Chronic Diarrhea and Constipation are More Common in Depressed Individuals

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Abstract

Background & Aims: Depression is a major health issue in the United States and is highly comorbid with gastrointestinal conditions. We collected data from the National Health and Nutrition Examination Survey (NHANES), a representative sample of the US population, to study the relationship between depression and bowel habits.

Methods: Using data from the NHANES (2009–2010), we identified 495 depressed and 4709 non-depressed adults who filled out the Bowel Health Questionnaire. Depression was defined according to a validated questionnaire. We used multivariable analysis, controlling for clinical and demographic variables, to evaluate the relationship between mood and bowel habits.

Results: In our weighed sample, 24.6% of depressed individuals and 12.6% of non-depressed individuals reported disordered bowel habits. Chronic diarrhea was significantly more prevalent in depressed individuals (15.53%; 95% CI, 11.34%–20.90%) than non-depressed individuals (6.05%; 95% CI, 5.24%–6.98%; P=.0001). Chronic constipation was also more common in depressed individuals (9.10%; 95% CI, 7.02%–11.69%) than non-depressed individuals (6.55%; 95% CI, 5.55%–7.70% CI; P=.003). Mean depression scores in patients with chronic diarrhea (4.9±5.8) and with chronic constipation (4.4±4.93) were significantly higher than mean depression scores for individuals with normal bowel habits (3.2±4.6) (P<.001). Moderate and severe depression were significantly associated with chronic diarrhea but not chronic constipation. Only mild depression was significantly associated with chronic constipation.

Conclusions: In an analysis of the NHANES database, we found a higher proportion of depressed individuals to have chronic diarrhea and constipation than non-depressed individuals; chronic diarrhea was more strongly associated with depression. Our findings provide support for

Disclosures: None

the relationship between mood and specific bowel habits, accounting for multiple co-variables in a large sample of the general US population.

Keywords

psychology; GI; irritable bowel syndrome; IBS; IBD

Introduction

Depression is a common comorbidity of many gastrointestinal disorders. For example, Irritable Bowel Syndrome (IBS) and Inflammatory Bowel Disease (IBD) are both associated with significantly higher rates and severity of depression in the general population[1–3] and up to 50% of patients with IBS[4,5] and 15–25% of patients with IBD[6,7] meet criteria for depression in clinical settings. Similarly, patients with diagnosed depression report significantly more frequent gastrointestinal symptoms compared to individuals without depression[8], with bowel-related symptoms highly associated with depression severity scores[9].

Although the relationship between mood and gastrointestinal comorbidities has been well established, there is less data evaluating the relationship between mood and specific bowel habits (i.e. constipation or diarrhea). There are two large, population-based studies evaluating factors associated with either diarrhea or constipation. One, in the United States, evaluated diarrhea in the general population and found depression to be a significant predictor of chronic diarrhea[10]. The other, in Iran, evaluated factors associated with chronic constipation and found depression to be significantly associated[11]. In addition, there are two meta-analyses evaluating depression in IBS subtypes. One found that both IBS-C and IBS-D were associated with higher levels of depression compared to controls[12], while the other only found this to be true for IBS-D[13].

Previous studies have suggested that mood may impact intestinal transit, with depression hypothesized to increase intestinal transit (IT) and anxiety to decrease IT. For example, in a sample of 21 psychiatric outpatients and 21 controls, Gorard et al found that whole gut transit (WGT) and orocaecal transit times were shorter in anxiety patients compared to patients with depression and healthy controls and that depression scores were significantly correlated with WGT[14]. Another small study similarly found that IT was faster in patients with anxiety and slower in patients with depression compared to controls[15]. More recently, a study of 110 outpatients with functional gastrointestinal disorders reported that depression, but not anxiety, was significantly associated with delayed transit[16]. However, these studies are limited by small sample sizes and high potential for selection bias.

To-date, there are no large, population-based studies evaluating mood in both constipation and diarrhea assessing both stool consistency and frequency as well as adjusting for other possible confounding variables such as diet and exercise. Therefore, the current research study aims to investigate the relationship between depression and bowel habit, controlling for clinical and demographic factors, in a representative sample of the United States population using the National Health and Nutrition Examination Survey (NHANES).

Methods

Study Cohort

Data was extracted from the 2009–2010 National Health and Nutrition Examination Survey (NHANES) dataset. The NHANES offers a publically-available, nationally representative sample of non-institutionalized individuals in the United States. The NHANES survey program is conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control (Atlanta, GA, USA). Participants are selected using stratified multistage probability design with oversampling of certain ethnic and age groups in order to allow for sample-weighted inference to the U.S. population. All participants provide written informed consent prior to completing the NHANES and there are no patient identifiers in the publicly available NHANES database.

Participants in the NHANES 2009–2010 database were included in this study if they completed the bowel health questionnaire and were 20 years of age or older. Individuals with self-reported history of inflammatory bowel disease, celiac disease, and/or colon cancer were excluded from the analysis.

Bowel Health Questionnaire and Mood Questionnaires

Subjects were considered to have chronic diarrhea or Chronic Constipation based on their responses to The Bowel Health Questionnaire. This questionnaire was completed using a Computer-Assisted Personal Interview (CAPI) System in a Mobile Examination Center (MEC) Interview Room. Participants were shown a card with colored pictures and descriptions of the seven Bristol Stool Form Scale types (BSFS; Type 1-Type 7) and asked to 'Please look at this card and tell me the number that corresponds with your usual or most common stool type.' Consistent with previous research ([10,17,18]), chronic constipation was defined as a usual or most common stool type of BSFS Type 1 (separate hard lumps, like nuts) or Type 2 (sausage-like, but lumpy) and chronic diarrhea was defined as a usual or most common stool type of BSFS Type 6 (fluffy pieces with ragged edges, a mushy stool) or Type 7 (watery, no solid pieces). Remaining subjects were classified as having normal bowel habits.

Depression Screener from the 2009–2010 NHANES was used to identify individuals with depression. This screener consisted of the Patient Health Questionnaire 9 (PHQ-9), which is a 9-item validated, and publicly available depression questionnaire[19]. The PHQ-9 asks about symptoms of depression on a 4 point scale ("0"=not at all; "3"=nearly every day) over the past 2 weeks with scores ranging from 0–27. A clinical cutoff score of 10 or higher on the PHQ-9, which has a sensitivity and specificity of 88% in the detection of major depression[19], was used to identify subjects with depression. The following, validated depression severity cutoff scores were also analyzed: a total score of 0–4 was identified as "no depression", 5–9 was identified as "mild depression", 10–14 as "moderate depression" and   15 as "moderately severe to severe"[19]

Co-variables

A number of co-variables were evaluated as factors hypothesized or previously shown to associate with chronic diarrhea and/or chronic constipation and depression and/or anxiety[20]. Calculations of adjusted risk ratios were performed following calculations of unadjusted risk ratios for all variables.

The co-variables included in this study included: gender, age (decade), race (white), higher education, living above poverty income threshold, SSRI use, laxative use, obese BMI, vigorous physical activity, heavy/moderate alcohol drinker, high caffeine intake, frequent milk intake, highest quartile fiber intake, highest quartile liquid intake, highest quartile carbohydrates intake, highest quartile sugar intake, highest quartile protein intake, highest quartile fat intake, and total number of reported medical comorbidities. Age was divided into groups by decade (20–29, 30–30, 40–49, 50–59, 60–69, and ≥70 years old). Race/ethnicity categories were Non-Hispanic White, Non-Hispanic Black, Hispanic, and other race/ethnicity (including multi-racial). Education levels were "less than high school", "high school or GED", or "greater than high school". Poverty income ratio was grouped as less than two or greater than or equal to two. SSRI use was classified as "yes/no" based on participant report. Patients were considered laxative users if they reported having taken a laxative in the past 30 days. BMI classifications were normal (BMI less than 25.0), overweight (BMI from 25.0 to 29.9), and obese (BMI greater than or equal to 30). Vigorous physical activity was classified as 'vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously.' Alcohol intake was divided into six categories: never drink, former drinker, rare drinker, light drinker, moderate drinker, and heavy drinker. Milk intake was divided into four categories: never consume, rarely consume (less than once a week), sometimes consume (once a week or more, but less than once a day), and often consume (once a day or more). Gram values from all other dietary intake parameters were obtained from the first day of the 24-hour dietary recall period and divided into quartiles based on previous literature[20]. Finally, total number of medical comorbidities was calculated based on responses to the Medical Conditions Questionnaire. This questionnaire asks about asthma, anemia, psoriasis, arthritis, gout, congenital heart failure, coronary heart disease, angina, heart attack, stroke, emphysema, thyroid problems, chronic bronchitis, liver conditions, and cancer. We calculated a total sum of these 15 comorbidities for each respondent.

As mentioned above, Selective Serotonin Reuptake Inhibitors (SSRIs; n=41 with chronic diarrhea and n=33 with chronic constipation) were included in our analyses. Due to very low numbers taking antidepressants, we were not able to control for Tricyclic Antidepressants (TCAs; n=6 with chronic diarrhea and n=3 with chronic constipation) or Serotonin and Norepinephrine Reuptake Inhibitors (SNRIs; n=8 with chronic diarrhea and 4 with chronic constipation). Similarly, there were very low numbers of respondents taking other medications that may impact bowel function (e.g. anticholinergics n=17) and, therefore, we did not control for these medications either.

Statistics

Differences between patients with and without depression within stool consistency categories (BSFS 1 & 2 for chronic constipation, BSFS 3, 4, & 5 for normal bowel habits, and BSFS 6 & 7 for chronic diarrhea) were first evaluated for statistical significance. Subsequently, log-binomial models provided mutually adjusted estimates of risk ratios (RRs) for chronic constipation and chronic diarrhea using our pre-defined co-variables. Both unadjusted and adjusted risk ratios were determined. The unadjusted regressions observed the association between the level of depression with chronic diarrhea or chronic constipation without accounting for co-variables, while adjusted regressions provided these associations balancing for all other factors. Adjusted RRs were evaluated for statistical significance against a value of 1.0. Wald Tests were used to test for differences between depression severity risk ratios. All CIs reported were 95% CIs. Chi-square analysis and ANOVA were used to detect statistically significant differences among groups. When ANOVA was employed, p-values from post-hoc analyses were reported based on the Bonferroni correction method. P values of 0.05 were considered to indicate statistically significant differences.

Estimates, association measures, and standard errors were all calculated with sampling weights to account for the complex nature of the NHANES database's survey design. Statistical analyses were performed using STATA statistical software version 14.2 (College Station, TX, U.S.A.).

Results

A total of 5,160 subjects completed the Bowel Health Questionnaire and met our eligibility criteria (age > 20 and did not report a history of Inflammatory Bowel Disease or Celiac). Of these, there were 491 depressed and 4,669 non-depressed.

In our weighted sample, 24.33% (19.57%–29.81% CI) of depressed subjects and 12.54% (11.17%–14.07% CI) of non-depressed subjects reported disordered bowel habits (p<0.0001). We found that chronic diarrhea was significantly more prevalent in depressed individuals (15.13%, 10.83%–20.73% CI) than in non-depressed individuals (5.96%, 5.12% –6.93% CI; p = 0.0001). Chronic constipation was also more common in depressed individuals (9.20%, 7.11%–11.82% CI) than non-depressed (6.58%, 5.59%–7.74% CI; p = 0.003, Figure 1).

There were no significant differences in percent reporting suicidal ideation (based on item 9 of the PHQ-9) between chronic constipation (5.6%) and chronic diarrhea (4.9%). Only chronic constipation was significantly more likely to report suicidal ideation when compared to normal bowels habits (2.7%, p=0.036).

Univariate analysis

Figure 2 shows the percentage of chronic constipation, chronic diarrhea, and normal bowel habits in each depression severity subgroup. Of the individuals who reported no depression, 5.70% had chronic diarrhea and 5.69% had chronic constipation.

Unadjusted risk ratios for each depression severity category are presented in Tables 1 and 2. Individuals without depression were half as likely to have chronic diarrhea or chronic constipation as individuals with any level of reported depression (mild, moderate, or moderately severe to severe).

Multivariable analysis

In multivariable analysis, controlling for co-variables detailed above, "moderate" and "moderately severe to severe" depression independently predicted chronic diarrhea. (Table 1) Only "mild" depression severity was a significant predictor of chronic constipation in adjusted analyses, while moderate and moderate-severe were not (Table 2).

Discussion

This is the first study to evaluate the relationship between depression and bowel habits (constipation, diarrhea, and normal) in a nationally representative adult sample in the United States. In this sample, 24.3% of patients with depression reported disordered bowel habits, compared to 12.5% of those without depression. Chronic diarrhea was present in nearly 16% of individuals with depression and chronic constipation was present in 9% of depressed patients.

In this study, depression severity was significantly associated with chronic diarrhea (controlling for SSRI use), with more severe depression predicting higher likelihood of diarrhea. Surprisingly, this was not true for chronic constipation (only mild depression was associated with constipation). This finding is in contrast to previous studies evaluating bowel transit times in anxiety and depression in which depression was associated with slower bowel transit[14–16,21]. However, those studies were limited by small sample sizes and high potential for selection bias. Our findings are consistent with previous studies that have found depression to be associated with both diarrhea and constipation[12,13,20].

The association between depression and gastrointestinal symptoms is often attributed to two main factors: the burden of chronic illness and dysfunction in the brain-gut axis. Living with chronic illness, regardless of the diagnosis, is known to cause significant physical and emotional distress. In a large population-based analysis[22] and a recent systemic review and meta-analysis[23], it was reported that individuals who suffered from one or more chronic medical conditions were found to have an increased risk of major depression, with 45% greater odds of having a depressive disorder with each additional medical diagnosis[23]. Likewise, patients with depression are estimated to have two- to three-fold more medical symptoms compared to controls without depression[24]. The relationship between chronic illness and emotional distress has been described as multifaceted, with patients perceiving the relationship between mood and physical health as causal, cyclical, or unrelated[25].

The relationship between mood and gastrointestinal disorders is unique from other chronic illnesses due to the significant interplay between the central nervous system and the gastrointestinal tract, also known as the brain-gut axis. For example, studies of neuronal stress pathways have found that the corticotropin-releasing factor (CRF) in the brain plays a significant role in mediating the relationship between emotional distress and changes in both

upper and lower GI motor function[26,27]. In functional GI disorders, such as IBS, functional dyspepsia, and chronic constipation or diarrhea, dysfunction of the autonomic nervous system, which acts directly on CRF, may play a role in alteration in bowel habits and gastric emptying[28]. Similarly, depression is associated with hyperactivity of CRF neuronal pathways[29] and CRF receptors have been suggested as a possible treatment target for both depression and GI disorders[30,31]. It is possible that consistent activation of the stress pathways mentioned above may lead to dysfunction in the brain-gut axis, making depressed patients more susceptible to symptoms such as chronic diarrhea or chronic constipation.

Given the significant overlap between altered bowel habits and mood, it is important for clinicians treating patients with chronic GI conditions to be prepared to screen for concerns regarding low mood and to refer to appropriate general mental health or health psychology services. Psychogastroenterology is a growing subspecialty field of health psychology with a range of evidence-based treatment options to address the complicated interplay between mood, stress, and gastrointestinal health[32–34]. These therapies are typically short-term and problem-focused interventions (such as Cognitive Behavioral Therapy or gut-focused hypnotherapy) that are distinct from traditional psychotherapy treatments for depression or anxiety.

Psychogastroenterology interventions have been shown to have direct effects on gastrointestinal symptoms independent of their effects on mood or quality of life[35,36], presumably by promoting improvements in the brain-gut axis. However, per Rome guidelines, most studies evaluating psychogastroenterology interventions have used global symptom improvement scales as their primary outcomes and have not reported the effects of these interventions on specific bowel habits. One study evaluating Cognitive Behavioral Therapy (CBT) and despipramine, a tricyclic antidepressant, for IBS reported that CBT was equally effective in treating constipation and diarrhea predominant IBS, but did not report any statistical tests regarding bowel habits[37]. There have also been several studies evaluating gut-focused hypnotherapy, which have indicated improvements in both diarrhea and constipation after treatment[36]. There is a need for additional research regarding the specific impact of psychogastroenterology treatment on bowel function and mood in order to further understand the complex relationship between depression and bowel habits.

There were several limitations to this study. First, although there are many benefits to using a large, nationally representative database such as the NHANES, there are inherent limitations of these databases such as their cross-sectional nature and risk of recall bias in self-reported data. Second, this study only reported most common stool consistency and did not assess other gastrointestinal symptoms such as abdominal pain. Therefore, it was not possible to identify individuals who would meet criteria for IBS. Third, we approximated 'chronicity' based on the wording of the Bowel Health Questionnaire, which inquired about respondents' "usual or most common" stool type. Thus, we cannot be sure that respondents met Rome criteria for chronic constipation or diarrhea. Lastly, there was no available data about rates or severity of anxiety in this patient population and, therefore, we are unable to compare our data about bowel habits in depression with anxiety, which is also significantly associated with gastrointestinal conditions.

In summary, this is the first study to use a nationally representative sample of the United States to evaluate the relationship between depression and disordered bowel habits, including both diarrhea and constipation. We found that both constipation and diarrhea were more common in depressed than non-depressed individuals. Moderate and severe depression were significant predictors of diarrhea, but not constipation. Only mild depression was a significant predictor of constipation.

Acknowledgments

Abbreviations:

NHANES	National Health and Nutrition Examination Survey
IBS	Irritable Bowel Syndrome
IBD	Inflammatory Bowel Disease
NCHS	National Center for Health Statistics
CAPI	Computer-Assisted Personal Interview
MEC	Mobile Examination Center
BSFS	Bristol Stool Form Scale
PHQ-9	Patient Health Questionnaire 9

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Need to Know

Background:

Many patients with gastrointestinal conditions have depression. We evaluate the relationship between depression and bowel habits using a representative sample of the United States population.

Findings:

In our weighed sample, 24.6% of depressed individuals and 12.6% of non-depressed individuals reported disordered bowel habits. Significantly higher proportions of depressed individuals had chronic diarrhea (15.5%) and constipation (9.1%) than non-depressed individuals (6.1% and 6.6%).

Implications for patient care:

Given the significant overlap between altered bowel habits and mood, it is important for clinicians treating patients with chronic gastrointestinal disorders to screen for mood disorders and to refer patients to appropriate mental health or psychology services.
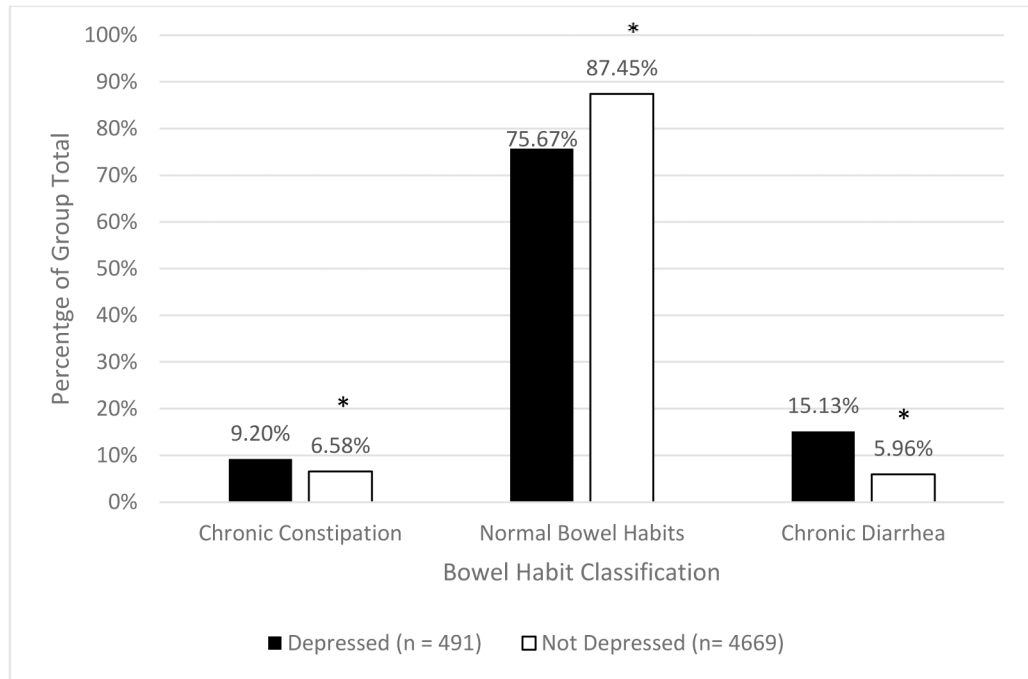
Figure 1.
Percentages of depressed and non-depressed individuals with chronic constipation, normal bowel habits, and chronic diarrhea.
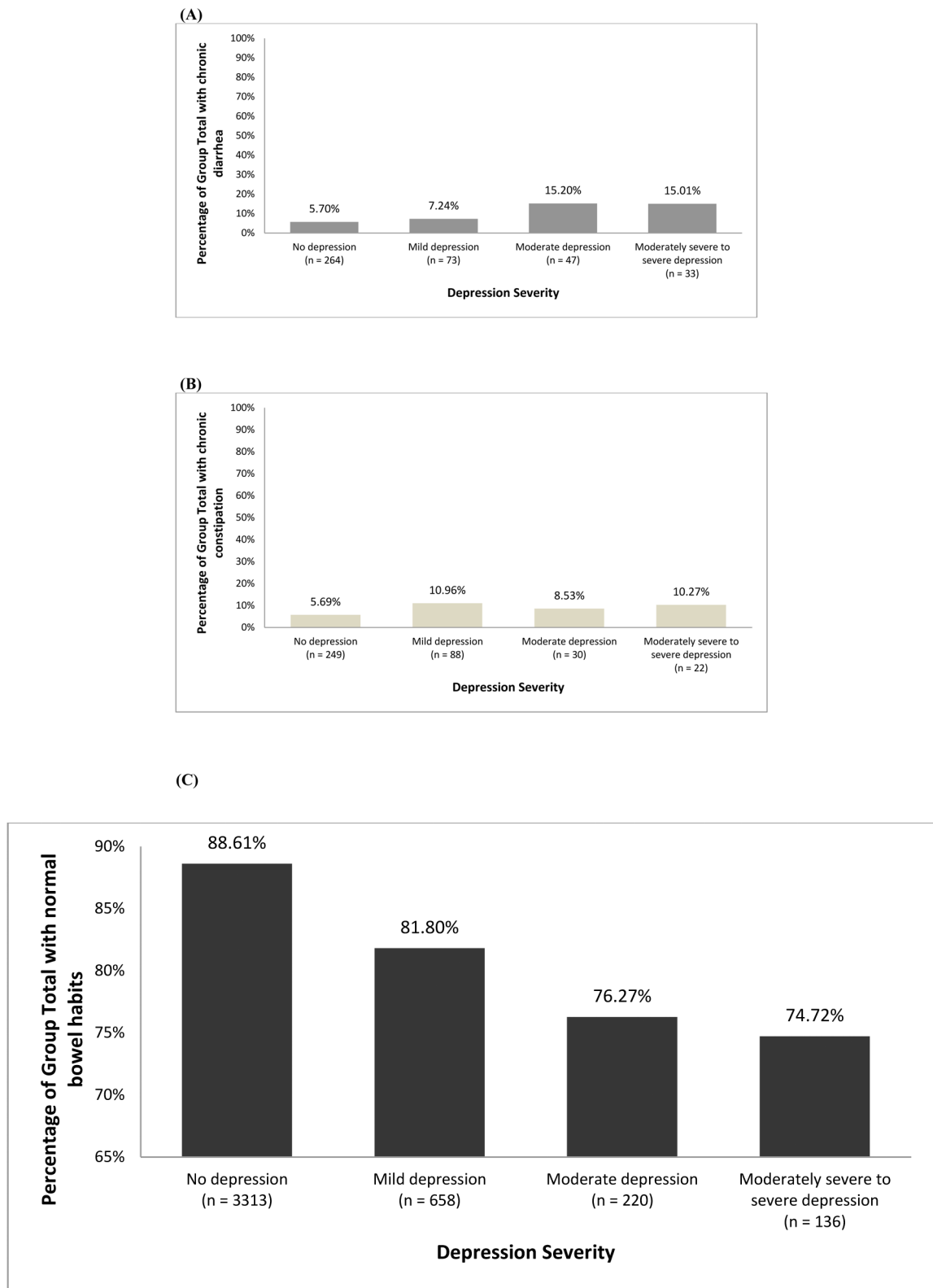
(A)

(B)

(C)

Figure 2.

Weighed percentage of population with (A) chronic diarrhea according to depression severity (B) chronic constipation according to depression severity and (C) normal bowel habits according to depression severity

Table 1.

Univariate and Multivariable analyses predicting chronic diarrhea

Depression Severity	Univariate analyses				Multivariable analyses			
	Unadjusted RR	Unadjusted 95% Cl		Unadjusted p-value	Adjusted RR[*]	Adjusted 95% Cl		Adjusted p-value
None	0.55	.36	.85	0.010	Omitted	Omitted		Omitted
Mild	1.29	.81	2.05	0.258	1.21	0.79	1.88	0.347
Moderate	2.97	1.67	5.26	0.001	3.05	1.59	5.85	**0.002**[*]
Moderately severe to severe	2.92	1.68	5.08	0.001	2.30	1.21	4.37	**0.014**[*]

[*] Multivariable analysis controlling for the following variables: gender, age (decade), race (white), higher education, living above poverty income, SSRI use, laxative use, obese BMI, vigorous physical activity, heavy/moderate alcohol drinker, high caffeine intake, frequent milk intake, highest quartile fiber intake, highest quartile liquid intake, highest quartile carbohydrates intake, highest quartile sugar intake, highest quartile protein intake, highest quartile fat intake, and total number of reported comorbidities.

RR data for each co-variable have been published elsewhere[17,20] and are not reported here.

All multivariable models are mutually adjusted and included appropriate sampling weight. Bold text and asterisk indicate a statistically significant difference with a p-value<0.05

CI, confidence interval; RR, risk ratio.

Table 2.

Univariate and Multivariable analyses predicting chronic constipation

Depression Severity	Univariate analyses				Multivariable analyses			
	Unadjusted RR	Unadjusted 95% Cl		Unadjusted p-value	Adjusted RR[*]	Adjusted 95% Cl		Adjusted p-value
None	0.52	0.37	0.73	0.001	Omitted	Omitted		Omitted
Mild	2.04	1.31	3.15	0.003	1.79	1.08	2.95	**0.027**[*]
Moderate	1.55	0.93	2.56	0.086	0.95	0.44	2.04	0.890
Moderately severe to severe	1.90	.1.10	3.27	0.024	1.15	0.59	2.22	0.661

[*] Multivariable analysis controlling for the following variables: gender, age (decade), race (white), higher education, living above poverty income, SSRI use, laxative use, obese BMI, vigorous physical activity, heavy/moderate alcohol drinker, high caffeine intake, frequent milk intake, highest quartile fiber intake, highest quartile liquid intake, highest quartile carbohydrates intake, highest quartile sugar intake, highest quartile protein intake, highest quartile fat intake, and total number of reported comorbidities.

[a] All multivariable models are mutually adjusted and included appropriate sampling weight. Bold text and asterisk indicate a statistically significant difference with a p-value<0.05

RR data for each co-variable have been published elsewhere[17,20] and are not reported here.

CI, confidence interval; RR, risk ratio.