Irritable bowel syndrome in medical students from Lima, Peru, during the COVID-19 pandemic, using virtual questionnaires according to the Rome IV criteria: prevalence and associated factors

Síndrome de intestino irritable en estudiantes de medicina de Lima, Perú, durante la pandemia de COVID-19, usando cuestionarios virtuales según los criterios de Roma IV: prevalencia y factores asociados

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ABSTRACT

Irritable bowel syndrome (IBS) is a functional gastrointestinal (GI) disorder, characterized by changes of the intestinal habit associated with abdominal pain. This study analyzed factors associated with this pathology during the COVID-19 pandemic, and it was seen that the impact of IBS was higher in young women who had ongoing studies in the medical field. **Objectives:** Determine the prevalence of IBS in medical students and explore the associated factors with the increase of its symptoms, through the use of digital tools. **Materials and methods:** Descriptive observational study with exploration of associations, with non-probabilistic sampling, until reaching the minimum sample of 110 participants with a confidence interval of 95%, finally having a total sample of 131 students, distributed in 3 proportional and representative subgroups of the last 3 years of study of the medical career from a university from Lima, Peru. The inclusion criteria were students of both sexes and legal age, who gave their consent to participate and did not have risk factors for GI disease. Once the study was approved, the link of a validated virtual questionnaire was shared through the institutional email. To explore the associated factors, the Chi-square test was used with a statistical significance of p < 0.05. **Results:** Responses were obtained from 195 students; 64 (32.82%) of them had at least one exclusion criteria, finally having a sample size of 131; 64 (48.85%) were women, and 52 (39.69%) were from 7th year. Using the Rome IV criteria, 23 participants were classified as having IBS, which indicates a prevalence of 17.56%, 14 (60.87%) of them were women and 10 (43.48%) were from the 7th year (last year of study of the medical career in Peru). It was observed that 1 in 3 students (32.06%) had chronic abdominal pain, and 1 in 2 (53.44%) reported having a history of Major Depression or Generalized Anxiety Disorder. Of the total, 51 (38.93%) had a history of having a positive COVID-19 test result. Regarding the associated factors, a significant association was only found between IBS and the diarrhea type, classified according to the Bristol Scale. **Conclusions:** The prevalence of IBS in medical students was 17.56%, the highest compared with studies in the general population and in medical students using Rome IV criteria. Of the associated factors, the clinical presentation of diarrhea, according to the Bristol scale, was associated with IBS.

Keywords: Irritable bowel syndrome; Students, medical; COVID-19; Diarrhea (source: MeSH NLM).

RESUMEN

El síndrome de intestino irritable (SII) es una patología gastrointestinal (GI) funcional, caracterizado por cambios y alteraciones del hábito intestinal asociado a dolor abdominal. El presente estudio analizó los factores asociados a esta patología durante la pandemia de COVID-19, y se vio que el impacto de SII fue mayor en mujeres jóvenes que tenían estudios en el área médica. **Objetivo:** Determinar la prevalencia de SII en estudiantes de medicina y explorar los factores asociados con el aumento de estos síntomas, usando herramientas digitales. **Materiales y métodos:** Estudio observacional descriptivo con exploración de asociaciones con muestreo no probabilístico, hasta alcanzar la muestra mínima de 110 participantes con un intervalo de confianza de 95%, teniendo una muestra final de 131 estudiantes distribuidos en 3 grupos proporcionales y representativos de los 3 últimos años de medicina de una universidad de Lima, Perú. Los criterios de inclusión fueron estudiantes de ambos sexos y mayores de edad, quienes dieron su consentimiento para participar y no tenían factores de riesgo para enfermedad GI. Una vez que el estudio fue aprobado, el link del cuestionario virtual validado fue compartido por el correo institucional. Para explorar

los factores asociados, se usó la prueba de Chi-cuadrado con una significancia estadística de p<0,05. **Resultados:** Se obtuvieron respuestas de 195 estudiantes; 64 (32,82%) tuvieron al menos un criterio de exclusión, teniendo una muestra final de 131; 64 (48,85%) fueron mujeres y 52 (39,69%) del 7mo año. Utilizando los criterios de ROMA IV, 23 participantes fueron clasificados con SII, lo que indica una prevalencia del 17,56%, de los cuales 14 (60,87%) fueron mujeres y 10 (43,48%) del 7mo año (último año de la carrera de medicina en Perú). Se observó que uno de cada tres estudiantes (32,06%) tenía dolor abdominal crónico, y 1 de cada 2 (53,44%) reportó antecedente de Depresión mayor o Trastorno de ansiedad generalizada. Del total, 51 (38,93%) tenían antecedente de resultado positivo a COVID-19. Respecto a los factores asociados, solo se encontró una asociación significativa entre el SII y el tipo diarrea clasificada según la escala de Bristol. **Conclusiones:** La prevalencia de SII en estudiantes de medicina fue de 17,56%, la más alta en comparación a estudios en población general y estudiantes de medicina usando los criterios de Roma IV. De los factores asociados, la presentación clínica de diarrea según la escala de Bristol estuvo asociada a SII.

Palabras clave: *Síndrome de intestino irritable; Estudiantes de medicina; COVID-19; Diarrea (fuente: DeCS Bireme).*

INTRODUCTION

Irritable bowel syndrome (IBS) is a functional intestinal disorder, characterized by changes of the bowel function, associated with abdominal pain, without any structural cause, and has a negative impact on quality of life [1]. Nowadays, the Rome IV criteria are the gold standard for the diagnosis of IBS, they are based on the abdominal pain, which can go from a mild symptom with no repercussions to a severe one that interferes with daily activities. This pain must be related to changes in intestinal habit, such as alternation of the stools between diarrhea and constipation. Generally, the pain tends to ease after defecation [2]. These symptoms occur chronically, at least once a week in the last 3 months, with a duration of at least 6 months [3,4]; may be accompanied by abdominal distension and increased flatulence, and do not usually occur at night, nor do they tend to wake up the patient, nor do they generate a negative impact on weight or alterations in laboratory tests [5]. There are subtypes of IBS according to the predominant pattern of stools, based on the Bristol scale, which classifies stool according to its shape and consistency into seven types [6]. In IBS where constipation predominates (IBS-C), there are hard stools (Bristol type 1 and 2), dischezia and sensation of incomplete evacuation; on the other hand, in case diarrhea predominates (IBS-D), there are soft stools not very voluminous (Bristol type 6 and 7) [6,7].

Gastrointestinal (GI) disorders are highly prevalent; approximately in more than 40% of the population worldwide [8,9]; between 10 to 21% of adults and adolescents have symptoms consistent with IBS, with a predominance in the female sex [10]. Various studies have been developed looking for the prevalence of IBS using the Rome IV criteria. In 2021, Alvizuri *et al.* did a cross-sectional study of 130 people from an Andean community between 18 and 93 years old and found a prevalence of 13.1% [10]. In that same year, Pontet *et al.* did a review of 16 studies published in Pubmed and Lilacs, carried out in nine Latin America countries and found an average prevalence of IBS of 6.98% [11]. In 2020, Oka *et al.* did a systematic review of studies published in MEDLINE, where they found that the IBS prevalence according to Rome IV criteria was 3.8% [12] in adults. The Rome 2020 Foundation conducted virtual and in-person surveys of adults from 33 countries worldwide, finding a prevalence of 4.1% and 1.5%, respectively.

Various studies have been made to identify the factors associated with this disorder. Choghakhori *et al.* evaluated the differences in IBS symptoms according to sex, for which they included 90 people, using the Rome IV criteria, where they reported that the female sex not only presents a higher frequency of this pathology, but also had more severe symptoms; furthermore, they observed that proinflammatory cytokines such as IL-17 and TNF-alpha had slightly higher values in females [13]. The study mentioned above by Alvizuri *et al.*, also explored associated factors such as age, sex, a higher educational level, the consumption of harmful substances, among others, and found that being female, a higher educational level, and a younger age had a statistically significant association, however this was not the case for the consumption of harmful substances [10]. Akhondi *et al.* conducted a cross-sectional study in adults and evaluated body max index (BMI) and abdominal circumference, and found that IBS was more prevalent in people with abdominal obesity (BMI greater than or equal to 30 in both sexes, and abdominal circumference greater than or equal to 102 cm in men and 88 cm in women), but no significant association was found between IBS and overweight or abdominal obesity [14]. Lee *et al.*, conducted a meta-analysis with a total of 27 studies with the objective of comparing the levels of depression and anxiety between patients with IBS and healthy controls, they included 2293 patients with IBS and 4951 healthy controls, and used scales to measure depression and anxiety, it was concluded that the levels of these pathologies were higher in those who suffered from IBS [15].

On the other hand, the COVID-19 pandemic could have increased GI diseases, because it is known that SARS-CoV-2 compromises the GI system, producing "post-infection-functional GI disorder (PI-FGID)" [16]. It is known that SARS-CoV-2 not only produces respiratory symptoms,

but by binding to ACE2 receptors [17], it also affects the GI tract, where these receptors function as regulators of the intestinal microbiota and the innate response, so this virus can cause GI symptoms such as abdominal pain, diarrhea, nausea and vomiting [18]. This is why there are cases in which GI symptoms precede respiratory symptoms or cases in which COVID-19 infection manifests only with GI symptoms. This was evaluated by Tian *et al.* in a review study that included studies collected by the World Health Organization (WHO) published in PubMed, carried out in patients with a confirmed diagnosis of COVID-19, where they found that diarrhea was the most common symptom (2%-49.5%) and abdominal pain, the least reported (2.2%-6%).

Finally, there are few studies on the prevalence of IBS in medical students using the Rome IV criteria. Vargas *et al.*, carried out an observational, retrospective, descriptive cross-sectional study in medical students from a university in Lima, in which they found a prevalence of IBS of 12.4% using the Rome III criteria [20]. However, the Rome IV criteria, allow to encompass the population better, since they take into consideration a longer duration of the presence of symptoms. Furthermore, as observed in the study published by Black CJ *et al.*, where all the demographic and symptomatological data of the patients were collected prospectively in the first clinical visit, they concluded that the Rome IV criteria had a better diagnostic criteria than Rome III criteria, since they demonstrated a likelihood ratio of 4.82 for the Rome IV criteria compared to 2.45 for the Rome III criteria, in addition to presenting a higher specificity (82.9%) and sensitivity (82.2%) [21].

The objective was to determine the prevalence of IBS in medical students, through the use of a validated instrument using digital tools, and to explore the associated factors with the increase in IBS symptoms such as age, sex, anxiety, depression, overweight, obesity, alcohol consumption, tobacco, drugs and COVID-19 infection (to explore which factors, such as age, sex, anxiety, depression, overweight, obesity, alcohol consumption, tobacco, drugs and COVID infection, are associated with the increase in IBS symptoms).

MATERIALS AND METHODS

Descriptive observational cross-sectional study with exploration of associations, with non-probabilistic sampling, until reaching the total sample by subgroups, with the target population being those people of legal age, from 5th to 7th year from the medical career at the "Universidad Peruana Cayetano Heredia" (UPCH) from Lima, Peru, in 2023. These students were contacted through their promotion delegates, to whom the link of the questionnaire was shared, which they could access through their institutional email (Figure 1). The inclusion criteria were students of both sexes and of legal age, who gave their consent to participate and who did not have previously diagnosed GI disease. The exclusion criteria were considered the risk factors such as personal or family

history of GI cancer, presence of GI bleeding, positive Thevenon test, night pain, unexplained spontaneous weight loss, and presence of palpable abdominal mass.

To calculate the sample size of this study, the OpenEpi version 3 program was used; 511 students were set as the population size (N) given that the 5th year had 170 students (33.27% of the total sample), the 6th year had 164 students (32.09% of the total sample), and the 7th year had 177 students (34.64% of the total sample). A value of 10% was considered as an anticipated hypothetical frequency based on the study by Alvizuri *et al.* [10]. The design effect was 1 and a total sample size (n) of 110 students was obtained, applying a 95% interval confidence. Considering that the three classes that participated in the study each had a different number of students, the number of participants per class was calculated using a simple rule of three, obtaining a total of 37 students from 5th year, 35 students from 6th year and 38 students from 7th year.

Operational definition of variables:

- Irritable bowel syndrome: Person who meets the criteria established by Rome IV for IBS.
- Medical student and year of study: Those who were in the last three years of study of the medical career were considered because they began and continued their university education, both before and during the pandemic.
- Age: Lifespan in years since birth.
- Sex: Indicates male or female genotypic characteristics.
- Anxiety: Participant who has or has had a history of diagnosis of General Anxiety Disorder established by a psychiatrist.
- Depression: Participant who has or has had a history of diagnosis of Major Depression established by a psychiatrist.
- BMI: Measure that indicates the relationship between the person's weight in kilograms and the square of height in meters. A normal BMI is considered between 18 and 24.9 kg/m^2. Its disturbances are overweight, when BMI has values between 25 and 29.9 kg/m^2, and obesity, when BMI is greater than or equal to 30 kg/m^2.
- Harmful habits: Consumption of Alcohol, Tobacco and/or Drugs.
- COVID-19 infection: Considering a positive result for any molecular or antigenic test for SARS-CoV-2.
- Pandemic period: It has been considered since the World Health Organization (WHO) declared the COVID disease on January 30, 2022, as a global health emergency. The end of the period is considered to be the declaration of the end of the global health emergency on May 5, 2023.

These variables will be registered through a Google Forms sent virtually.

The Rome IV criteria were used as a validated instrument to classify whether or not a student met the diagnosis of IBS. These criteria consist of chronic recurrent abdominal
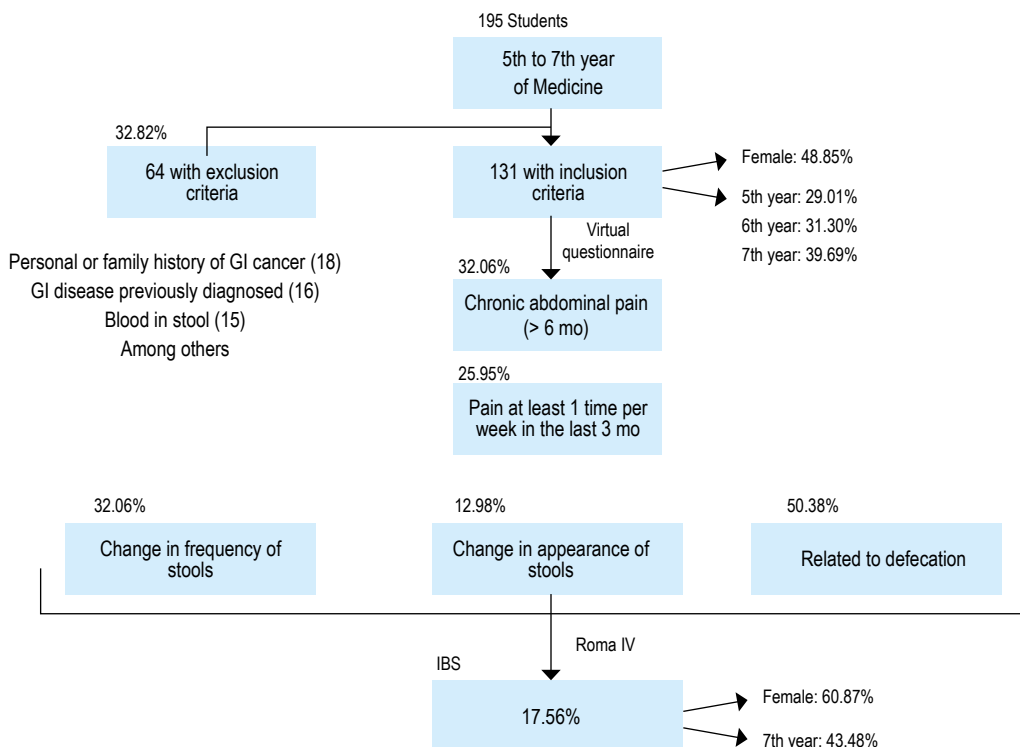
Figure 1. Flow diagram of study.

pain associated with at least two of three criteria, which include a change in the frequency or appearance of stools, as well as pain related to defecation [4,6]. The Bristol Scale was also used, which classifies the stool according to its shape and consistency in seven types [6], and it also allows to classify IBS into four subtypes (Table 1).

The data collected through Google Forms, which was sent virtually, was taken as the source of information. The information obtained was entered into Google Sheets and a database was created on this site. The absolute and relative frequencies (percentages) were calculated, and the tables were made in Google Sheets. The data was analyzed with the statistical package STATA version 17. Descriptive statistics were used with proportions and means and their respective confidence intervals. To explore associations between the variables, the Chi-square test was used considering a statistical significance of $p < 0.05$.

Ethical considerations

The study was approved by the Institutional Research Ethics Committee for human beings of the Universidad Peruana Cayetano Heredia. Confidentiality was guaranteed, the participants were coded, thus avoiding the use of data such as names, surnames, identification documents and emails in order to keep the collected information anonymous. The project was proposed following the seven ethical requirements of Ezekiel Emanuel [22] and complied with

the provisions of guideline 22 of the international Ethical Guidelines for health-related research with human beings prepared by the Council of International Organizations of Medical Sciences (CIOMS), which provides guidance on the use of data obtained in online environments and digital tools in health-related research [23]. Furthermore, only students who gave their approval through informed consent participated.

RESULTS

Response to the questionnaire was obtained from 195 students, 64 of them (32.82%) presented at least one exclusion criterion such as personal or family history of GI cancer (18 participants), previously diagnosed GI disease (16 participants), bleeding in stools in the last 6 months (15 participants), among other risk factors. From the participants with previously diagnosed GI disease, the most common was gastritis in 15 participants. On the other hand, 8 participants did not answer the total questionnaire, 2 participants were not part of the educational institution, and 1 participant did not give its consent to participate, they were excluded from the study. From the excluded participants, a group presented symptoms compatible with IBS according to Rome IV criteria, but organic causes would need to be ruled out. For this reason, 131 students were considered as valid samples, after accepting the informed consent and the use of their data. Of the total sample, 64

Table 1. Demographic characteristics of total vs IBS participants.

Demographic characteristics	Total n = 131 (100%)	IBS n = 23 (100%)	*p* value
Sex			
Male	67 (51.15%)	9 (39.13%)	
Female	64 (48.85%)	14 (60.87%)	0.20
Average age (years old): 24.04			
Below than average	84 (64.12%)	15 (65.22%)	
Greater than average	47 (35.88%)	8 (34.78%)	0.90
Year of study			
5th year	38 (29.01%)	8 (34.78%)	
6th year	41 (31.30%)	5 (21.74%)	
7th year	52 (39.69%)	10 (43.48%)	0.53
Bristol scale and IBS subtype*			
Bristol 1-2 (Constipation) vs IBS-C	42 (32.06%)	7 (30.43%)	
Bristol 3-5 (Normal) vs IBS-M	106 (80.92%)	1 (4.35%)	0.75
Bristol 6-7 (Diarrhea) vs IBS-D	9 (6.87%)	4 (17.39%)	0.0019
BMI (Kg/m^2)			
<18	4 (3.05%)	0 (0%)	
18-24,9	71 (54.20%)	13 (56.52%)	
25-29,9	43 (32.83%)	7 (30.43%)	
> 30	13 (9.92%)	3 (13.04%)	0.87
Background			
Depression			
Yes	34 (25.95%)	9 (39.13%)	
No	97 (74.05%)	14 (60.87%)	0.11
Anxiety			
Yes	36 (27.48%)	7 (30.43%)	
No	95 (72.52%)	16 (69.57%)	0.72
COVID-19 Positive test			
Yes	51 (38.93%)	9 (39.13%)	
No	80 (61.07%)	14 (60.87%)	0.98
Harmful habits			
Alcohol			
Yes	56 (42.75%)	11 (47.83%)	
No	75 (57.25%)	12 (52.17%)	0.58
Tobacco			
Yes	12 (9.16%)	3 (13.04%)	
No	119 (90.84%)	20 (86.96%)	0.47
Drugs			
Yes	4 (3.05%)	0 (0%)	
No	127 (96.95%)	23 (100%)	0.35

* The Bristol scale was evaluated in the general population and with it the IBS subtype was classified in those who had the Rome IV criteria. IBS-C: Irritable bowel disease-constipation, IBS-M: Irritable bowel disease-mixed, IBS-D: Irritable bowel disease-diarrhea.

participants (48.85%) were women and 67 (51.15%) were men. Participants had an average age of 24.04 years old, being the minimum age 21 years old, and the maximum, 34 years old, and 84 students (64.12%) were below the average age. Of the total number of students, 52 (39.69%) belonged to seventh year; 41 (31.30%), to sixth year; and 38 (29.01%), to fifth year (Table 1).

According to the Rome IV criteria, 23 students (17.56%) were diagnosed with IBS. Of these, 14 (60.87%) were women and 9 (39.13%) were men. Ten students (43.48%) belonged to the 7th year; five (21.74%), to 6th year; and eight (34.78%), to 5th year (Table 1). Regarding the IBS symptoms, all participants reported suffering abdominal pain frequently. Despite not being part of

the Rome IV criteria, 17 participants (73.91%) reported that the symptoms intensified when eating food and 5 (21.74%) when having rest; on the other hand, 20 students (86.96%) mentioned that this symptom was relieved with defecation. Furthermore, 21 (91.30%) presented abdominal distention (Table 2). According to the defecation habit, 10 (43.48%) students reported changes in the frequency and appearance of feces; 7 (30.43%), changes in frequency but not in appearance; 4 (17.39%), changes in appearance but not in frequency, and 18 (78.26%) had alternation between diarrhea and constipation. Likewise, when relating IBS to the Bristol scale, the most frequent subtype of IBS was constipation in 7 students (30.43%), while the least frequent one was diarrhea in 4 of them (17.39%) (Table 1).

Table 2. Clinical characteristics of total population vs population with IBS.

Demographic characteristics	Total n = 131 (100%)	IBS n = 23 (100%)
Symptoms		
Do you frequently suffer from abdominal pain?	79 (60.31%)	23 (100%)
Did the pain start more than 6 months ago?	42 (32.06%)	23 (100%)
Is the pain present at least 1 day a week in the last 3 months?	34 (25,95%)	23 (100%)
Abdominal pain aggravator		
When eating food	55 (41.98%)	17 (73.91%)
At rest	15 (11.45%)	5 (21.74%)
When making depositions	5 (3.82%)	3 (13.04%)
When doing physical activity	4 (3.05%)	1 (4.35%)
Abdominal pain relievers		
When making depositions	61 (46.56%)	20 (86.96%)
Do you have abdominal distention?	67 (51.15%)	21 (91.30%)
Bowel habit		
Change in both frequency and appearance of stools	21 (16.03%)	10 (43.48%)
Change in frequency, but not in appearance of stools	17 (12.98%)	7 (30.43%)
Change in appearance, but not in frequency of stools	17 (12.98%)	4 (17.39%)
Alternation between diarrhea and constipation	39 (29.77%)	18 (78.26%)

Respecting the other associated factors, 13 (56.52%) students had a normal BMI, 7 (30.43%) were overweight and 3 (13.04%) had obesity. It was also found that 9 (39.13%) had a diagnosis of Major Depressive Disorder (MDD) and 7 (30.43%) had Generalized Anxiety Disorder (GAD) diagnosed by a psychiatrist, 9 (39.13%) had history of COVID-19 infection. Finally, regarding the presence of harmful habits, 11 (47.83%) consumed alcohol, and 3 (13.04%) consumed tobacco. On the other hand, of the total sample, we found that 34 students (25.95%) had a history of MDD; 36 (27.48%), GAD; and 51 (38.93%), COVID-19 infection (Table 1).

DISCUSSION

This is the first research about IBS in medical students using digital tools in Lima, Perú. Students of the last three years of study of the medical human career from UPCH were considered as population of this research, since there are no studies carried out in this population using the current Rome IV criteria, nor carried out after the pandemic, nor using online tools. In this population, there was a significant percentage of students who did not have the inclusion criteria, so they were not part of the sample studied, since some organic causes had to be ruled out, for which they were recommended to be evaluated by a medical specialist.

The prevalence of IBS obtained is higher than the one described in the general population and in medical students in Peru, also than the one found in Latin American countries and by the Rome Foundation worldwide [9-12]. Our results reflect that approximately 1 in 5 students in the last years of study of the medical career at UPCH present IBS according to Rome IV criteria. This prevalence is higher than the 13.1% found by Alvizuri *et al.*, who found a positive association between the diagnosis of IBS and the highest educational level and lowest age in years, their study was carried out mainly up to the school educational level and had a greater range of ages evaluated [10]. Therefore, the prevalence found would be in line with what was described in our population; however, no statistically significant association was found between IBS and ages, or years of study (Table 1). Women consistently have more IBS, this predominance is widely known in the literature, where there are different theories such as hormonal factors, greater visceral stimulation and greater perception of pain [24]; in addition, the higher prevalence of mental illnesses such as anxiety and depression exists in the female gender [10,13]. This is consistent with a study carried out by Bjorkman *et al.*, where they analyzed data from questionnaires given to patients with an established diagnosis of IBS over an eight-year interval, where they found that female patients presented greater severity in terms of GI symptoms, greater presence of anxiety and lower quality of life, compared to the opposite sex [25]. However, in our study, no association was found between the presence of IBS and female sex, although the higher frequency it had (Table 1).

The most common subtype of IBS was constipation (IBS-C) (30.43%) followed by the diarrhea type (IBS-D) (17.39%) (Table 1). This data coincides with what was described by Choghakhori *et al.*, who described that IBS-C is the most common both in the female and general population, followed by mixed subtype (IBS-M); while IBS-D was more common in men [13]. However, in this study, it was found that the most frequent subtype in men was also IBS-C (44.44%), while the number of patients in women was equal between the IBS-C and IBS-D, both with a frequency of 21.42%. In this study, a positive association was found between having diarrhea-type stools (6 and 7 according to the Bristol scale) and IBS (Table 1).

According to a report published by the WHO in 2020, the prevalence of anxiety and depression increased by

25% worldwide, affecting more women and young people, being the stress by isolation one of the main causes [26]. On the other hand, it was found that the prevalence of mental illness such as generalized anxiety disorder (GAD) and major depressive disorder (MDD) is higher compared to other groups [27], since 53.44% of our population studied mentioned having GAD or MDD as a history, with 25.95% of those having MDD and 27.48% of those having GAD. Gutierrez *et al.* made a systematic review of literature published in PubMed and MedLine, where it was found that the general prevalence of MDD was 2 to 21% [28], while Vargas *et al.* made a cross-sectional analytical study in medical students at different universities in Peru, where it was found that the prevalence of MDD was 13.5% [29]; in both studies, it was more frequent in female sex. Our study reveals a higher prevalence of MDD than the previously mentioned studies. On the other hand, the prevalence of GAD is lower than the prevalence found by Szuhany *et al.* of 34%, but we must consider that this is in the general population [30]. In addition, it is important to mention, without being an object of study, that one out of two students reported having a history of MDD or GAD; of which 14.50% had both. However, no association was found between these diseases and the presence of IBS (Table 1). Finally, it must be considered that there may have been underdiagnosed cases of MDD and GAD, taking into account that it is possible that there are students who did not have a history of a diagnosis established by a psychiatrist, or other conditions included in mood disorders, such as persistent depressive disorder or dysthymia [31].

The literature describes an association between the psychiatric diseases mentioned and COVID-19 disease, Mejia *et al.* made a systematic review in Pubmed and MEDLINE, where it was found that the prevalence of MDD and GAD in health workers during the COVID-19 pandemic was 26.6% and 36.4%, respectively [32]. On the other hand, Pacheco *et al.* made a descriptive cross-sectional study in people diagnosed with COVID-19 disease, where it was found that the prevalence of MDD and GAD was 25.22% and 34.15%, respectively [33]. Mohammadian *et al.*, made a cross-sectional study in health workers, where they found that those with COVID-19 infection or who had contact with infected patients had a higher risk of depression and anxiety [34]. On the other side, despite what was established in previous studies, no association was found between IBS and COVID-19 infection. This was also the case of IBS and BMI, or IBS with the consumption of harmful substances, in which no statistical association was found. (Table 1).

It is important to raise awareness about the perception of this syndrome in the studied population, future health service providers, about the high prevalence and importance of this pathology and not consider it an unreal disease as mentioned in the study by Henick *et al.*, who conducted surveys to 106 medical students about their knowledge and attitudes towards functional and organic pathologies (IBS and inflammatory bowel disease, respectively), being organic pathologies considered more relevant than functional pathologies [35].

Regarding the limitations, when answering the questionnaire virtually, there was no availability for participants to ask additional questions or comments and there was a considerable percentage of students who met the ROME IV diagnosis criteria for IBS but could not be included because they presented at least one exclusion criteria; at the same time, the type of non-probabilistic sampling, since our study is a descriptive study, does not give the possibility of generalizing, but it does give the possibility of raising hypotheses. On the other hand, there were also strengths such as the use of digital tools to carry out the surveys, which allowed us to reach a large majority of students and be able to answer it quickly and safely on any electronic device. This study allows us to learn more about the prevalence of this little-studied syndrome in our country and, since IBS is a common pathology, this study can be the basis for future research and highlight the importance of this diagnosis and management.

In conclusion, the prevalence of IBS in students from the last three years of study of medical career was 17.56%, the highest compared to studies of the general population and in medical students using the Rome IV criteria; due to this high prevalence, it is important to do a clinical follow-up of these students. Of the associated factors studied, the clinical presentation of diarrhea, according to the Bristol scale, was the one that was associated with IBS; on the other hand, the female sex had a high frequency without association. It is important to mention that one in two (53.44%) students reported having a history of Major Depression or Generalized Anxiety disorder, and one in seven had both. Furthermore, 38.93% had a history of having a positive result on a COVID-19 test. Finally, we observed that one in three students (32.06%) suffers from chronic abdominal pain.

REFERENCES

1. Golla R, Vuyyuru S, Kante B, Kumar P, Mathew DT, Makharia G, *et al.* Long-term gastrointestinal sequelae following COVID-19: A prospective follow-up cohort study. Clin Gastroenterol Hepatol. 2022;21(3):789-796.e1. doi: 10.1016/j.cgh.2022.10.015.

2. Marynowski M, Likońska A, Zatorski H, Fichna J. Role of environmental pollution in irritable bowel syndrome. World J Gastroenterol. 2015;21(40):11371-8. doi: 10.3748/wjg.v21.i40.11371.

3. Ford AC, Lacy BE, Talley NJ. Irritable bowel syndrome. N Engl J Med. 2017;376(26):2566-78. doi: 10.1056/NEJMra160754.

4. Aziz I, Törnblom H, Palsson OS, Whitehead WE, Simrén M. How the change in IBS criteria from Rome III to Rome IV impacts on clinical characteristics and key pathophysiological factors. Am J Gastroenterol. 2018;113(7):1017-25. doi: 10.1038/s41395-018-0074-z.

5. Drossman DA. Functional gastrointestinal disorders: History, pathophysiology, clinical features and Rome IV. Gastroenterology. 2016;150(6):1262-1279.e2. doi: 10.1053/j.gastro.2016.02.032.

6. Mearin F, Ciriza C, Mínguez M, Rey E, Mascort JJ, Peña E, *et al.* Guía de práctica clínica: síndrome del intestino irritable con estreñimiento y estreñimiento funcional en adultos: concepto, diagnóstico y continuidad asistencial. Semergen. 2017;43(1):43-56. doi: 10.1016/j.semerg.2016.06.009.

7. Lacy BE, Mearin F, Chang L, Chey WD, Lembo AJ, Simren M, *et al.* Bowel disorders. Gastroenterology. 2016;150(6):1393-1407. e5. doi: 10.1053/j.gastro.2016.02.031.

8. Gubatan J, Zikos T, Spear Bishop E, Wu J, Gottfried A, Becker L, *et al*. Gastrointestinal symptoms and healthcare utilization have increased among patients with functional gastrointestinal and motility disorders during the COVID-19 pandemic. Neurogastroenterol Motil. 2022;34(4):e14243. doi: 10.1111/nmo.14243.

9. Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, Simren M, Tack J, *et al*. Worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome foundation global study. Gastroenterology. 2021;160(1):99-114.e3. doi: 10.1053/j.gastro.2020.04.014.

10. Alvizuri Gómez CM, Bellido Caparó Á, Samalvides Cuba F, Pinto Valdivia JL. Epidemiology and associated factors of irritable bowel syndrome in an Andean community from Peru. Rev Gastroenterol Peru. 2021;41(1):6-10. doi: 10.47892/rgp.2021.411.1236.

11. Pontet Y, Olano C. Prevalencia de síndrome de intestino irritable en América Latina. Rev Gastroenterol Peru. 2021;41(3):144-149. doi: 10.47892/rgp.2021.413.1154.

12. Oka P, Parr H, Barberio B, Black CJ, Savarino EV, Ford AC. Global prevalence of irritable bowel syndrome according to Rome III or IV criteria: a systematic review and meta-analysis. Lancet Gastroenterol Hepatol. 2020;5(10):908-17. doi: 10.1016/S2468-1253(20)30217-X.

13. Choghakhori R, Abbasnezhad A, Amani R, Alipour M. Sex-related differences in clinical symptoms, quality of life, and biochemical factors in irritable bowel syndrome. Dig Dis Sci. 2017;62(6):1550-60. doi: 10.1007/s10620-017-4554-6.

14. Akhondi N, Memar Montazerin S, Soltani S, Saneei P, Hassanzadeh Keshteli A, Esmaillzadeh A, *et al*. General and abdominal obesity in relation to the prevalence of irritable bowel syndrome. Neurogastroenterol Motil. 2019;31(4):e13549. doi: 10.1111/nmo.13549.

15. Lee C, Doo E, Choi JM, Jang S-H, Ryu H-S, Lee JY, *et al*. The increased level of depression and anxiety in irritable bowel syndrome patients compared with healthy controls: Systematic review and meta-analysis. J Neurogastroenterol Motil. 2017;23(3):349-62. doi: 10.5056/jnm16220.

16. Ghoshal UC, Ghoshal U, Rahman MM, Mathur A, Rai S, Akhter M, *et al*. Post-infection functional gastrointestinal disorders following coronavirus disease-19: A case-control study. J Gastroenterol Hepatol. 2022;37(3):489-98. doi: 10.1111/jgh.15717.

17. Wan Y, Shang J, Graham R, Baric RS, Li F. Receptor recognition by the novel coronavirus from Wuhan: an analysis based on decade-long structural studies of SARS coronavirus. J Virol. 2020;94(7):e00127-20. doi: 10.1128/JVI.00127-20.

18. Groff A, Kavanaugh M, Ramgobin D, McClafferty B, Aggarwal CS, Golamari R, *et al*. Gastrointestinal Manifestations of COVID-19: A Review of What We Know. Ochsner J. 2021;21(2):177-180. doi: 10.31486/toj.20.0086.

19. Tian Y, Rong L, Nian W, He Y. Review article: gastrointestinal features in COVID-19 and the possibility of faecal transmission. Aliment Pharmacol Ther. 2020;51(9):843-51. doi: 10.1111/apt.15731.

20. Vargas-Matos I, Ng-Sueng LF, Flores-Arriaga J, Beltrán-Flores S, Lema-Correa M, Piscoya A, *et al*. Superposición del síndrome de intestino irritable y dispepsia funcional basados en criterios ROMA III en estudiantes de medicina de una universidad privada de Lima, Perú. Rev Gastroenterol Peru. 2015;35(3):219-25.

21. Black CJ, Craig O, Gracie DJ, Ford AC. Comparison of the Rome IV criteria with the Rome III criteria for the diagnosis of irritable bowel syndrome in secondary care. Gut. 2021;70(6):1110-6. doi: 10.1136/gutjnl-2020-322519.

22. Rodríguez Yunta E. Comités de evaluación ética y científica para la investigación en seres humanos y las pautas CIOMS 2002. Acta Bioeth. 2004;10(1):37-48. doi: 10.4067/S1726-569X2004000100005.

23. Council for International Organizations of Medical Sciences. Pauta 22: Uso de datos obtenidos en entornos en línea y de herramientas digitales en la investigación relacionada con la salud. In: Pautas éticas internacionales para la investigación relacionada con la salud con seres humanos. 4ta ed. Ginebra: CIOMS; 2017. p. 93-5.

24. Yoon K, Kim N. Roles of sex hormones and gender in the gut Microbiota. J Neurogastroenterol Motil. 2021;27(3):314-25. doi: 10.5056/jnm20208.

25. Björkman I, Jakobsson Ung E, Ringström G, Törnblom H, Simrén M. More similarities than differences between men and women with irritable bowel syndrome. Neurogastroenterol Motil. 2015;27(6):796-804. doi: 10.1111/nmo.12551.

26. Organización Mundial de la Salud. La pandemia de COVID-19 aumenta en un 25% la prevalencia de la ansiedad y la depresión en todo el mundo. Ginebra: OMS; 2022 [citado el 24 de Octubre de 2023]. Disponible en: https://www.who.int/es/news/item/02-03-2022-covid-19-pandemic-triggers-25-increase-in-prevalence-of-anxiety-and-depression-worldwide

27. Mariños-Llajaruna HR, Chafloque-Chafloque A. Asociación entre el Síndrome de Intestino Irritable y la ansiedad y depresión en pacientes atendidos en el Hospital Regional Docente de Trujillo. Rev médica Trujillo. 2019;14(4):181-8. doi: 10.17268/rmt.2019.v14i04.05.

28. Gutiérrez-Rojas L, Porras-Segovia A, Dunne H, Andrade-González N, Cervilla JA. Prevalence and correlates of major depressive disorder: a systematic review. Brazilian Journal of Psychiatry. 2020;42(6):657-672. doi: 10.1590/1516-4446-2020-0650.

29. Vargas M, Talledo-Ulfe L, Heredia P, Quispe-Colquepisco S, Mejia CR. Influencia de los hábitos en la depresión del estudiante de medicina peruano: estudio en siete departamentos. Rev Colomb Psiquiatr. 2018;47(1):32-6. doi: 10.1016/j.rcp.2017.01.008.

30. Szuhany KL, Simon NM. Anxiety disorders: A review. JAMA. 2022;328(24):2431-45. doi: 10.1001/jama.2022.22744.

31. Sekhon S, Gupta V. Mood Disorder. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023.

32. Mejía-Zambrano H, Ramos-Calsín L. Prevalencia de los principales trastornos mentales durante la pandemia por COVID-19. Rev Neuropsiquiatr. 2022;85(1):72-82. doi: 10.20453/rnp.v85i1.4157.

33. Pacheco-Vasquez DR, Guerrero-Alcedo JM. Prevalencia de trastornos mentales en población peruana con COVID-19 atendida en el programa "Te Cuido Perú". Archivos Venezolanos de Farmacología y Terapéutica. 2021;40(9):902-6.

34. Mohammadian Khonsari N, Shafiee G, Zandifar A, Mohammad Poornami S, Ejtahed H-S, Asayesh H, *et al*. Comparison of psychological symptoms between infected and non-infected COVID-19 health care workers. BMC Psychiatry. 2021;21(1):170. doi: 10.1186/s12888-021-03173-7.

35. Henick D, Italiano T, Person H, Keefer L. Medical students' knowledge and perception of irritable bowel syndrome in comparison to inflammatory bowel disease. Neurogastroenterol Motil. 2023;35(10):e14576. doi: 10.1111/nmo.14576.