PREVALENCE OF IRRITABLE BOWEL SYNDROME IN COLLEGE STUDENTS AND ASSOCIATION WITH ANXIETY, DEPRESSION AND FODMAP DIET

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ABSTRACT: BACKGROUND: Irritable bowel syndrome (IBS) is the most common functional gastro-intestinal disorder. The data regarding the prevalence of IBS in young adults is limited along with its association with anxiety and depression in a community setting in India.

MATERIALS AND METHODS: the prevalence of IBS and its subtypes based on Rome iii criteria were assessed in 2078 college students above 18 years of age along with the prevalence of anxiety and depression based on hospital anxiety depression scale. Frequency of intake of food containing fermentable oligo-di-monosaccharides and polyols (Fodmaps) were obtained.

RESULTS: The mean age of the study group is 19.73±1.4 years. The prevalence of IBS is 5.2%, the prevalence in females (6.1%) as compared with males (3.9%). Mixed type of IBS is the most common involving 47.9% of students followed by diarrhea predominant in 22.9%, un subtype in 17.7% and constipation predominant in 11.5%. The mean anxiety score in students with IBS is 9.61±3.74 as compared to 7.15±3.73 in students without IBS with a p-value of 0.000. The mean depression score as per hads-d in students with IBS is 5.79±3.290 as compared to 4.39±2.942 in students without IBS with a p-value of 0.000. Among students with IBS 48.9% were found to have psychological disorders as compared to 21% without IBS. There was no difference in the intake of food containing fodmaps.

KEYWORDS: Irritable bowel syndrome, India, College students, Anxiety, Depression, Fodmap diet.

INTRODUCTION: Irritable Bowel Syndrome (IBS) is a functional gastrointestinal disorder characterized by longstanding abdominal discomfort or pain and change in bowel habits without any organic cause.¹ ² The prevalence of IBS in the general population of western countries is 15%-24%, irrespective of age or race, with a male/female ratio of 1:1.5.³ ⁴ The prevalence of IBS in various Asian countries is 5% - 10%.⁵ In an urban community study done in India using Manning criteria the prevalence of IBS was 7.5%.⁶ The prevalence of IBS from a rural community study from north India based on ROME III criteria is 4%.⁷ In a study done by Indian society of gastroenterology task force for IBS the symptoms suggestive of IBS was found in 4.2% of community subjects.⁸ More than 50% of population in India are less than 25 years of age, the average age of an Indian is expected to be 29 by year 2020 where as it is 37 for Chinese and 48 for Japanese.⁹ ¹⁰ IBS is often undiagnosed or untreated, and few than a quarter of sufferers seek physician consultation.¹¹ ¹² ¹³ Several criteria were used for the diagnosis of IBS, currently ROME III criteria is widely used which was based on a formal consensus.¹⁴
The symptoms IBS can markedly reduce the quality of life and IBS is the second common cause for absence from school and work, and effects the academic and professional performance.\textsuperscript{[15]} While the enteric nervous system is the predominant cause for the symptoms of IBS, causing increased visceral hypersensitivity and disturbances in gut motility, others including diet and psychological factors do contribute to symptoms.

Psychological factors have a significant role in modulating the disease. Depression, anxiety and somatisation co-exist with IBS effecting 40-90\% of patients with IBS through modulation of central (brain) responses to pain.\textsuperscript{[16,17,18]}

Fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAPs) are food constituents which are not absorbed well in the small intestine and are osmotically active molecules that are fermented by intestinal bacteria.\textsuperscript{[19]} Abdominal symptoms like bloating, pain and disturbed bowel habits were noted on acute provocation tests with fructose, lactose and fructo-oligosaccharides and sorbitol more in people with IBS.\textsuperscript{[20,21]} Monash University Department of Medicine, Australia, has developed “Low FODMAP diet” which has shown to reduce symptoms in patients with IBS.\textsuperscript{[19]}

The prevalence of IBS in student Population and the impact of psychological factors and FODMAP diet has not been evaluated as of to our knowledge and the current study aims to address these issues.

**MATERIALS AND METHODS:**

**STUDY DESIGN:** A community based, cross sectional study.

**SAMPLE SIZE:** Minimum sample size required was 2000 subjects, based on estimated 5\% prevalence rate, a precision of 1\% and a non–response rate of 10\%.

**AIM OF THE STUDY:** To assess the prevalence of IBS in college students and its subtypes. Association of IBS with anxiety and depression. Frequency of intake diet containing Fermentable oligosaccharides, disaccharides, monosaccharides and polyols and its possible effect on IBS.

**INCLUSION CRITERIA:** All students above 18 years of age and willing to participate in the study.

**EXCLUSION CRITERIA:** Students who are known to have inflammatory bowel disease and Celiac disease.

**METHODOLOGY:** Institute ethics committee clearance was obtained. 2000 random sample of college students pertaining to medical education representing medical, dental and nursing students from Chennai. Privacy and confidentiality of the participant students and institutions was preserved. The questionnaire was administered to the students consenting for the study after a brief introduction to the students about IBS and FODMAP diet by the principal investigator.

Data was collected based on ROME III criteria for IBS, which is defined by the presence of recurrent abdominal pain or discomfort for a minimum of 3 days per month (In women the symptoms should not be present only at the time of menstruation) over the past 3 months with onset of symptoms 6 months prior along with the presence of 2 of the following 3 features, improvement of pain and discomfort with passage of stools at least sometimes, association of abdominal pain or discomfort at least sometimes with a change in frequency of defecation or at
least sometimes with a change in appearance (Looser or harder) of stools. IBS is further subdivided based on the appearance of stools over the past 3 months into diarrhoea predominant (IBS-D) if the person passes watery/mushy/loose stools sometimes, constipation predominant (IBS-C) if the person passes lumpy or hard stools sometimes, mixed (IBS-M) if the person passes both hard and loose stools or un-subtyped (IBS-U) if neither loose nor hard stools were reported.

HADS questionnaire (Hospital anxiety depression score) which was validated for the assessment of psychological health and self-prepared questionnaire regarding the frequency of consumption of specific foods containing FODMAPs. Incomplete questionnaires were not considered for further analysis. All the students who fulfilled the ROME III criteria are considered to have IBS. All the students with a HADS score for anxiety and depression ≥11 were considered to have the same.

STATISTICAL ANALYSIS: The collected data was analysed with SPSS 16.0 version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and for continuous variables the mean and S.D were used. To find the significance in categorical data Chi-Square test was used. In the above statistical tool the probability value. 05 are considered as significant level.

RESULTS: PREVALENCE OF IBS - Out of 2078 students, completed forms were obtained from 1842 (88.64%) students which were taken for further analysis. The study includes younger population with a mean age of 19.73±1.408 years. Males constitute 40.2% of study population and females constitute 59.8% of the study population. The prevalence of Irritable bowel syndrome is 5.2% in the college students of Chennai who represent the young adult population hailing from various parts of the state and the country. The prevalence of IBS is more in females (6.1%) as compared to males (3.9%) with a P-value of 0.041.

Among the subtypes of IBS, mixed type constitute the major subtype involving 47.9% of students with IBS and with an overall prevalence of 2.5%. Diarrhea predominant IBS constitutes 22.9% of students with IBS with an overall prevalence of 1.2%. Unsubtyped IBS constitutes 17.7% of students with IBS with an overall prevalence of 0.9%. Constipation predominant IBS is the least common presentation involving 11.5% of students of IBS with an overall prevalence of 0.6%.

PSYCHOLOGICAL FACTORS: The mean anxiety score as per HADS-A in students with IBS is 9.61±3.737 as compared to 7.15±3.726 in students without IBS with a P-value of 0.000. The mean depression score as per HADS-D in students with IBS is 5.79±3.290 as compared to 4.39±2.942 in students without IBS with a P-value of 0.000. 22.5% of the study population is found to have psychological disturbances (Anxiety and/or depression). 48.9% of students with IBS are found to have psychological disturbances as compared to 21% of students without IBS. 20.6% of the study population has anxiety. Among students with IBS 44.8% has anxiety as compared to 19.3% of students without IBS with a P-value of 0.000 and an Odds ratio of 3.393 (95% CI of 2.184-5.265). 4.5% of the study population has depression. Among students with IBS 11.5% has depression as compared to 4.1% of students without IBS with a P-value of 0.001 with an Odds ratio of 3.009 (95% CI of 1.449–6.109). 2.6% of the study population has both anxiety
and depression. Among students with IBS 7.3% has both as compared to 2.3% of students without IBS with a P-value of 0.000.

**FODMAP DIET:** The frequency of intake of constituents of FODMAP diet did not seem to significantly differ in students with and without IBS. All the students took any one of the constituents of the FODMAP diet on a daily or at least several times a week. 55.2% of students with IBS as compared to 45.6% of students without IBS consume milk and milk products daily with no statistical significance. Cereals consisting FODMAPs are consumed by 70.6% of students with IBS and 71.6% of students without IBS daily or several times a week. Onion and garlic are consumed by 79.2% of students with IBS as compared with 79.4% of students without IBS daily or several times a week. Pulses and beans are consumed by 70.6% of students with IBS and 71.6% of students without IBS daily or several times a week. Frequently consumed fruits consisting FODMAPs are consumed by 47.9% of students with IBS and 40.9% of students without IBS daily or several times a week. Infrequently consumed fruits and like apricots, pears and plums containing FODMAPs are consumed by 10.4% of students with IBS and 9% of students without IBS daily or several times a week. Vegetables containing FODMAP are consumed by 29.2% of students with IBS and 25.5% of students without IBS daily or several times a week. 7% of students with IBS and 3.1% without IBS consume Mushrooms daily or several times a week. Artificial sweeteners are consumed by 17.7% of students with IBS and 21.7% of students without IBS daily or several times a week. Chocolate is consumed by 57.3% of students with IBS and 56.3% of students without IBS daily or several times a week.

| SUB TYPES      | MALES (%) | FEMALES (%) | Total Subjects (%) |
|----------------|-----------|-------------|--------------------|
| IBS- CONSTIPATION | 740       | 1102        | 1842               |
| IBS- DIARRHEA   | 3(0.4%)   | 8(0.7%)     | 11(0.6%)           |
| IBS- MIXED      | 9(1.2%)   | 13(1.2%)    | 22(1.2%)           |
| IBS- UNSUBTYPED | 14(1.9%)  | 32(2.9%)    | 46(2.5%)           |
| IBS             | 3(0.4%)   | 14(1.3%)    | 17(0.9%)           |

Table 1: gender distribution and prevalence of IBS and its subtypes

P-VALUE- 0.041

| ANXIETY PRESENT(%) | IBS | NO IBS | TOTAL |
|--------------------|-----|--------|-------|
| 43(44.8)           | 337(19.3) | 1462(79.4) |
| 53(55.2)           | 1409(80.7) |

Table 2: IBS and anxiety as per HADS-A

P-VALUE- 0.000.
Table 3: IBS and depression as per HADS-D

| DEPRESSION PRESENT (%) | IBS | NO IBS | TOTAL |
|------------------------|-----|--------|-------|
| ABSENT (%)             |     |        |       |
| IBS                    | 11 (11.5) | 72 (4.1) | 83 (4.5) |
| NO IBS                 | 85 (88.5) | 1674 (95.7) | 1759 (95.5) |

P-VALUE- 0.001.

DISCUSSION: The prevalence of IBS has varied from 1% to 45% in various studies, the wide variation is because of the population studied, criteria used for diagnosis and the social and economical factors of the study group.[22] Younger people have a higher prevalence of IBS in the community. As per the earlier studies available in India the prevalence of IBS in a Mumbai urban population based on Manning criteria is 7.6%,[6] a study done by Indian society of gastroenterology task force on IBS who used a symptom complex generated from an earlier diagnosed IBS cohort is 4.2%[8] and the prevalence is 4% in a rural community based study from north India using ROME III criteria, the prevalence of the current study is slightly more than the two later studies.

| STUDY | Current study | Indian society of Gastroenterology task force[8] | Rural community study by Makaria et al[7] | Urban community study by Shah et al[6] |
|-------|---------------|-----------------------------------------------|--------------------------------------------|----------------------------------------|
| DIAGNOSTIC CRITERIA | ROME III | diagnosis based on symptom complex | ROME III | Manning criteria |
| PREVALENCE | 5.2% | 4.2% | 4% | 7.6% |
| MEAN AGE (Years) | 19.7±1.4 | 34.9±14.5 | 34.6±10.8 | 37.2±14.1 |

Table 4: Comparison with earlier studies from India

Gender-specific prevalence rates for IBS are higher in women with an odds ratio of 1.67 as compared to men in a meta-analysis, this was not observed in South Asia or South America.[23] Whereas female predominance was noted in western countries[24] there is variability in the data from Asia.[25] The prevalence of IBS was more in women as compared to men in the study done by Makaria et al,[7] whereas the prevalence is more in males in the study done by Shah et al[10] and Indian society of Gastroenterology task force study[8] which were hospital based and the male predominance can probably be secondary to early healthcare seeking behavior on men in India as compared to women. Healthy women were known to have greater rectal sensitivity, reduced colonic transit, and smaller stool quantity than men, which explains why symptoms like straining and hard stools are found to be more common in women.[26,27]

The prevalence of subtypes of IBS in males is constipation predominant- 0.4%, diarrhea predominant-1.2%, mixed-1.9% and undifferentiated-0.4% as compared to 0.2%, 1.3%, 1.4% and 0.4% respectively from the study by Makaria et al.[7] The prevalence of subtypes of IBS in females is constipation predominant- 0.7%, diarrhea predominant-1.2%, mixed-2.9% and undifferentiated-1.3% as compared to 0.3%, 1.8%, 2.0% and 0.7% respectively from the study by Makaria et al.[7]
In studies composing a similar group of medical students the prevalence of IBS was 32.1% from China\textsuperscript{28} and 35.5% from Japan\textsuperscript{29} based on ROME III criteria, the prevalence rates are several times higher than the current study, which shows there is considerable heterogeneity across various populations in the prevalence of IBS as shown in earlier studies. The current study is unique as it represents the young professional students in a developing country where 50% of population is less than 25 years of age and the health of the individual will have an impact on the academic performance. Earlier studies from Asia have showed similar higher prevalence rates in the age group of 20-29.\textsuperscript{25}

In a study from Mumbai\textsuperscript{30} assessing the prevalence of depression and anxiety in 35 patients diagnosed to have IBS based on ROME II criteria based on Hamilton depression and anxiety rating scale the prevalence of depression and anxiety were 37.1% and 31.4% as compared to 8.6% and 5.7% in the control group composing of patients with non-ulcer dyspepsia. The current study showed higher rates of Anxiety (44.8%) and lower rates of depression (11.5%) as compared to earlier study. In a study from Hyderabad,\textsuperscript{31} the mean Hamilton depression rating scale was 18.49 in males and 23.62 in females in patients with IBS diagnosed on ROME II criteria as compared to 2.87 and 2.26 in controls respectively. The mean Hamilton anxiety rating scales were 17.9 and 24.38 in IBS patients and 2.23 and 2.0 in controls in males and female respectively. The high rates of anxiety in the study might me because of the psychological stress undergone by this selected group of students who have high academic and societal demands. Whereas the earlier studies assessing the psychological factors were done in patients who sought health care where the health care seeking behavior will have an impact on the psychological status of the patients, the current study is unique as it is done in community setting. The prevalence of psychological disturbances is in accordance with the earlier known literature and the effects of anxiety and depression over IBS are mutual.\textsuperscript{16,17,18} The presence of psychological disturbances among a quarter of the study group and half the students with IBS is a concern as it will have an impact on the overall wellbeing of the subjects. The relative stress of the medical education, expectations from the family will probably have an impact oven the mental status of the subjects. Hypnotherapy and cognitive and behavioral therapy in the treatment of IBS has an important role with a NNT of 3.

Even though there is no significant difference between the intake of foods containing FODMAP in students with and without IBS, this study is able to provide information regarding the relative frequency of intake of the foods containing FODMAP as Indian diet significant varies as compared to western diet. As of to our knowledge this is the first study in India to assess the frequency of intake of diet constituting FODMAPs. The study was not able to demonstrate any difference between the intakes of diet containing FODMAPs as the FODMAPs per se will not produce the symptoms but produce the symptoms of bloating and pain in a person who has IBS due increased osmotic load and increased gas production in the distal small intestine and the colon. Rather than the frequency of intake of the FODMAP foods it is the total load of FODMAPs taken per day that may produce the symptoms of IBS. Recent studies have shown that restriction of FODMAPs in the diet lead to reduction of symptoms in patients with IBS.

**LIMITATIONS OF THE STUDY:** The study was done in a college background and from a single university which does not represent the community as a whole but represents a selected subgroup of population. The study may underestimate the true prevalence of IBS as the study...
population is younger (18-24 years), as prevalence may increase as the group grows old. The study group does not represent the entire socioeconomic spectrum of the society which will have an impact on the disease prevalence, but rather represents the middle and upper socioeconomic group. As part of the students do not stay in home environment and stay in dormitories the frequency of food intake might not represent the dietary intake at home. The ideal way to assess the impact of low FODMAP diet and regular diet over IBS is by a randomized crossover study in subjects with and without IBS.

CONCLUSION: The prevalence of IBS in college students in south India is 5.2%. The prevalence of IBS is more in females (6.1%) as compared to males (3.9%). Mixed subtype of IBS is the most common presentation involving 47.9% of subjects with IBS. The students with IBS have high significant mean anxiety and depressive scores as compared to colleagues without IBS. They also have significantly high prevalence rates of anxiety and depression. There was no difference in the intake of diet containing FODMAPs. The study was able to demonstrate that FODMAPs are a frequent component in south Indian diet.

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