

1 **THE PREVALENCE OF IRRITABLE BOWEL SYNDROME (IBS) IN A PRIVATE-UNIVERSITY IN MALAYSIA,**
2 **AND ITS ASSOCIATED FACTORS INCLUDING STRESS, DEPRESSION AND ANXIETY**

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.

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

40 O'Malley D (2018) states that pathophysiological changes linked to Irritable Bowel Syndrome (IBS)
41 include stress and immune activation, changes in gastrointestinal microbial and bile acids profiles and
42 sensitisation of extrinsic and intrinsic gut neurons. [2]

43

44 O'Malley further states that the heterogeneity of IBS underscores a complex multifactorial
45 pathophysiology, which involves dysfunction of the bidirectional signaling-axis between the brain and
46 the gut. This axis incorporates efferent and afferent branches of the autonomic nervous system,
47 circulating endocrine-hormones and immune factors, local paracrine and neurocrine factors and
48 microbial metabolites. [2]

49 Additionally states that, L-cells, which are electrically-excitabile biosensors embedded in the
50 gastrointestinal epithelium, secrete glucagon-like peptide-1 (GLP-1) in response to nutrients in the small
51 intestine. But, these appear to function differently more distally in the gastrointestinal tract, where they
52 are activated by luminal-factors including short-chain fatty-acids, bile-acids and microbial metabolic-
53 products, all of which are altered in IBS patients. GLP-1 can also interact with the hypothalamic-
54 pituitary-adrenal stress-axis and immune-system, both of which are activated in IBS. Given that a GLP-1-
55 mimetic has been found to alleviate acute pain symptoms in IBS patients, GLP-1 may be important in the
56 manifestation of IBS symptoms. [2]

57 Rome III subtype classifies as follows: Subjects affected mainly by "loose bowels/diarrhea" are classified
58 into IBS-D. Those mainly affected by "constipation" are classified as IBS-C, and those with both are
59 considered to be IBS-M. [1]

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

64 In addition, the classification of IBS subtypes is based on the predominant stool pattern. IBS with
65 constipation (IBS-C) has hard or lumpy stool in at least 25% of the time and loose (mushy) or watery
66 stools in less than 25% of bowel movements. IBS with diarrhea (IBS-D) has loose (mushy) or watery

67 stools at least in 25% of the time and hard stools in less than 25% of bowel movements. Mixed IBS (IBS-
68 M) has hard or lumpy stool in at least 25% of bowel movements and loose (mushy) or watery stool in at
69 least 25% of bowel movements. Un-subtyped IBS means insufficient abnormality of stool consistency to
70 meet criteria of the other three subtypes. [3]

71 It is one of the commonest disorders diagnosed by gastroenterologists and is a common cause of
72 general-practice visit. Although the disease is not life-threatening, patients appear badly affected in
73 their everyday life. [4] Its prevalence and associated-factors have been ascertained using different
74 methodologies with varying results. [5] Its prevalence varies in different communities. [6 – 7]

75 Information on the prevalence of IBS in Asian-populations is relatively scanty.[8] There have been only a
76 few Asian studies concerning anxiety and depression associated with irritable bowel syndrome (IBS). [9]

77 The impact of the psychological factors associated with IBS has been widely studied in Western
78 countries. [10] Individuals may interpret one's health events in a manner that is partly dependent on
79 their social and cultural backgrounds. However, there are only a few studies in Asia, and these studies
80 have mainly focused on the prevalence, symptom patterns, or impact on the QOL of IBS patients. [11]

81 Epidemiological studies of irritable bowel syndrome (IBS) among young adults are few, especially in
82 Asian countries. [12] Functional gastrointestinal disorders, including functional dyspepsia, irritable bowel
83 syndrome and functional constipation are very common worldwide. [3] Patients with IBS are more likely
84 to suffer from anxiety leading to burden of illness affecting quality of life. [13]

85 Some Asian IBS-studies have been published in recent decades since the evolution of the IBS-definition,
86 and the understanding in the pathogenesis, diagnosis and treatment. These studies describe the current
87 situation of IBS in many countries and show conspicuous cultural-differences within Asia, and in
88 comparison with the West. Asian IBS subjects do experience psychological disturbances including

89 anxiety, depression, agoraphobia and neuroticism. Accordingly, their quality of life is poor and there is
90 absenteeism leading to excessive physician visits. [14]

91 Changing-lifestyles and rapid changes in the socioeconomic-environment contribute to the increased
92 prevalence of IBS in Asian countries. Recently, more attention has been given to the influence of
93 psychosocial factors in the pathogenesis, severity, course, and outcome of IBS. [15] Gender differences,
94 psychological symptoms, and response to psychological treatments have not been well-studied. [16]

95 However, Chang FY and Lu CL (2006) say Western recommended criteria clearly diagnose Asian IBS and
96 many factors are mutual leading to IBS. Current IBS treatments remain useful. [14]

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

100 The Objective of our study was to determine the prevalence of Irritable Bowel Syndrome (IBS) among
101 the Nursing-students diploma and bachelor) from the Faculty of Nursing at the MAHSA University in
102 Malaysia. The Objective was also to determine the Sub-types, besides the association between socio-
103 demographic factors, such as gender, age, living conditions (with a family, in a private house or in
104 hostel), ethnicity, and Irritable Bowel Syndrome – and also, its association with stress, anxiety and
105 depression.

106 **Method**

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

111 No Sampling was done, and our study was conducted by the census-method at the start of the students'
112 classes.

113 To calculate sample size, the prevalence of IBS in the study-population was estimated from previous
114 studies which showed values of prevalence rate, $p= 17.4\%$, $(1 - p) q= 82.6\%$ and 'degree of precision' =
115 5%. Using acceptable significance-level (p-value) as 0.05 at 95% CI and $Z\alpha= 1.96$, a Sample-size of 220
116 was arrived at, although only 203 Nursing-students participated in the study.

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

- 123 1. Improvement with defecation
- 124 2. Onset associated with a change in frequency of stool
- 125 3. Onset associated with a change in form (appearance) of stool

126 The criteria above needed to be fulfilled for the last 3 months with symptom onset at least 6 months
127 prior to diagnosis. [17]

128 The third part was the Depression Anxiety and Stress Scales - 21 (DASS 21). The English-version of the
129 DASS-21 was used. The English-version of the DASS-21 has been validated by many studies. One of them
130 is by Nieuwenhuijsen K et al (2003) [18]

131

132 The DASS is a set of 3 scales designed to assess distress along the dimensions of depression, anxiety and
133 stress.

134 The 21-item version has three sub-scales with 7 items each concerning Anxiety (Items 2, 4, 7, 9, 15, 19,
135 20), Depression (Items 3, 5, 10, 13, 16, 17, 21) and Stress (Items 1, 6, 8, 11, 12, 14, 18). The scale-point
136 ranged between 0 (Does not apply to me at all) and 3 (Applies to me very much or most of the time).

137 The respondents indicate the frequency or extent to which they experienced each of the symptoms
138 described on the Items. The scores for each scale were obtained by summing the responses and
139 multiplying by two.

140 **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+ |

141

142 The study was approved by the Ethics Committee of the Faculty of Medicine, MAHSA University,
143 Malaysia.

144 Data-management and data-analysis (both Descriptive and Analytical) was done using IBM Corp.

145 Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.

146 Hypothesis testing for all variables was conducted using the Chi-squared test to determine the presence
147 of association between each variable of socio-demographic characteristic and Irritable Bowel Syndrome.

148 Binary logistic regression was performed to determine association between anxiety, stress, and
149 depression with IBS.

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

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

154 There are a number of limitations to our study.

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

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

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

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

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

164 Sixth, the subjects' Past Medical History, Social History, and Dietary History was not obtained. Such
165 would have made our study more complete. This is particularly made prominent in a requirement
166 because the study by Ng QX et al in 2018, showed that inflammatory bowel disease (IBD) in remission
167 could also produce IBS-like symptoms.[19]

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

169 **Results**

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

171 The prevalence of IBS among nursing students according to Rome III criteria was 46.3% (95% CI: 39.6%
 172 to 53.2%). (Table III). The prevalence of IBS among female students was more than in male students, 85
 173 (47.5 %) and 9 (9.6%)) respectively. There was a significant association between gender and IBS ($\chi^2 =$
 174 10.24) ($p < 0.01$).

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

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

176

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

178 **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 | | | 2.111 | >0.30 |
| 17-20 | 167 (82.3%) | 74 78.7% | | |
| 21-24 | 29 (14.3%) | 17 18.1% | | |
| ≥ 25 | 7 (3.4%) | 3 3.2% | | |

| | | | | | |
|-----------------|-------------|--------------|------------|---------------|----------------|
| Ethnicity | | | | | |
| Malay | 110 (54.2%) | 55 58.5% | | | |
| Indian | 13 (6.4%) | 5 5.3% | 1.459 | >0.69 | |
| Chinese | 20 (9.9%) | 9 9.6% | | | |
| Other | 60 (29.6%) | 25 28.6% | | | |
| Symptoms | | Total | IBS | No IBS | P value |

| | | | | | |
|------------------|-------------|----------|-------|--------|--|
| Living Condition | | | | | |
| Hostel | 189 (93.1%) | 89 94.7% | | | |
| With family | 4 (2.0%) | 2 2.1% | 1.202 | > 0.61 | |
| Private house | 10 (4.9%) | 3 3.2% | | | |

179

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

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

187

In the last 3 months (abdominal pain or discomfort)

| | | | | |
|--|-----|------------|------------|---------|
| 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 |

188

189 Students who stayed at the Hostel were found to have a significant association with IBS-C 35 (39.3%, $p <$
 190 0.05). Malay students were found to have IBS-C more commonly i.e. 23 (41.8%), followed by IBS-D, 22
 191 (40.0%), and followed by IBS-M, 10 (18.2%). Fourteen (56.0%) of Other Race students were found to
 192 have IBS-D, 9 (36.0%) had IBS-C and 2 (8.0%) had IBS-M.

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

195 In female-students, IBS-D was found the commonest i.e. 39 (45.9%), while IBS-M was much lower at 11
 196 (12.9%). There was no significant association between gender and IBS-D, IBS-C, IBS-M ($p > 0.30$).

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

198

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

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

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

| Anxiety | | | | | |
|------------------------|---------------|-------------|-----------------|---------------|-------------------------|
| Characteristics | 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%) | 52 (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 (0%) |
| Ethnicity | | | | | |

| | | | | | |
|------------------------------|-----------------------|-------------------|-------------------|------------------|------------------|
| Malay | 43 (39.1%) | 16 (14.5%) | 34 (30.9%) | 9 (8.25%) | 8 (7.3%) |
| Indian | 5 (38.5%) | 1 (7.7%) | 5 (38.5%) | 0 (0%) | 2 (15.4%) |
| Chinese | 8 (40.0%) | 6 (30.0%) | 3 (15.0%) | 3 (15.0%) | 0 (0%) |
| Others | 27 (45.0%) | 5 (8.3%) | 18 (30.0%) | 6 (10.0%) | 4 (6.7%) |
| 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%) |

206

207 **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%) |

208

209

Psychological factors in relation to the Irritable Bowel Syndrome

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

211

Tables VIII - X

212

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

213

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

214

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

215 and IBS ($p < 0.05$), indicating that depression could be a predictor of IBS and that psychological factors
 216 play a role in the development of IBS. Table VII.

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

| Characteristics | Anxiety | | | | | X ² | P |
|-------------------------|------------|------------|------------|-----------|-----------|----------------|------|
| | Normal | Mild | Moderate | Severe | Ex severe | | |
| 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%) | | |

222

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

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

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

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

227

228 **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%) | | | |

229

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

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

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

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

234

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

| Characteristics | Depression | | | | | X ² | P |
|------------------|-------------|------------|------------|----------|-----------|----------------|------|
| | Normal | Mild | Moderate | Severe | Ex severe | | |
| 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%) | | |

236

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

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

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

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

241 **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 |

242

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

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

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

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

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

248 **Discussion**

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

252 This value is higher than that reported in China among medical and nursing students i.e. 32.1%
253 according to Rome II criteria. [19] It is also higher than that reported in Egypt (22.9%) among medical
254 and non-medical students using Rome III criteria and the questionnaire was administered to Suez Canal
255 University students. [21] The studies that were conducted in Saudi Arabia showed that the prevalence
256 was 31.8% to 32.5% and the two studies used Rome III criteria, [22] while the prevalence of IBS among
257 University students in Lebanon according to Rome III criteria was 20%. [23] In Pakistan, a prevalence of
258 28.3% has been reported among medical students and the study used Rome III criteria. [24]

259 In addition, our finding is higher than that those reported in two Chinese studies which were conducted
260 among nursing and university students of China. The prevalence of IBS according to Rome III criteria
261 was reported as 7.85% in the year 2010, [25] as compared to the prevalence of 17.4% in the year 2014.
262 [15]

263 Prevalence was 12.6% among medical students of Gilan, Northern Province of Iran.[6] Internet survey in
264 Japan reported that the prevalence of IBS according to Rome III criteria was 13.1%. [1] The Saudi
265 Arabian study among medical students reported that the prevalence of IBS was 21%. [7] A school-based
266 study in China in the year 2014 reported that the prevalence of Irritable Bowel Syndrome according to

267 Rome III criteria was 22.9%. [15] In Nigeria, it was reported that the prevalence among students was
268 26.1%. [26] These prevalences are lower than that found in our study.

269 The differences in the prevalences above between this study and other previous studies outside
270 Malaysia could be due to Geographical differences, and the differences in the Socio-demographic
271 Factors.

272 Our study showed a significant gender difference in prevalence of IBS. Female gender has long been
273 believed to be a factor leading to IBS. In a meta-analysis, Kang indicated that eight of 14 Western-studies
274 and four of eight Eastern studies have been female pre-dominant. In addition, Gwee stated that there
275 was no female predominance except in a Japanese study. In contrast, an inter-national cooperation
276 study does not show a female predominance in Japan. Many Chinese-studies appear to show a female
277 predominance in ethnic Chinese IBS subjects. However, after correction for gender ratio in the control
278 population, the female predominance existed only in one study. [14]

279 In contrast, multiracial Malaysian and Singaporean studies show a female predominance although the
280 gender factor of the Chinese population is not addressed. Interestingly, two earlier Singaporean studies
281 did not obtain this trend for female-gender, while recent Rome I and II analyses reported similar gender
282 trends. An Indian prevalence study also provides no distinct gender difference. It is believed that female
283 gender is not a main risk factor for IBS in Asia. [14]

284 In our study, the total number of participants having IBS was 94, and these were characterized by
285 diarrhea (44), constipation (38) and mixed (12). These findings are quite similar to that reported by Lee
286 (2009). [27] One study in China reported that the IBS of the Diarrhea-type is more frequent than the IBS
287 Constipation-type. [25] The Results of our study are also consistent with findings of a study conducted
288 among Japanese University students which showed that the Constipation-type was more prevalent

289 (47.8%). [12] However, the findings of our study are not in agreement with the results shown by Naeem
290 et al., (2012) [24] where the most common type was the Mixed-type followed by the Constipation-type.

291 We wish to note though here that in a prospective, multi-centre study in 2004, Mearin F et al showed
292 that "IBS symptoms are instable over time and varies in intensity. Many patients with D-IBS or C-IBS
293 move to A-IBS; but, shift from D-IBS to C-IBS, or vice versa, is very infrequent." [28]

294 The study in Saudi Arabia showed that IBS was Relieved by Defecation among 37.9% of the study-
295 subjects while our study showed that students who have IBS felt more Comfortable after Defecation
296 than the students who do not have IBS.

297 Regarding sleep, the study in Saudi Arabia showed that the students who sleep less than 8 h/day had a
298 slightly higher prevalence of IBS compared to others. [29]

299 Poor sleep was independently associated with IBS among adolescents in Shanghai, China. [30] Similarly,
300 our study shows that Not Enough Sleep was found significantly higher in students who had IBS (56.4%)
301 than those did not have IBS (34.6%) ($p < 0.0015$).

302 In our study, depression among nursing students was proved to be a major association with Irritable
303 Bowel Syndrome. Our study is in agreement with the study by Dong et al., (2013) [3] which showed that
304 depression was associated with IBS. On the other hand, our finding shows that anxiety is not associated
305 with IBS, whereas the study by Dong et al., (2013) showed that it was. [3]

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

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

312 Chan Y et al (2018) in a study aimed to model the moment-to-moment relationship between daily life
313 stress, negative emotions and bowel symptoms among patients with irritable bowel syndrome –
314 diarrhoea subtype (IBS-D) in the flow of daily life showed that patients with IBS-D reported more severe
315 bowel symptoms than healthy-controls (HCs), but levels of daily life stress and negative affect were
316 comparable between the groups. Time-lagged analysis of data revealed that, among patients with IBS-D,
317 daily life stress predicted a decrease in abdominal pain and urgency to defecation at a subsequent time
318 point, whereas severity of bowel symptoms and presence of diarrhoea predicted a subsequent increase
319 in negative affect and daily life stress. The above associations were not found among HCs. [31]

320 In a Systematic-review with meta-analysis in 2018, Ng QX et al showed that random-effects meta-
321 analysis found post-traumatic stress disorder (PTSD) to be a significant risk factor for IBS (pooled odds
322 ratio 2.80, 95% confidence interval: 2.06 to 3.54, $P < 0.001$) among US Army veterans from eight
323 primary-studies. They said their study provides “insights into the probable (patho)physiology and
324 management of IBS, supporting a holistic consideration of the psychosocial aspects of IBS and further
325 research into effective multi-modal therapeutics.” [32]

326 Dietary factors (which can be dramatically different in the Western world) could also influence the
327 prevalence of IBS-like symptoms, including through non-digestible carbohydrates (prebiotics) that are
328 present in the foods we eat. [33]

329 Besides polyphenols (most polyphenols have little bioavailability and reach the colon almost unaltered)
330 exert potential effects on the gut microbiota which may then affect IBS. [34]

331 Dietary polyphenols represent a wide variety of compounds that occur in fruits, vegetables, wine, tea,
332 extra virgin olive oil, chocolate and other cocoa products. They are mostly derivatives and/or isomers of
333 flavones, isoflavones, flavonols, catechins and phenolic acids, and possess diverse biological properties
334 such as antioxidant, anti-aging, anti-carcinogen, anti-inflammation, anti-atherosclerosis, cardiovascular
335 protection, improvement of the endothelial function, as well as inhibition of angiogenesis and cell
336 proliferation activity. Most of these biological actions have been attributed to their intrinsic reducing
337 capabilities. They may also offer indirect protection by activating endogenous defense systems and by
338 modulating cellular signaling processes [35]

339 Ng XQ et al (2018) found in random-effects meta-analysis based on three studies and 326 patients, a
340 phyto-chemical (curcumin) to have a beneficial albeit not statistically significant effect on IBS symptoms
341 (pooled standardized mean difference from baseline IBS severity rating -0.466, 95% CI: -1.113 to 0.182,
342 $p = 0.158$). This was the first meta-analysis to examine the use of the phyto-chemical in IBS. With its
343 unique anti-oxidant and anti-inflammatory activities and ability to modulate gut microbiota, it is a
344 potentially useful addition to agents for IBS. More robust clinical trials involving a standardized-
345 preparation and larger sample sizes should be encouraged. [33]

346

347

348 CONCLUSIONS:

349 Overall, PTSD is associated with an increased likelihood of IBS. This is the first meta-analysis to
350 specifically examine the association between PTSD and IBS, and it provides insights into the probable
351 (patho)physiology and management of IBS, supporting a holistic consideration of the psychosocial
352 aspects of IBS and further research into effective multi-modal therapeutics.

353 Conclusions and Recommendations

354 The prevalence of IBS among nursing students studying in MAHSA University, Malaysia, is 46.3% which is
355 conspicuously higher than previous studies in other countries. IBS-D is the commonest sub-type of IBS
356 (46%). In addition, IBS is significantly associated with depression, but anxiety and stress are not. There is
357 no significant association between IBS and Socio-demographic factors. Students who stay in hostel were
358 significantly associated with IBS-D and IBS-C. This study shows that proportionately more female
359 students suffer from IBS than male students. It is recommended that more studies on Objective
360 Measurement of Dietary Factors and Habits besides Exercise are needed to add to the understanding of
361 the Scope and Dimensions of IBS in the population. Malaysian Universities should provide psychological-
362 support by means of adequate counselling-services aimed at improving the socio-cultural-economic and
363 psychological status of nursing-students, and other students in general. Nursing-students, and students
364 in general, should also receive Health Education on IBS, as part of general Health Promotion among
365 them. As Lu CL and Chang FY (2006) said, continued-education in this for medical professionals may be
366 necessary in this matter.

367

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