

1 **PREVALENCE OF IRRITABLE BOWEL SYNDROME AND ASSOCIATED FACTORS, INCLUDING STRESS,**
2 **ANXIETY AND DEPRESSION, AMONG NURSING STUDENTS IN A PRIVATE UNIVERSITY IN MALAYSIA**

3 **Running Title: Irritable Bowel Syndrome in a Private University, Malaysia**

4 **Abstract**

5 **Background to the Study**

6 Information on the prevalence of Irritable bowel syndrome (IBS) in the Asian population is relatively
7 scanty although it is prevalent in the general population. There have only been few Asian studies
8 concerning anxiety, stress and depression in their association with IBS. IBS is a common gastrointestinal
9 disorder, and its prevalence and demographics have been only been studied using different
10 methodologies and with varying results.

11 **Objectives**

12 To determine the prevalence of IBS among nursing students at MAHSA University, Malaysia, and to
13 determine whether anxiety, depression, stress is associated with IBS, besides
14 determining the common sub-types.

15 **Method**

16 This cross-sectional study was conducted from March to July 2017 at MAHSA University, Malaysia on
17 nursing students from the Faculty of Nursing. All participants completed a self-administered
18 Questionnaire.

19 **Results**

20 The prevalence of IBS among nursing students according to Rome III criteria was 46.8%. The commoner
21 sub-type of IBS was IBS-Diarrhea (44, 46.8%) followed by IBS-Constipation (38, 40.4%) and IBS-Mixed

22 (12, 12.8%). Students who stayed at the hostel had significant association with IBS-C ($p < 0.05$)
23 compared to IBS-D and IBS-M. Depression and IBS were significantly associated ($p < 0.05$).

24 **Conclusion**

25 The prevalence of IBS among nursing students studying in MAHSA University, Malaysia is 46.3% which is
26 conspicuously higher than in previous studies in other countries. IBS-D is the commonest sub-type of IBS
27 (46%). In addition, IBS is significantly associated with depression, but anxiety and stress are not. There is
28 no significant association between IBS and Socio-demographic factors, except in gender.

29 **Key-words:** Irritable Bowel Syndrome (IBS), prevalence, nursing students, anxiety, stress, depression,
30 association, socio-demographic factors, IBS-subtypes

31

32 **Introduction**

33 Irritable Bowel Syndrome (IBS) is one of the most common functional bowel disorders, defined as the
34 presence of abdominal pain or discomfort in association with altered bowel habits, without any organic
35 damage to the intestine, (1) although abnormal gut motor and sensory functions have been implicated
36 among the Asian IBS subjects. Recently, there is evidence of altered colonic neuro-immune function
37 leading to gut hypersensitivity and dysmotility. An Asia–Pacific trial also confirmed tegaserod efficiency
38 on female C-IBS subjects. (Chang FY and Lu CL 2006)

39 It is a commonly prevalent gastrointestinal disorder. The pathophysiology of IBS is still not completely
40 understood, but psychological disorders may affect the onset and outcome of IBS in many patients. 1

41 Rome III subtype classifies as follows: Subjects affected mainly by “loose bowels/diarrhea” are classified
42 into IBS-D. Those mainly affected by “constipation” are classified as IBS-C, and those with both are
43 considered to be IBS-M. 1

44 To diagnose IBS, patients must have recurrent abdominal pain or discomfort for at least three months in
45 the previous six months, with two or more of the following symptoms: (1) relief with defecation, (2)
46 onset associated with a change in frequency of stool, and (3) onset associated with a change in form
47 (appearance) of stool. 2

48 In addition, the classification of IBS subtypes is based on the predominant stool pattern. IBS with
49 constipation (IBS-C) has hard or lumpy stool in at least 25% of the time and loose (mushy) or watery
50 stools in less than 25% of bowel movements. IBS with diarrhea (IBS-D) has loose (mushy) or watery
51 stools at least in 25% of the time and hard stools in less than 25% of bowel movements. Mixed IBS (IBS-
52 M) has hard or lumpy stool in at least 25% of bowel movements and loose (mushy) or watery stool in at
53 least 25% of bowel movements. Un-subtyped IBS means insufficient abnormality of stool consistency to
54 meet criteria of the other three subtypes. 2

55 It is one of the commonest disorders diagnosed by gastroenterologists and is a common cause of
56 general-practice visit. Although the disease is not life-threatening, patients appear badly affected in
57 their everyday life. 3 Its prevalence and associated-factors have been ascertained using different
58 methodologies with varying results. 4 Its prevalence varies in different communities. 5 - 6

59 Information on the prevalence of IBS in Asian-populations is relatively scanty.7 There have been only a
60 few Asian studies concerning anxiety and depression associated with irritable bowel syndrome (IBS). 8

61 The impact of the psychological factors associated with IBS has been widely studied in Western
62 countries. (Lackner JM et al, 2007) Individuals may interpret one's health events in a manner that is
63 partly dependent on their social and cultural backgrounds. However, there are only a few studies in Asia,
64 and these studies have mainly focused on the prevalence, symptom patterns, or impact on the QOL of
65 IBS patients. (Si JM et al, 2004)

66 Epidemiological studies of irritable bowel syndrome (IBS) among young adults are few, especially in
67 Asian countries. 9 Functional gastrointestinal disorders, including functional dyspepsia, irritable bowel
68 syndrome and functional constipation are very common worldwide. 2 Patients with IBS are more likely
69 to suffer from anxiety leading to burden of illness affecting quality of life. 10

70 Some Asian IBS-studies have been published in recent decades since the evolution of the IBS-definition,
71 and the understanding in the pathogenesis, diagnosis and treatment. These studies describe the current
72 situation of IBS in many countries and show conspicuous cultural-differences within Asia, and in
73 comparison with the West. Asian IBS subjects do experience psychological disturbances including
74 anxiety, depression, agoraphobia and neuroticism. Accordingly, their quality of life is poor and there is
75 absenteeism leading to excessive physician visits. 11

76 Changing-lifestyles and rapid changes in the socioeconomic-environment contribute to the increased
77 prevalence of IBS in Asian countries. Recently, more attention has been given to the influence of
78 psychosocial factors in the pathogenesis, severity, course, and outcome of IBS.12 Gender differences,
79 psychological symptoms, and response to psychological treatments have not been well-studied.13

80 However, Chang FY and Lu CL (2006) say Western recommended criteria clearly diagnose Asian IBS and
81 many factors are mutual leading to IBS. Current IBS treatments remain useful. 11

82 IBS is common in the general population, but students may be at particularly special-risk because of
83 psychological-distress due to examinations and study-load, and because they may be far from their
84 families.

85 The Objective of our Study was to determine the prevalence of Irritable Bowel Syndrome (IBS) among
86 the Nursing-students diploma and bachelor) from the Faculty of Nursing at the MAHSA University in
87 Malaysia. The Objective was also to determine the Sub-types, besides the association between socio-
88 demographic factors, such as gender, age, living conditions (with a family, in a private house or in

89 hostel), ethnicity, and Irritable Bowel Syndrome – and also, its association with stress, anxiety and
90 depression.

91

92 **Method**

93 Our Study was of a Cross-sectional Design. To our knowledge, this is the first study using Rome III
94 criteria to determine the prevalence and the associated factors of Irritable Bowel Syndrome among
95 nursing students in Malaysia. The period of our Study was from March to July 2017. The Questionnaire
96 was first pre-tested on a sample of 20 students.

97 No Sampling was done, and our Study was conducted by the census-method at the start of the students'
98 classes.

99 To calculate sample size, the prevalence of IBS in the Study-population was estimated from previous
100 studies which showed values of prevalence rate, $p= 17.4\%$, $(1 - p) q= 82.6\%$ and 'degree of precision' =
101 5%. Using acceptable significance-level (p-value) as 0.05 at 95% CI and $Z\alpha= 1.96$, a Sample-size of 220
102 was arrived at, although only 203 Nursing-students participated in the Study.

103 All participants completed a Self-administered Questionnaire after providing Informed-consent. The
104 Questionnaire was first pre-tested on a sample of 20 students. A standardized self-administered
105 Questionnaire, which has been developed by the Rome Foundation Board to identify Functional
106 Gastrointestinal Disorders (FGIDs) was used. In this, IBS is defined as recurrent abdominal pain or
107 discomfort at least three days/month in the last three months associated with two or more of the
108 following:

109 1. Improvement with defecation

110 2. Onset associated with a change in frequency of stool

111 3. Onset associated with a change in form (appearance) of stool

112 The criteria above needed to be fulfilled for the last 3 months with symptom onset at least 6 months

113 prior to diagnosis. 14

114 The third part was the Depression Anxiety and Stress Scales - 21 (DASS 21). The English-version of the

115 DASS-21 was used. The English-version of the DASS-21 has been validated by many studies. One of them

116 is by Nieuwenhuijsen K et al (2003)

117 The DASS is a set of 3 scales designed to assess distress along the dimensions of depression, anxiety and

118 stress.

119 The 21-item version has three sub-scales with 7 items each concerning Anxiety (Items 2, 4, 7, 9, 15, 19,

120 20), Depression (Items 3, 5, 10, 13, 16, 17, 21) and Stress (Items 1, 6, 8, 11, 12, 14, 18). The scale-point

121 ranged between 0 (Does not apply to me at all) and 3 (Applies to me very much or most of the time).

122 The respondents indicate the frequency or extent to which they experienced each of the symptoms

123 described on the Items. The scores for each scale were obtained by summing the responses and

124 multiplying by two.

125
126
127

128 **Table 1: Classification of Severity of Depression, Anxiety and Stress according to DASS-21 Scores**

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18

Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

129

130 The Study was approved by the Ethics Committee of the Faculty of Medicine, MAHSA University,
131 Malaysia.

132 Data-management and data-analysis (both Descriptive and Analytical) was done using IBM Corp.
133 Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.

134 Hypothesis testing for all variables was conducted using the Chi-squared test to determine the presence
135 of association between each variable of socio-demographic characteristic and Irritable Bowel Syndrome.
136 Binary logistic regression was performed to determine association between anxiety, stress, and
137 depression with IBS.

138 Level of significance acceptable was set at $p < 0.05$.

139 Only 'Age' as a variable was quantified as a Numerical Scale which was subsequently transformed into
140 Categorical Ordinal. Thus, the 'Mean' and the 'Standard Deviation (SD)' is not denoted here for any of
141 the Variables.

142 There are a number of limitations to our study.

143 First, the age-range is limited – thus, comparison of IBS-prevalence among the different age groups is
144 limited.

145

146 Secondly, our study uses a self-administered questionnaire – and thus, sensitive questions especially to
147 adolescents, were avoided.

148 Thirdly, our data is based on a selected-group of nursing-students and may not be generalizable to all
149 nursing-students. No Random Sampling was done.

150 Fourthly, the extra-stress on students when having their exam may have exaggerated their
151 gastrointestinal symptoms and psychological stressors, thus affecting our results.

152 Fifth, the Total Number of subjects was slightly less than the sample-size calculated.

153 Sixth, the subjects' Past Medical History, Social History, and Dietary History was not obtained. Such
154 would have made our Study more complete.

155 Lastly, males in our study comprised only 11.8%.

156 **Results**

157 **Prevalence of Irritable Bowel Syndrome and association with Socio-demographic Factors**

158 The prevalence of IBS among nursing students according to Rome III criteria was 46.3% (95% CI: 39.6%
159 to 53.2%). (Table III). The prevalence of IBS among female students was more than in male students, 85
160 (47.5 %) and 9 (9.6%) respectively. There was a significant association between gender and IBS ($\chi^2 =$
161 10.24) ($p < 0.01$).

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163

164 **Table II: Prevalence of Irritable Bowel Syndrome among nursing students**

Frequency	%	95% CL	
		Lower	Upper
94	46.3%	39.58%	53.17%

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166 The Socio-demographic factors in relation to prevalence of IBS is summarized here in Table III.

167 **Table III: Relationship between demographic characteristics and IBS**

	Total n (%)	IBS	χ^2	P-value
Gender				
Male	24 (11.8%)	9 9.6%	10.24	<0.01
Female	179 (88.2%)	85 47.5%		
Age				
17-20	167 (82.3%)	74 78.7%	2.111	>0.30
21-24	29 (14.3%)	17 18.1%		
≥ 25	7 (3.4%)	3 3.2%		
Ethnicity				
Malay	110 (54.2%)	55 58.5%	1.459	>0.69
Indian	13 (6.4%)	5 5.3%		
Chinese	20 (9.9%)	9 9.6%		
Other	60 (29.6%)	25 28.6%		
Living Condition				
Hostel	189 (93.1%)	89 94.7%	1.202	> 0.61
With family	4 (2.0%)	2 2.1%		
Private house	10 (4.9%)	3 3.2%		

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169

170 Most of participants who have IBS were from the age group of 17-20 years i.e. 74 (78.7%). Seventeen
 171 participants (18.1%) were from the age-group of 21-24 years and three participants (3.2%) were aged \geq
 172 25. There was no significant association between age and IBS ($\chi^2 = 2.07$) ($p > 0.30$). Similarly, Ethnic
 173 group and Living-condition.

Symptoms	Total	IBS	No IBS	P value
In the last 3 months (abdominal pain or discomfort)				

174 Comfort after Completing a Bowel-movement, Change of Frequency of Stool (whether more frequent),
 175 Change of Frequency of Stool (whether less frequent), and Whether Enough Sleep in relation to
 176 presence of IBS are tabulated in Table IV.

177

Feeling more comfortable after completing a bowel movement	105	79 (75.2%)	26 (24.8%)	<0.001
Change in the frequency of stool (more frequently)	55	42 (76.4%)	13 (23.6%)	<0.001
Change in the frequency of stool (less frequently)	45	35 (77.8%)	10 (22.2%)	<0.001
Symptoms wake from sleep	52	34 (65.4%)	18 (34.6%)	<0.0015

178

179 Students who stayed at the Hostel were found to have a significant association with IBS-C 35 (39.3%, $p <$
180 0.05). Malay students were found to have IBS-C more commonly i.e. 23 (41.8%), followed by IBS-D, 22
181 (40.0%), and followed by IBS-M, 10 (18.2%). Fourteen (56.0%) of Other Race students were found to
182 have IBS-D, 9 (36.0%) had IBS-C and 2 (8.0%) had IBS-M.

183 Students in the age-group 17-20 years were mostly affected with IBS-D 36 (48.6%), whereas IBS-C
184 numbered 28 (37.8%) and IBS-M, 10 (13.5%).

185 In female-students, IBS-D was found the commonest i.e. 39 (45.9%), while IBS-M was much lower at 11
186 (12.9%). There was no significant association between gender and IBS-D, IBS-C, IBS-M ($p > 0.30$).

187 **Relationship between Socio-demographic characteristics and anxiety, stress and depression**

188 The relationship between Socio-demographic characteristics and anxiety, stress and depression is
189 summarized in Tables V – VII

190 **Table IV: Symptoms in association with presence of IBS**

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198 **Table V: Relationship between Socio-demographic characteristics and anxiety**

Characteristics	Anxiety		
	Normal	Mild	
Moderate	Severe	Extremely severe	
Gender			
Male	11 (45.8%)	2 (8.3%)	7
(29.2%)	3 (12.5%)	1 (4.2%)	
Female	72 (40.2%)	26 (14.5%)	53
(29.6%)	15 (8.4%)	13 (7.3%)	
Age			
17-20	66 (39.5%)	24 (14.4%)	51
(30.5%)	14 (8.4%)	12 (7.2%)	
21-24	14 (48.3%)	3 (10.3%)	7
(24.1%)	3 (10.3%)	2 (6.9%)	
≥ 25	3 (42.9%)	1 (14.3%)	2
(28.6%)	1 (14.3%)	0	
Ethnicity			

Malay (30.9%)	43 (39.1%) 9 (8.2%)	16 (14.5%) 8 (7.3%)	34
Indian (38.5%)	5 (38.5%) 0	1 (7.7%) 2 (15.4%)	5
Chinese (15.0%)	8 (40.0%) 3 (15.0%)	6 (30.0%) 0	3
Other (30.0%)	27 (45.0%) 6 (10.0%)	5 (8.3%) 4 (6.7%)	18

Living Conditions

Hostel	77 (40.7%)	28 (14.8%)	56 (29.6%)	17 (9.0%)	11 (5.8%)
With family	1 (25.0%)	0	2 (50.0%)	0	1 (25.0%)
Private homes	5 (50.0%)	0	2 (20.0%)	1 (10.0%)	2 (20.0%)

Table VI: Relationship between Socio-demographic characteristics and stress

Characteristics	Stress				
	Normal	Mild	Moderate	Severe	Extremely severe
Gender					
Male	18 (75.0%)	3 (12.5%)	1 (4.2%)	2 (8.3%)	0
Female	153 (85.5%)	18 (10.1%)	7 (3.9%)	1 (0.6%)	
Age					
17-20	144 (86.2%)	16 (9.6%)	5 (3.0%)	2 (1.2%)	0
21-24	21 (72.4%)	4 (13.8%)	3 (10.3%)	1 (3.4%)	
≥ 25	6 (85.7%)	1 (14.3%)	0 (0.0%)	0 (0.0%)	
Ethnicity					

Malay	92 (83.6%)	12 (10.9%)	4 (3.6%)	2 (1.8%)	0
Indian	9 (69.2%)	1 (7.7%)	2 (15.4%)	1 (7.7%)	
Chinese	19 (95.0%)	1 (5.0%)	0 (0.0%)	0 (0.0%)	
Other	51 (85.0%)	7 (11.7%)	2 (3.3%)	0 (0.0%)	
Living Condition					
Hostel	163 (86.2%)	19 (10.1%)	6 (3.2%)	1 (0.5%)	0
With family	2 (50.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)	
Private homes	6 (60.0%)	0 (0.0%)	2 (20.0%)	2 (20.0%)	

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Table VII: Relationship between Socio-demographic characteristics and depression

Characteristics	Depression				
	Normal	Mild	Moderate	Severe	Extremely severe
Gender					
Male	15 (62.5%)	3 (12.5%)	5 (20.8%)	1 (4.2%)	0 (0.0%)
Female	121 (67.6%)	26 (14.5%)	26 (14.5%)	5 (2.8%)	1 (0.6%)
Age					

17-20	114 (68.3%)	23 (13.8%)	24 (14.4%)	5 (3.0%)	1 (0.6%)
21-24	17 (58.6%)	5 (17.2%)	6 (20.7%)	1 (3.4%)	0 (0.0%)
≥ 25	5 (71.4%)	1 (14.3%)	1 (14.3%)	0 (0.0%)	0 (0.0%)
Ethnicity					
Malay	74 (67.3%)	15 (13.6%)	17 (15.5%)	3 (2.7%)	1 (0.9%)
Indian	7 (53.8%)	4 (30.8%)	1 (7.7%)	1 (7.7%)	0 (0.0%)
Chinese	15 (75.0%)	3 (15.0%)	2 (10.0%)	0 (0.0%)	0 (0.0%)
Other	40 (66.7%)	7 (11.7%)	11 (18.3%)	2 (3.3%)	0 (0.0%)
Living Condition					
Hostel	129 (68.3%)	28 (14.8%)	27 (14.3%)	4 (2.1%)	1 (0.5%)
With family	2 (50.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)
Private homes	5 (50.0%)	0 (0.0%)	3 (30.0%)	2 (20.0%)	0 (0.0%)

202

203

Psychological factors in relation to the Irritable Bowel Syndrome

204

The relationship between anxiety, stress and depression, each separately with IBS, is summarized in

205

Tables VIII - X

206

Binary logistic regression was used to determine the relationship between anxiety, stress and

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depression with Irritable Bowel Syndrome. Anxiety and stress were not significantly associated with IBS

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(p value > 0.09, > 0.38 respectively). In contrast, there was significant association between depression

209

and IBS (p < 0.05), indicating that depression could be a predictor of IBS and that psychological factors

210

play a role in the development of IBS. Table VII.

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Table VIII: Psychological factors in relation to the Irritable Bowel Syndrome: Anxiety

Anxiety							
Characteristics	Normal	Mild	Moderate	Severe	Ex severe	χ^2	P
Gender							
Male	11 (45.8%)	2 (8.3%)	7 (29.2%)	3 (12.5%)	1 (4.2%)	1.339	0.80
Female	72 (40.2%)	26 (14.5%)	53 (29.6%)	15 (8.4%)	13 (7.3%)		
Age							
17-20	66 (39.5%)	24 (14.4%)	51 (30.5%)	14 (8.4%)	12 (7.2%)	2.360	0.90
21-24	14 (48.3%)	3 (10.3%)	7 (24.1%)	3 (10.3%)	2 (6.9%)		
≥ 25	3 (42.9%)	1 (14.3%)	2 (28.6%)	1 (14.3%)	0		
Ethnicity							
Malay	43 (39.1%)	16 (14.5%)	34 (30.9%)	9 (8.2%)	8 (7.3%)	11.44	0.40
Indian	5 (38.5%)	1 (7.7%)	5 (38.5%)	0	2 (15.4%)		
Chinese	8 (40.0%)	6 (30.0%)	3 (15.0%)	3 (15.0%)	0		
Other	27 (45.0%)	5 (8.3%)	18 (30.0%)	6 (10.0%)	4 (6.7%)		
Living Condition							
Hostel	77 (40.7%)	28 (14.8%)	56 (29.6%)	17 (9.0%)	11 (5.8%)	7.866	0.30
With Family	1 (25.0%)	0	2 (50.0%)	0	1 (25.0%)		
Private Home	5 (50.0%)	0	2 (20.0%)	1 (10.0%)	2 (20.0%)		

212

213 **Footnote: 1. Ethnicity is a Categorical Nominal variable**

214 **2. Living Condition is a Categorical Nominal variable**

215 **3. Age is a Categorical Ordinal variable**

216 **4. Gender is a Categorical Nominal variable**

217

218 **Table IX. Psychological factors in relation to the Irritable Bowel Syndrome: Stress**

Characteristics	Stress					X ²	P
	Normal	Mild	Moderate	Severe	Ex severe		
Gender							
Male	18 (75.0%)	3 (12.5%)	1 (4.2%)	2 (8.3%)		6.655	0.06
Female	153 (85.5%)	18 (10.1%)	7 (3.9%)	1 (0.6%)			
Age							
17-20	144 (86.2%)	16 (9.6%)	5 (3.0%)	2 (1.2%)		7.704	0.20
21-24	21 (72.4%)	4 (13.8%)	3 (10.3%)	1 (3.4%)			
≥ 25	6 (85.7%)	1 (14.3%)	0 (0.0%)	0 (0.0%)			
Ethnicity							
Malay	92 (83.6%)	12 (10.9%)	4 (3.6%)	2 (1.8%)		8.665	0.30
Indian	9 (69.2%)	1 (7.7%)	2 (15.4%)	1 (7.7%)			
Chinese	19 (95.0%)	1 (5.0%)	0 (0.0%)	0 (0.0%)			
Other	51 (85.0%)	7 (11.7%)	2 (3.3%)	0 (0.0%)			
Living Condition							
Hostel	163 (86.2%)	19 (10.1%)	6 (3.2%)	1 (0.5%)		22.240	0.01
With family	2 (50.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)			
Private Home	6 (60.0%)	0 (0.0%)	2 (20.0%)	2 (20.0%)			

219

220 **Footnote: 1. Ethnicity is a Categorical Nominal variable**

221 **2. Living Condition is a Categorical Nominal variable**

222 **3. Age is a Categorical Ordinal variable**

223 **4. Gender is a Categorical Nominal variable**

224

225 **Table X: Psychological factors in relation to the Irritable Bowel Syndrome (Depression)**

Depression							
Characteristics	Normal	Mild	Moderate	Severe	Ex severe	χ^2	P
Gender							
Male	15 (62.5%)	3 (12.5%)	5 (20.8%)	1 (4.2%)	0 (0.0%)	2.078	0.70
Female	121 (67.6%)	26 (14.5%)	26 (14.5%)	5 (2.8%)	1 (0.6%)		
Age							
17-20	114 (68.3%)	23 (13.8%)	24 (14.4%)	5 (3.0%)	1 (0.6%)	4.582	0.90
21-24	17 (58.6%)	5 (17.2%)	6 (20.7%)	1 (3.4%)	0 (0.0%)		
≥ 25	5 (71.4%)	1 (14.3%)	1 (14.3%)	0 (0.0%)	0 (0.0%)		
Ethnicity							
Malay	74 (67.3%)	15 (13.6%)	17 (15.5%)	3 (2.7%)	1 (0.9%)	8.538	0.80
Indian	7 (53.8%)	4 (30.8%)	1 (7.7%)	1 (7.7%)	0 (0.0%)		
Chinese	15 (75.0%)	3 (15.0%)	2 (10.0%)	0 (0.0%)	0 (0.0%)		
Other	40 (66.7%)	7 (11.7%)	11 (18.3%)	2 (3.3%)	0 (0.0%)		
Living Condition							
Hostel	129 (68.3%)	28 (14.8%)	27 (14.3%)	4 (2.1%)	1 (0.5%)	15.097	0.06
With family	2 (50.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)		
Private Home	5 (50.0%)	0 (0.0%)	3 (30.0%)	2 (20.0%)	0 (0.0%)		

226

227 **Footnote: 1. Ethnicity is a Categorical Nominal variable**

228 **2. Living Condition is a Categorical Nominal variable**

229 **3. Age is a Categorical Ordinal variable**

230 **4. Gender is a Categorical Nominal variable**

231 **Table XI: The relationship between anxiety, depression, stress and IBS by Binary logistic regression**

Variables	B	Odds ratio	95% CI		P value
			Lower	Upper	
Anxiety	0.099	1.104	0.966	1.260	0.10
Stress	0.057	1.058	0.917	1.222	0.40
Depression	-0.152	0.859	0.745	0.992	0.03

232

233 **Footnote: 1. Age is a Categorical Ordinal variable**

234 **2. Gender is a Categorical Nominal variable**

235 **3. Presence of Anxiety is a Categorical Nominal variable**

236 **4. Presence of Stress is a Categorical Nominal variable**

237 **5. Presence of Depression is a Categorical Nominal variable**

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240 **Discussion**

241 To our knowledge, this is the first study using Rome III criteria to determine the prevalence and the
 242 associated factors of Irritable Bowel Syndrome among nursing students in Malaysia. The prevalence rate
 243 of IBS was found to be 46.3% among the nursing students studying at MAHSA University, Malaysia.

244 This value is higher than that reported in China among medical and nursing students i.e. 32.1%
 245 according to Rome II criteria. 15 It is also higher than that reported in Egypt (22.9%) among medical and
 246 non-medical students using Rome III criteria and the questionnaire was administered to Suez Canal
 247 University students. 16 The studies that were conducted in Saudi Arabia showed that the prevalence
 248 was 31.8% to 32.5% and the two studies used Rome III criteria, 17 while the prevalence of IBS among

249 University students in Lebanon according to Rome III criteria was 20%. 18 In Pakistan, a prevalence of
250 28.3% has been reported among medical students and the study used Rome III criteria. 19
251 In addition, our finding is higher than that those reported in two Chinese studies which were conducted
252 among nursing and university students of China. The prevalence of IBS according to Rome III criteria
253 was reported as 7.85% in the year 2010, (20) as compared to the prevalence of 17.4% in the year 2014.
254 12

255 Prevalence was 12.6% among medical students of Gilan, Northern Province of Iran.⁵ Internet survey in
256 Japan reported that the prevalence of IBS according to Rome III criteria was 13.1%. 1 The Saudi Arabian
257 study among medical students reported that the prevalence of IBS was 21%. 6 A school-based study in
258 China in the year 2014 reported that the prevalence of Irritable Bowel Syndrome according to Rome III
259 criteria was 22.9%. 12 In Nigeria, it was reported that the prevalence among students was 26.1%. 21
260 These prevalences are lower than that found in our Study.

261 The differences in the prevalences above between this Study and other previous Studies outside
262 Malaysia could be due to Geographical differences, and the differences in the Socio-demographic
263 Factors.

264 Our Study showed a significant gender difference in prevalence of IBS. Female gender has long been
265 believed to be a factor leading to IBS. In a meta-analysis, Kang indicated that eight of 12 Western-studies
266 and four of eight Eastern studies have been female pre-dominant. In addition, Gwee stated that there
267 was no female predominance except in a Japanese study. In contrast, an inter-national cooperation
268 study does not show a female predominance in Japan. Many Chinese-studies appear to show a female
269 predominance in ethnic Chinese IBS subjects. However, after correction for gender ratio in the control
270 population, the female predominance existed only in one study. 11

271 In contrast, multiracial Malaysian and Singaporean studies show a female predominance although the
272 gender factor of the Chinese population is not addressed. Interestingly, two earlier Singaporean studies
273 did not obtain this trend for female-gender, while recent Rome I and II analyses reported similar gender
274 trends. An Indian prevalence study also provides no distinct gender difference. It is believed that female
275 gender is not a main risk factor for IBS in Asia. 11

276 In our Study, the total number of participants having IBS was 94, and these were characterized by
277 diarrhea (44), constipation (38) and mixed (12). These findings are quite similar to that reported by Lee
278 (2009). 22 One study in China reported that the IBS of the Diarrhea-type is more frequent than the IBS
279 Constipation-type. 20 The Results of our Study are also consistent with findings of a study conducted
280 among Japanese University students which showed that the Constipation-type was more prevalent
281 (47.8%). 9 However, the findings of our Study are not in agreement with the results shown by Naeem et
282 al., (2012) 19 where the most common type was the Mixed-type followed by the Constipation-type.

283 The Study in Saudi Arabia showed that IBS was Relieved by Defecation among 37.9% of the Study-
284 subjects while our Study showed that students who have IBS felt more Comfortable after Defecation
285 than the students who do not have IBS.

286 Regarding sleep, the study in Saudi Arabia showed that the students who sleep less than 8 h/day had a
287 slightly higher prevalence of IBS compared to others. 23

288 Poor sleep was independently associated with IBS among adolescents in Shanghai, China. 24 Similarly,
289 our Study shows that Not Enough Sleep was found significantly higher in students who had IBS (56.4%)
290 than those did not have IBS (34.6%) ($p < 0.0015$).

291 In our Study, depression among nursing students was proved to be a major association with Irritable
292 Bowel Syndrome. Our Study is in agreement with the study by Dong et al., (2013) 2 which showed that

293 depression was associated with IBS. On the other hand, our finding shows that anxiety is not associated
294 with IBS, whereas the study by Dong et al., (2013) showed that it was. 2

295 The nursing students in our Study experienced more Psychological-stress due to Examinations and
296 Study-load. They had Lack of Concentration in different tasks. These individuals had a difficulty in
297 managing their anger and at work or university activities.

298 The differences between our Study and others may somewhat be due to characteristics of the study-
299 subjects, differences in sampling method, methodological differences in assessment of psychological
300 factors, and/or cultural differences in perception of somatic-symptoms of psychological problems.

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302

303 Conclusions and Recommendations

304 The prevalence of IBS among nursing students studying in MAHSA University, Malaysia, is 46.3% which is
305 conspicuously higher than previous studies in other countries. IBS-D is the commonest sub-type of IBS
306 (46%). In addition, IBS is significantly associated with depression, but anxiety and stress are not. There is
307 no significant association between IBS and Socio-demographic factors. Students who stay in hostel were
308 significantly associated with IBS-D and IBS-C. This Study shows that proportionately more female
309 students suffer from IBS than male students. It is recommended that more studies on Objective
310 Measurement of Dietary Factors and Habits besides Exercise are needed to add to the understanding of
311 the Scope and Dimensions of IBS in the population. Malaysian Universities should provide psychological-
312 support by means of adequate counselling-services aimed at improving the socio-cultural-economic and
313 psychological status of nursing-students, and other students in general. Nursing-students, and students
314 in general, should also receive Health Education on IBS, as part of general Health Promotion among

315 them. As Chang FY and Lu CL (2006) say, additional reeducation for medical professionals may be
316 necessary.

317 **References:**

- 318 1. Miwa, H. Prevalence of irritable bowel syndrome in Japan: Internet survey using Rome
319 III criteria. *Patient Prefer Adherence*. 2008; 2, 143-147.
- 320 2. Dong Y.-Y., Chen F.-X., Yu Y.-B., Du C., Qi Q.-Q. & Liu H. *et al.* A school-based study with
321 Rome III criteria on the prevalence of functional gastrointestinal disorders in Chinese
322 college and university students. *PLoS One*, 2013; 8, e54183.
- 323 3. Ahmed, A., Mohamed, R. A., Sliem, H. A. & Eldein, H. N. Pattern of irritable bowel
324 syndrome and its impact on quality of life in primary health care center attendees, Suez
325 governorate, Egypt. *Pan African Medical Journal*. 2011; 9.
- 326 4. Andrews E., Eaton S., Hollis K., Hopkins J., Ameen V. & Hamm L. Prevalence and
327 demographics of irritable bowel syndrome: results from a large web-based survey.
328 *Alimentary pharmacology & therapeutics*. 2005; 22, 935-942.
- 329 5. Mansour-Ghanaei F., Fallah M., Heidarzadeh A., Jafarshad R., Joukar F. & Ghasemipour.
330 Prevalence and characteristics of irritable bowel syndrome (IBS) amongst medical
331 students of Gilan Northern Province of Iran. *Middle East Journal of Digestive Diseases*
332 (MEJDD). 2009; 1, 100-105.
- 333 6. Al-Ghamdi S., Alosamey F., Alhamdani A., Alnujaydi A., Turkistani A. & Alrasheed, A *et al.*
334 A study of impact and prevalence of irritable bowel syndrome among medical students.
335 *International Journal of Medicine and Medical Sciences*.2015; 7, 139-147.

- 336 7. Tan Y. M., Goh K. L., Muhidayah R., Ooi C. L. & Salem O. 2003. Prevalence of irritable
337 bowel syndrome in young adult Malaysians: a survey among medical students. *Journal*
338 *of gastroenterology and hepatology*. 2003; 18, 1412-1416.
- 339 8. Cho H. S., Park J. M., Lim C. H., Cho Y. K., Lee I. S. & Kim S. W. Anxiety, depression and
340 quality of life in patients with irritable bowel syndrome. *Gut Liver*.2011; 5, 29-36.
- 341 9. Shiotani A., Miyanishi T. & Takahashi T. Sex differences in irritable bowel syndrome in
342 Japanese university students. *Journal of gastroenterology*.2006; 41, 562-568.
- 343 10. Mohammadi S., Izadi-Mazidi M. & Akkbarian-Firoozabad M. Anxiety and Quality of Life
344 in patients with Irritable Bowel Syndrome. *Journal of Medical Sciences*.2015; 15, 235.
- 345 11. Chang F. Y. & Lu C. L. Irritable bowel syndrome in the 21st century: Perspectives from
346 Asia or South-east Asia. *Journal of gastroenterology and hepatology*. 2007; 22, 4-12.
- 347 12. Liu L., Xiao Q.-F., Zhang Y.-L. & Yao S.-K. A cross-sectional study of irritable bowel
348 syndrome in nurses in China: prevalence and associated psychological and lifestyle
349 factors. *Journal of Zhejiang University Science B*. 2014a; 15, 590-597.
- 350 13. Fukudo S. 2006. Sex and gender in irritable bowel syndrome. *Journal of*
351 *gastroenterology*. 2006; 41, 608-610.
- 352 14. Drossman D., Corazziari E. & Delvaux M. Appendix A: Rome III Diagnostic Criteria for
353 FGIDs. *Rome III The functional Gastrointestinal Disorders*. 3rd ed. McLean: Degnon
354 Associates, Inc. 2006. 885-97.
- 355 15. Okami Y., Nin G., Harada K., Wada S., Tsuji T. & Okuyama Y. Irritable bowel syndrome in
356 Chinese nursing and medical school students—Related lifestyle and psychological
357 factors. *Open Journal of Gastroenterology*.2013; 3, 55.

- 358 16. Darweesh M. M., El Hameed M. A. M. A., Hassan Y. M., El Rheem K. A. A., Mohamed S.
359 A. & Mahdy M. A. The prevalence of irritable bowel syndrome among medical and non-
360 medical Suez Canal University students. *Open Journal of Gastroenterology*.2005; 5, 42.
- 361 17. El-Fetoh, N. M. A., El-Mawgod, M. M. A., Mohammed, N. A., Alruwaili, H. S. A. & Alanazi,
362 E. O. M. Irritable Bowel Syndrome among Medical and Non-Medical Northern Border
363 University Students, Kingdom of Saudi Arabia: Across Sectional Study. *Open Journal of*
364 *Gastroenterology*.2016; 6, 188.
- 365 18. Costanian C., Tamim H. & Assaad S. Prevalence and factors associated with irritable
366 bowel syndrome among university students in Lebanon: Findings from a cross-sectional
367 study. *World Journal of Gastroenterology*. 2015; *WJG*, 21, 3628.
- 368 19. Naeem S. S., Siddiqui E. U., Kazi A. N., Memon A. A., Khan S. T. & Ahmed B. Prevalence
369 and factors associated with irritable bowel syndrome among medical students of
370 Karachi, Pakistan: a cross-sectional study. *BMC research notes*. 2012; 5, 255.
- 371 20. Dong Y.-Y., Zuo X.-L., Lli C.-Q., Yu Y.-B., Zhao Q.-J. & Li Y.-Q. Prevalence of irritable bowel
372 syndrome in Chinese college and university students assessed using Rome III criteria.
373 *World J Gastroenterol*. 2010a; 16, 4221-4226.
- 374 21. Okeke E., Agaba E., Gwamzhi L., Achinge G., Angbazo D. & Malu, A. Prevalence of
375 irritable bowel syndrome in a Nigerian student population. *African journal of medicine*
376 *and medical sciences*. 2005; 34, 33-36.
- 377 22. Lee S., Wu J., Ma Y., Tsang A., Guo W. J. & Sung J. Irritable bowel syndrome is strongly
378 associated with generalized anxiety disorder: a community study. *Alimentary*
379 *pharmacology & therapeutics*. 2009; 30, 643-651.

- 380 23. Ibrahim N. K. R., Battacharjee W. F. & Almehmadi S. A. Prevalence and predictors of
381 irritable bowel syndrome among medical students and interns in King Abdulaziz
382 University, Jeddah. Libyan Journal of Medicine, 2013; 8.
- 383 24. Zhou H.-Q., Yao M., Chen G.-Y., Ding X.-D., Chen Y.-P. & Li D.-G. 2012. Functional
384 gastrointestinal disorders among adolescents with poor sleep: a school-based study in
385 Shanghai, China. Sleep and Breathing.2012; 16, 1211-1218.
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