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Predictive study of academic stress with the irritable bowel syndrome in medicine students at a public university in Mexico

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ABSTRACT

Background: Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder associated with stress, which may appear by an educational context, given that students are exposed to demands in the academic environment during their education process that may lead to developing diseases. This study reports on the relationship between the IBS and academic stress and compares results of men and women.

Methods: A random survey was made of 561 medicine students at a public university in Mexico. The ROMA III criteria were used for the IBS and the *Academic Stress Inventory* for academic stress. A multiple regression analysis was made.

Results: The results showed that students with academic overload and lack of time are at risk for developing the IBS.

Conclusions: Therefore, the recommendation is to implement educational programs aiming at self-care as well as gaining knowledge about academic stress-related factors and the physical responses that may result in repercussions with serious consequences for student life such as pain, disease and dropping out of school.

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Academic stress; irritable bowel syndrome; medical students; correlational study; Guadalajara; Mexico

Irritable bowel syndrome (IBS) is one of the most common gastrointestinal diseases associated with stress. The colon is known to be connected to the brain by means of signals that influence bowel function [1]. Stress is present in almost all facets of our life; but when it emerges at the context of an educational process, it is usually referred to as academic stress (AS). It is considered to be the excessive tension experienced by students during learning periods demanding a large amount of physical and psychological resources with manifestations resulting in a worrisome problem. They may have a negative influence on academic performance as well as on students' health [2,3].

As an epidemiological factor, stress is considered to be an important aspect because it is a significant generator of pathologies, including IBS, which may appear with changes in bowel movements ranging from constipation to diarrhea and symptoms such as migraines, flatulence, abdominal pain, loss of appetite, nausea and distension or bloating. Some of these symptoms may get worse over the course of weeks or months and then diminish for a time [1,4,5]. The spectrum of severity for IBS is quite diverse, from patients with very slight discomfort to those with incapacitating symptoms. Further studies as well as clinical experience have shown that there are more severe cases and the clinical importance of IBS has been underestimated [6,7].

During a stressful moments, bowels become more sensitive and contract more under stress, which is considered to be a physiological reaction of the organism in which different defense mechanisms come into play to cope with a situation perceived as threatening or as increased demand, as explained by the 'cognitive-transactional model' proposed by Lazarus and Folkman in 1986 [8].

In particular, due to physical and mental health problems detected in some of the students such as anxiety, depression and sleep disorders [7,9], el AS may be a natural response for survival in the academic environment, which involves different factors such as academic overload, group activities, lack of technological resources and counseling [10].

Specialized literature indicates that anyone may suffer from IBS; nevertheless, most studies show that females are more prone than males. It is two to four times more frequent among women in Spain than in men [11]. Studies also show that stress in college students is six times more common in females than in males [1,12,13]. The difference between sexes in Mexico, Colombia, Brazil and Uruguay is between 9% and 18% [5].

Other studies about student stress are directly linked to anxiety, meditation as a therapeutic measure, and psychophysiological correlates under psychosocial stress [12,14–16].

The characteristics of medical students in Mexico [17] requires the capacity to analyze and investigate to meet challenges posed by the environment, master a second language, have the necessary economic means during the education process as well as the academic load during their morning and afternoon schedules, the lack of time to carry out administrative and/or academic procedures, all this besides years and hours of study, demanding coursework and exams as well as other less obvious situations such as their first experience in the anatomy laboratory, their first contact with death and a dead body. These are all physically, emotionally and intellectually difficult situations, which may be manifested in symptoms of AS [18,19].

Given the importance of stress in IBS, the objective of this study was to examine the correlation and predictive values between the IBS and the *Academic Stress Inventory* as well as the sex variable. Data of male and female students at a public university in Mexico were compared.

On the other hand, given that IBS is associated with stress, this study is pertinent because it contributes evidence to the transactional theory of stress and its negative manifestations in academic environments, which in the future may lead to creating models that explain the role of AS situations and components predictive of the presence of IBS.

1. Material and methods

1.1. Sampling and procedure

A cross-sectional analytical study was made during the 2014 school year of college students studying medicine at a public university in Guadalajara, Mexico. The total population consisted of 1,101 students (48% males and 52% females). A simple random sampling was made of this total population, determined with an expected prevalence of 64.5%; 70% was taken as the minimum acceptable rate, and an accuracy level of 99%, to put together a sampling of 561 individual interviews of medical students.

The college student population was selected pursuant to the technique of random and proportional numbers according to gender and school year. The list of students enrolled in the 2014 school year enabled a search of those chosen to answer the survey voluntarily under the condition of informed consent. The research protocol was assigned reference number IISO/CI/2012–2013 at the Occupational Health Research Institute of the University of Guadalajara in adherence to the 1975 Helsinki Declaration on ethics for research involving human beings and the General Health Law in effect in Mexico.

1.2. Instruments

1.2.1. ROMA III criteria

The IBS diagnoses were based on the ROMA III criteria, the clinical diagnosis criteria describing symptoms

and applying frequency and duration parameters, thus enabling a more precise diagnosis of IBS [11].

The ROMA III criteria (Criterion fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis).

Recurrent abdominal pain or discomfort (means an uncomfortable sensation not described as pain) at least 3 days/month in the last 3 months associated with two or more of the following: (1) improvement with defecation, (2) onset associated with a change in frequency of defecation (3) onset associated with a change in form (appearance) of stool.

IBS was classified according to the severity of symptoms on the Bristol Scale, [20] based on the consistency of stool, according to scale type 1 ('separate hard lumps like nuts'); type 2 ('sausage-shaped but lumpy'); type 3 ('like a sausage or serpent but with cracks on the surface'); type 4 ('like a sausage or serpent, smooth and soft'); type 5 ('Soft balls with clear edges (easy to evacuate)'); type 6 ('fluffy pieces with ragged edges, a mushy stool') and type 7 ('watery, no solid pieces'). The IBS classification consisted of the following: if more than 25% of defecations were type 1 or 2, the students was deemed to have ('IBS with constipation'); if more than 25% of defecations were type 6 or 7, the students was considered to have ('IBS with diarrhea'); and if more than 25% of both types (1 or 2, or 6 or 7), the diagnosis was ('IBS with mixed bowel habits'). On the other hand, students who had bowel movements of type 3 and 4 were considered normal [11].

1.3. Academic stress inventory

The Academic Stress Inventory (ASI) [21], validated by the Spanish Society for Anxiety and Stress, was used. This is a questionnaire with 11 situations considered to be potential stressors. Each situation offers a scaled answer from 1 (no stress) to 5 (a lot of stress) by which the participant assigns a value according to his or her perception of whether stress is triggered or not.

The 11 situations considered to be potential stressors are: taking an exam, classroom presentation, class participation, going to tutoring sessions, academic overload, classroom massification, lack of time, mandatory work, homework, group work and competitiveness among classmates. Reliability in terms of internal consistency had a Cronbach's alpha coefficient of 0.90, considered satisfactory [21]. The scoring was converted into ordinal numbers to be able to establish associations as follows: if the value assigned was between 1 and 2, it was considered low level, a value of 3 was considered medium level and between 4 and 5 high level AS.

It also presents the sex variable.

1.4. Statistical analysis

The *t*-test statistic was used to evaluate group differences (males and females) for continuous variable (IBS). Significance was expressed at the $p < 0.05$ level.

A Pearson correlation was performed to specify predictive value information and a step-by-step regression analysis was carried out to determine the effectiveness of the measures obtained in IBS and ASI, by simultaneously introducing an equation of the measurements at a significance level ($p < 0.05$). The variables in these analyses appear to be orderly in the equation in terms of the percentage of explained variance.

Later, an hierarchical multiple regression analysis was applied to determine the predictive value of the AS situations vis-à-vis IBS, and the *Introduce* method as used for this purpose. This procedure yielded an incremental predictive value of the variable included in third place once the effects of second and first place were controlled.

The data were tabulated and processed with SPSS (Statistical Package for Social Sciences) Version 15 for Windows XP, under the university's license.

2. Results

2.1. Descriptive statistics and correlations

Five hundred sixty-one medical students at a public university were interviewed for this study: 293 (52%) females and 268 (48%) males. Ages ranged between 18 and 33 years, with an average age of 20.97 (± 1.82).

The student *t*-analysis identified significant differences in the presence of IBS and in AS situations: taking an exam, academic overload, classroom massification, lack of time and group work in women with respect to men, as seen in Table 1.

The descriptive analysis of IBS, according to the ASI, showed that 346 (61.7%) students met the IBS criteria (ROMA III) and had significant IBS values. Seventy seven

(22%) of them had IBS with constipation, 203 (59%) had IBS with diarrhea and 66 (19%) had mixed bowel habits. The highest levels present for ASI situations were 34.4% (193) when taking an exam, 34.2% (192) due to lack of time, 30.4% (171) for academic overload, 28.3% (159) for classroom massification, 20.3% (114) for classmate competitiveness, 12.8% (72) for mandatory work, 12.6% (71) for classroom presentations, 12.4% (70) for homework, 10.6% (60) for group work, 9.6% (54) for class participation and 8.9% (50) for going to tutoring sessions. These data are itemized and described according to the type of IBS and sex, in Table 2.

2.2. Predictive value of ASI in connection with IBS

Table 3 shows the correlates between IBS scores as related to ASI and study variables. The analysis showed that the positive correlates appearing with moderate strength were: academic overload ($r = 0.52$; $p < 0.05$), followed by the lack of time situation ($r = 0.39$; $p < 0.05$). The AS situations that present a weak correlation with r less than 0.30 were as follows: taking an exam, classroom presentation, class participation, mandatory work and going to tutoring sessions. The classroom massification, group work and classmate competitiveness situations showed no correlation with IBS (Table 3).

The correlation coefficients obtained from the step-by-step regression analysis of IBS scored with the ROMA III criteria and AS scored according to ASI, revealed that the ASI situations of academic overload and lack of time met the prediction criteria with a significance value for the presence of IBS ($R^2 = 0.62$; $F = 41.1$; $p < 0.05$). The AS situation of academic overload showed the strongest correlation according to R^2 adjusted; in the first model this situation contributed 52% of the prediction of IBS ($F = 78.4$ $p < 0.01$). Nevertheless, when the lack of time situation was introduced, the prediction increased only by 10%. The rest of the situations were excluded with no correlation (Table 4).

Table 1. Mean differences between irritable bowel syndrome and academic stress situations of students at a public university in Mexico, 2014.

Variables	Women (n = 293)		Men (n = 268)		t	p
	M	de	M	de		
Irritable Bowel Syndrome	1.30	(0.461)	1.29	(0.438)	1.21	0.015*
Academic stress situations						
Taking an exam	2.77	(1.00)	2.56	(0.979)	2.52	0.012*
Classroom presentation	3.07	(1.05)	2.91	(1.11)	1.76	0.078
Class participation	2.51	(1.08)	2.39	(1.08)	1.27	0.202
Going to tutoring sessions	2.58	(1.10)	2.46	(0.992)	0.99	0.322
Academic overload	2.69	(1.08)	2.29	(1.10)	3.99	0.000*
Classroom massification	2.48	(1.15)	2.18	(1.06)	3.21	0.001*
Lack of time	2.70	(1.19)	2.50	(1.10)	2.08	0.037*
Mandatory work	2.57	(1.35)	2.41	(1.06)	1.71	0.086
Homework	2.61	(1.22)	2.44	(1.09)	1.72	0.084
Group work	2.64	(1.25)	2.41	(1.00)	2.43	0.015*
Classmate competitiveness	2.29	(1.00)	2.16	(0.996)	1.49	0.136

M = mean; de = standard deviation.

* = significant.

Table 2. Distribution of ROMA III criteria of irritable bowel syndrome according to levels of academic stress situations and sex of students at a public university in Mexico, 2014.

ACADEMIC STRESS SITUATIONS	Levels	IRRITABLE BOWEL SYNDROME					
		IBS With constipation Sex		IBS With diarrhea Sex		IBS Mixed bowel habits Sex	
		Male <i>n</i>	Female <i>n</i>	Male <i>n</i>	Female <i>n</i>	Male <i>n</i>	Female <i>n</i>
Taking an exam	High	12	26	63	54	14	24
	Low	17	22	41	45	5	23
Classroom presentation	High	1	10	10	26	1	23
	Low	28	38	94	73	18	24
Class participation	High	7	7	13	18	2	7
	Low	22	41	91	81	17	40
Going to tutoring sessions	High	2	11	9	19	2	7
	Low	27	37	95	80	17	40
Academic overload	High	12	21	63	43	10	22
	Low	17	27	41	56	9	25
Classroom massification	High	13	20	58	39	10	19
	Low	16	28	46	60	9	28
Lack of time	High	15	26	65	50	9	27
	Low	14	22	39	49	10	20
Mandatory work	High	4	12	13	30	1	12
	Low	25	36	91	69	18	35
Homework	High	3	11	13	29	1	13
	Low	26	37	91	70	18	34
Group work	High	3	10	13	22	2	10
	Low	26	38	91	77	17	37
Classmate competitiveness	High	9	17	31	32	9	16
	Low	20	31	73	67	10	31

n = Frequency.

Table 3. Correlation coefficient between of irritable bowel syndrome according and of academic stress situations of students at a public university in Mexico, 2014.

Academic stress situations	Irritable bowel syndrome			
	Pearson's <i>r</i>	<i>p</i>	95% Lower CI	95% Upper CI
Taking an exam	0.14*	<0.05	0.08	0.25
Classroom presentation	0.19*	<0.05	0.18	0.37
Classroom participation	0.07*	<0.05	0.23	0.41
Tutoring sessions	0.14*	<0.05	0.19	0.36
Academic overload	0.52	<0.05	0.23	0.41
Classroom massification	0.04	0.28	0.01	0.17
Lack of time	0.39*	<0.05	0.09	0.26
Mandatory work	0.18*	<0.05	0.16	0.35
Homework	0.00	0.41	0.10	0.30
Group work	0.17	0.25	0.14	0.32
Classmate competitiveness	0.03	0.34	0.18	0.34

Table 4. Hierarchical multiple regression of irritable bowel syndrome of each academic stress situation in the academic stress inventory.

	<i>Beta</i>	<i>ET</i>	(<i>p</i>)	<i>R</i> ²	<i>F</i>
MODEL					
Academic overload	0.04	0.02	<0.01	0.62*	41.10
Lack of time	0.42	0.03	<0.05		
	0.23				

* *p* < 0.05.

The results show a significant increase of the AS and IBS explanation as scored by the college students. The regression equation consists of the following: (IBS) = 0.7 (academic overload) + 0.04 (lack of time). The rest of the variables with low or inverse correlation values were excluded from the model, which increased the explained percentage of the variable under study (IBS) significantly (Table 4).

Different contrasts were made to the data regarding to independence, normality and homoscedasticity assumptions. We should mention in this regard that the data did not show multicollinearity between the predictive variables. The average statistical values of <Tolerance> for physical, psychological and behavioral factors was 0.91, with no value less than 0.89. The closeness of these values to the maximum value (range 0–1) indicates the independence of the predictive variable contributions from the values of the 11 AS situations, indicating that the residual variance is constant and establishing that residuals are distributed normally. The average value Variance Inflation Factor VIF = 1.14) showed there was no collinearity problem.

3. Discussion

This study showed the existence of a positive correlation between students meeting the IBS criteria and the AS situations of academic overload and lack of time and the presence of IBS. The ratio indicates a dependency between the variables: when one of them increases so does the other at a constant proportion. These results enable us to validate knowledge that this is the first predictive report identifying the existence of a relation between IBS and AS situations in college students. The resulting model of this investigation contributes to confirming the transactional theory of the social cognitive approach that emphasizes the interaction of stress variables, based on cognitive processes that develop around a stressful situation, such as the internal

representation of particular problematic situations between students and their academic environment and health.

Other studies have already shown the relation between IBS and student stress [1,12–14,22]. The results of this study have also succeeded in establishing the previous relationship, especially in the AS situations of lack of time and academic overload. The difference between our study and other studies lies in the kind of analyzed stress; while the stress addressed in this study is academic stress, the other studies we aimed at other kinds of situations such as anxiety disorders, chronic stress, psychological stress, acculturative stress, depression and mental stress [1,5,7,12,14,22,23]. Another likely cause for the differences are the differences in study designs, especially those dealing with AS in different situations, such as coping and the tendency of students to have poor academic performance [3,24–26].

The results also showed that compared to men, women had a higher mean score for IBS as well as for AS dimensions, that is, taking an exam, classroom presentation, academic overload, classroom massification, lack of time and group work. It is important to watch the female population closely because other studies have reported that females are under greater risk for associated IBS and stress [12–14,27,28].

Academic environment stressors influenced by personality traits may trigger negative emotional states leading to improper behavior as pointed out in other studies [14,29,30]. Higher education in Mexico [31] considers the college student profile to be, among other things, of a student having the capacity to analyze and investigate, and to cope with and resolve challenges, handle technology, master a second language and have the required monetary resources and time to deal with administrative and academic procedures. But in reality, Mexican students and public universities face some other obstacles due to the high levels of poverty in the country. A large portion of them have to work besides studying and fulfilling the academic load during mixed schedules (morning and afternoon) as well as professional practice outside school hours, all of which create an overload of activities as seen in the lack of time to fulfill their academic obligations, and thus the high levels of AS [32].

4. Limitations

One of the strengths of this study is the size of the sample, which is both large and representative. Fifty-four percent of all medical at this center of higher learning were interviewed, a larger inclusion of students than in other AS studies [25,33]. The study's limitations should also be mentioned, mainly the existence of other factors that may have had an influence on IBS and AS at the time the questionnaires were applied, such as diet, social, difficulties

economic, and family characteristics, which were not evaluated in this study.

5. Conclusion

In conclusion, our study determined that only the academic stress situations of academic overload and lack of time are predictive for having IBS. In addition, diarrhea is more common than constipation and mixed bowel habits in the medical students of a public university in Mexico.

The exact identification of stressors could help to reduce and understand stress, thus eliminating its harmful effects, which negatively affect the academic performance of students. From here, the implementation of educational programs aimed at preventing stress and its negative effects, which promote the ability of students to cope with stressful situations, is recommended.

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No potential conflict of interest was reported by the authors.

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