable; significant predictors are shown in red. The model explained 5% of the variability in FR-QoL-29 scores among patients with CD. Data from patients with IC were excluded from this analysis. BMI, body mass index; CD, Crohn's disease; FR-QoL-29, 29-item Food-Related Quality of Life Questionnaire; HBI, Harvey-Bradshaw index.

immigration status do not impact FRQoL, whereas age and disease duration mitigate the impact of IBD on FRQoL. We did not find any differences in mean FR-QoL-29 scores between CD and UC patients, in contrast to previous studies.[8,12] Interestingly, IBD patients recruited from a community-based private gastroenterology center (Gastro-Health) had numerically higher FR-QoL-29 scores than those recruited from a tertiary IBD center. We speculate that this is due to referral bias, which is inherent in tertiary care centers; in other words, patients who are referred to tertiary centers are more likely to have more severe disease. Another interesting finding is the positive relationship between FRQoL and disease duration in both UC and CD patients. Patients who have had IBD for a longer time have greater experience dealing with the disease; they may have developed adaptive coping mechanisms to improve their QoL or have been provided with more clinical support, such as by dieticians.

Previous studies have shown that FRQoL is related to disease activity in IBD patients. A large study demonstrated that greater frequency of disease flares was associated with poorer FRQoL.[8] Several other studies analyzed CD and UC patients together when examining the impact of clinical disease activity.[13,17] In the present study, we analyzed CD and UC patients separately, showing that poorer FRQoL is associated with greater disease activity in UC patients

(SCCAI values) but not in CD patients (HBI values). Furthermore, we included a subset of patients who had recently undergone endoscopy. We found that FR-QoL-29 scores were negatively correlated with endoscopic Mayo scores in UC patients but were not correlated with SESCD values in CD patients. These 2 findings are novel. Regarding disease extent, we found a positive association of left-sided UC with FR-QoL-29 scores; however, we did not find any associations of FR-QoL-29 scores with any categories of Montreal classification in patients with CD.

Our finding of an inverse relationship between endoscopic findings and FRQoL in UC patients but not CD patients is not surprising given the poor correlation between clinical disease activity and endoscopic inflammation previously reported in CD patients.[21–24] Interestingly, although FR-QoL-29 scores were not correlated with the endoscopic findings in CD patients, they were positively correlated with hemoglobin and iron levels. We are the first to show that although objective measures of inflammation (endoscopic assessments and overt clinical symptoms) are not correlated with FRQoL in patients with CD, other parameters of active disease (eg, anemia) are associated with FRQoL. These other parameters may represent a way to identify patients who are likely to need medical and nutritional optimization. The stronger negative association between FR-QoL-29 scores and SCCAI values in UC patients is likely due

Table 4. Subgroup Analyses of Laboratory Data and Endoscopy Scores

Ulcerative colitis	R	P value
Blood parameters		
WBC (n = 196)	−0.12	.08
Hemoglobin (n = 196)	0.07	.29
Platelets (n = 195)	**−0.22**	**.001**
Iron (n = 183)	0.21	.003
Ferritin (n = 183)	0.13	.06
Albumin (n = 195)	0.11	.11
Vitamin D (n = 176)	−0.09	.2
CRP (n = 155)	−0.07	.36
Fecal parameters		
Calprotectin (n = 77)	−0.28	.01
Endoscopic parameters		
EMS (n = 182)	**−0.24**	**.0009**
Crohn's disease	**R**	**P value**
Blood parameters		
WBC (n = 288)	−0.17	.003
Hemoglobin (n = 288)	**0.24**	**< .0001**
Platelets (n = 287)	**−0.24**	**< .0001**
Iron (n = 264)	**0.2**	**.001**
Ferritin (n = 265)	0.03	.55
Albumin (n = 285)	0.02	.65
Vitamin D (n = 263)	0.12	.04
CRP (n = 229)	−0.15	.01
Fecal parameters		
Calprotectin (n = 120)	−0.22	.01
Endoscopic parameters		
SESCD total (n = 205)	−0.05	.47

Reported values reflect correlations (Spearman or Pearson) of each variable listed with FR-QoL-29 scores. Significant values are indicated in bold. Sample sizes reflect the number of participants with available data for each variable. Data from IC patients were excluded from these analyses. CRP, C-reactive protein; EMS, endoscopic Mayo score; SESCD, Simple Endoscopic Score for Crohn's Disease; WBC, white blood cells.

to the more immediate relationship of eating with bowel movements and urgency in patients with UC.[25,26] As intended, the FR-QoL-29 provides insight into the impact of eating, perceived food enjoyment, and QoL in patients with IBD.

Interestingly, we did not find any associations between FRQoL and ethnicity (Latinx vs non-Latinx), even in first-generation immigrants. This suggests that there is a similar impact of IBD on FRQoL despite potential differences in diet and cultural perceptions of food, highlighting the robustness of the FR-QoL-29. The findings may be explained by a few factors. First, Latinx immigrants often adopt a Western diet after immigrating to the United States.[27] Second, in other studies, we have found that some Latinx patients with IBD exhibit a milder disease phenotype; thus, they may experience less of an impact of IBD on FRQoL than non-Latinx White patients with IBD.[28] Differences in disease phenotype may complicate the interpretation of these results.

Our findings raise the question of whether poor FRQoL may stem from comorbid psychiatric and functional bowel symptoms rather than active inflammation in patients with CD. Indeed, patients with CD are more likely to have symptoms consistent with irritable bowel syndrome (IBS) than patients with UC[29] and have higher risks of anxiety and depression.[30] Patients with quiescent disease but experiencing functional symptoms were previously shown to have impaired FRQoL.[12] This finding may also explain why female patients in our study had lower FRQoL than male patients, aligning with previous studies:[8] women are more likely to have at least 1 IBS component, anxiety, and depression than men.[31,32] These parameters were not measured in the present study. However, many beliefs, behaviors, and associations regarding food and nutrition exhibit gender differences; therefore, we cannot rule out an independent association of poorer FRQoL with women among patients with IBD.

Our study has several strengths. First, our study is the largest to measure FRQoL among patients with IBD in the United States to date. Second, our patients represent a unique IBD population, with a high proportion of Latinx patients as well as first-generation immigrants. Third, in addition to subjective clinical disease activity indices, our study is the first to include robust laboratory and endoscopic data from a large number of patients when evaluating the relationship between FRQoL and disease activity.

Our study also has several limitations. Its cross-sectional design prevents inference of causality in the relationships between the variables of interest and FRQoL; thus, we describe our findings in terms of associations only. A number of patients did not have complete laboratory and endoscopic data collected within the set time frame, precluding their incorporation into the multivariable model for analysis. Finally, we did not administer any psychometric surveys, nor did we document any comorbid psychiatric or functional gastrointestinal diagnoses. Thus, we could not explore the potential confounding effects of these variables on FRQoL.

Conclusion

In summary, our study further validates the use of the FR-QoL-29 in a wide swath of American patients with IBD, including those of Latinx descent. We developed and validated a Spanish version of the FR-QoL-29 that can benefit other researchers and clinicians, allowing the assessment of patients who do not feel comfortable reading in English. We found associations of demographic and clinical characteristics with FRQoL in IBD patients. Importantly, active IBD (especially UC) has a detrimental impact on FRQoL. Our research underscores the need for diet intervention studies that alleviate inflammation and improve FRQoL. The ultimate goal is to improve the QoL of people with IBD while achieving mucosal healing.

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Chunsu Jiang: Conceptualization, study design, data collection, data interpretation, and manuscript writing. Gala Godoy-Brewer: Study design, data collection, and manuscript writing. Andres Rodriguez: Data collection and manuscript revision. Erica Graff: Data collection and manuscript revision. Maria Alejandra Quintero: Supervision and manuscript revision. James Leavitt: Data collection and manuscript revision. Joanna Lopez: Data collection and manuscript revision. David S. Goldberg: Methodology, supervision, and manuscript revision. Oriana M. Damas: Supervision and manuscript revision. Kevin Whelan: Conceptualization, study design, supervision, data interpretation, and manuscript revision. Maria T. Abreu: Conceptualization, study design, supervision, data interpretation, manuscript writing, and manuscript revision.

Conflicts of Interest:
These authors disclose the following: Maria T. Abreu has been a consultant or advisory board member for AbbVie Inc, Alimentiv Inc, Amgen, Bristol Myers Squibb, Celsius Therapeutics, Eli Lilly and Company, Gilead Sciences, Janssen Pharmaceuticals, Materia Prima, and Pfizer Pharmaceutical. She has been a teacher, lecturer, or speaker for Janssen Pharmaceuticals and Takeda Pharmaceuticals. She has received funding from The Leona M. and Harry B. Helmsley Charitable Trust. Kevin Whelan has received IBD research funding from charities including Crohn's and Colitis UK, ForCrohns, The Leona M. and Harry B. Helmsley Charitable Trust, and the Kenneth Rainin Foundation. He is the co-inventor of a device measuring volatile organic compounds used in the diagnosis and management of IBS. He is the license holder for the FR-QoL-29 and FR-QoL-29-Spanish. Oriana M. Damas has received research support from Pfizer as well as consulting fees from Pfizer Pharmaceutical, Janssen Pharmaceuticals, and AbbVie Inc. Andres Rodriguez has received prior research support from Takeda Pharmaceuticals, has served on the advisory board of the GI Health Foundation, and has received honoraria from the American Board of Internal Medicine for committee work. The remaining authors disclose no conflicts.

Ethical Statement:
All patients provided informed consent before participating. The study was approved by the University of Miami Institutional Review Board (IRB20081100).

Data Transparency Statement:
Individual participant data will not be shared.

Reporting Guidelines:
STROBE.