Assessment of Eating Behaviors and Lifestyle Habits of Community Living Indian Adults, with and without Irritable Bowel Syndrome

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Abstract: *The study was aimed at comparing the eating behaviours, stress symptoms and lifestyle habits, like sleep quality and amount of physical activity, also anthropometric indices and socio-demographic variables of community living 18-45 years old Indian adults with and without Irritable Bowel Syndrome (IBS). The study was an observational cross sectional study. Snowball method of convenience sampling was used to recruit 214 participants. An electronic self reported questionnaire was used to collect data. The association between categorical variables was assessed using chi square test. Linear regression was used to predict the independent association of lifestyle factors on the odds of having IBS. Significance for all the statistical measures was determined at <0.05 level. IBS was diagnosed positive for 16 of the 214 participants, thus prevalence was found to be 7.5%. In the IBS positive group, about 54% were females and 87.5% were in the age group of 18-25 years alone. 62.5% of the IBS positives had a larger than normal waist circumference. 67% reported their bowel habit to be alternating between diarrhoea and constipation. Sleep quality was reported to be poor in 100% of the IBS positive population. Mild and moderate depression was found to be prevalent among the IBS positives. About 74.3% of the individuals with IBS were found to be moderately inactive. Pulse preparations (p=0.003), and fruits like apples (p<0.000) and bananas (p<0.010), were consumed lesser by the IBS group. HFSS items like Biscuits (p=0.041) and Cakes (p<0.000) were consumed more often by them. A similar trend was seen for Chaats (p=0.012), Ice creams (p<0.000), Chocolates (p=0.006), Coffee (p=0.049) and Soft drinks (p=0.038). Skipping at least one major meal in a day (p<0.000) and replacing a meal with an energy bar (p=0.029) were more frequent in the IBS group than the normal individuals. Linear regression analysis revealed that a lower PSQI Score (p= 0.012), Larger waist circumference (p=0.001), Certain foods being triggers to GI symptoms and thus avoiding them (p=0.006), Consuming alcohol (p=0.042) to be significantly related to the IBS occurrence. The study concluded that a female gender and younger age group can be predicted to be a risk factor of IBS. Irregular eating habits and bad dietary choices can aggravate symptoms. Regular physical activity, taking care of mental health, following sleep hygiene and being conscious about food choices can be beneficial in preventing IBS symptoms.*

Keywords: Irritable Bowel Syndrome, Lifestyle etiology, Eating behavior

1. Introduction

Irritable Bowel Syndrome (IBS) is considered to be the most prevalent chronic and debilitating gastrointestinal disorder in the general population globally (Vahedi et al., 2010)[1], and is estimated to affect about every 1 in 10 people worldwide (Black & Ford, 2020)[2]. IBS is a functional gastrointestinal (GI) disorder distinguished by symptoms of altered bowel habits along with abdominal discomfort, pain accompanied by flatulence or bloating, and an absence of any structural or biochemical abnormalities (Saha, 2014)[3]. The diagnosis of IBS relies on a symptom-based differential criteria with regular outcomes on a few numbered complementary tests that rule out other possible diagnoses (Elhosseiny et al., 2019)[4]. The current gold standard for the diagnosis of IBS is the Rome IV criteria. IBS can be classified as either diarrhoea-predominant (IBS-D), constipation-predominant (IBS-C), or with mixed constipation and diarrhoea or pain-predominant. To complicate matters, those with one predominant bowel pattern can alternate with the other (IBS-A) (Lacy & Patel, 2017)[5].

The global estimation of IBS prevalence is 11.2%, although it varies based on the geographic region, age, gender and diagnostic criteria (Ferreira A.I., 2020)[6]. Even though, half of the cases referred to gastroenterologists with GI symptoms are related to IBS, no clear etiology is identified yet; however, some researches have revealed that, certain factors such as psychological disturbances, dietary habits, and level of exercise can be related to the onset of IBS and prolonging the course. There might be also a genetic role in the etiology of IBS. Moreover, personal factors including age and gender might influence the occurrence of IBS (Weaver et al., 2017)[7]. Subjects from many studies with IBS relate their symptoms to their patterns of food intake. In simpler words, there seems to be a contribution of certain foods in precipitating or aggravating IBS related symptoms. An association between diet and lifestyle habits and IBS has been reported by several investigators. IBS patients are remarkably affected by sleep quality impairment, eating habits, diet, exercise, and other lifestyle factors. It can be conceived that, a combination of diet and lifestyle habits may lead to GI symptoms causing IBS in patients. However it is also evident that very few surveys have been performed to explore this kind of an association between diet and lifestyle habits and IBS at the same time. Moreover, most of the literature on IBS has found to be focused on Western developed societies and a scanty data base of yet developing countries like India. (Zhuang et al., 2017)[8].

With rapid development and urbanization; a rigorous change in lifestyle, sociocultural and eating habits is seen in our country. These factors are contributing to increased amounts of stress and other psychological repercussions as well as a neglect of health that may have various physical manifestations and an overall compromised quality of life. One such manifestation can be seen as an increasing prevalence of IBS and its related symptoms. While the prevalence is found to be increasing, review of literature

suggests that, there are very few community-based epidemiological studies on IBS in India, that are focused on the significantly related factors of this group of symptoms. In lieu of addressing the concern of early detection, lifestyle modification and thus, in turn preventing the rather avoidable disorder of Irritable Bowel Syndrome, This study is aimed at assessing the prevalence of IBS along with evaluating the association between the most fundamental yet critical contributors of the disorder i.e. eating habits, stress symptoms, sleep quality and physical activity patterns along with age, gender, socio economic status and anthropometric indices among the population (18-45 years old).

2.Literature Survey

Studies from the past had suggested a lower prevalence of IBS in the developing countries, but more recent research has evidences of an increasing prevalence in newly developed as well as the developing countries, as they are becoming more 'westernised', by which they tried pulling attention towards these countries adopting a western cultural (Gunn et al., 2019)[9]. A wide variation in the prevalence of IBS is found globally and more rigorous studies are required to accurately determine any differences that might exist between countries as well as the explanations relating to potential etiologies, is what is depicted by most of the epidemiological data (Christopher J. Black, 2020)[2].

IBS is certainly becoming more and more prevalent in both developing as well developed nations, particularly the rate is faster in the developing countries due to their rapid shift in culture towards the west. While there is enough evidence on the increasing prevalence of IBS, there isn't much reliable data on its etiology, remarkably the lifestyle factors. Without any uncertainty, IBS was found to hamper quality of life of those suffering from it. Studies on the lifestyle factors of IBS were scant, particularly from the Indian subcontinent and needs more evidence to conclude if they actually play a role in the etiology.

3.Methods / Approach

The study was an Observational Cross Sectional study. An electronic self reported questionnaire was used to collect data from the participants and 18-45 year old Indian adult participants from various cities and states were recruited through snowball sampling method. Sample size was estimated to be 150-200 participants, considering percentage of prevalence of IBS in the population on the basis of review of literature and 95% confidence limits. The final sample size was 214 participants. Previously conducted studies were reviewed and internationally validated questionnaires were referred to select the list of questions to be included in the questionnaire. The questionnaire was subjected to content validation by a panel of gastroenterologists and researchers in the field of nutrition and health sciences. After receiving validation from the experts panel. Later, a pilot study was conducted on a sub set of the population, 21 (10%) participants. The responses of all participants were reviewed by a gastroenterologist to check the accuracy of the diagnosis

of IBS. The questionnaire consisted of seven sections (Table 1).

Table 1: Sections and variables of the questionnaire and their references

Section and Variables	Reference
Demographic and Socioeconomic Status Gender, Age Occupational status Marital status Number of family members Occupation of the head of the family Education of the head of the family Total monthly income of the family	Kuppuswamy SES Scale 2020
Anthropometric indices Weight Height Waist	BMI and Waist Circumference and Waist to Height Ratio by WHO Asian cut offs
Eating habits Presence of food allergies or intolerances Addictions Food frequency questionnaire Daily water consumption Frequency of eating habits	40 items FFQ
Diagnosis of IBS Frequency of abdominal pain Reasons of difficulty in passing stools Perception of bowel habits	ROME IV Criteria
Sleep quality / latency Sleep latency Frequency of troubles in sleeping Overall sleep quality rating	Pittsburg Sleep Questionnaire- 9 (PSQI)
Stress / Depression symptoms Frequency of being bothered by symptoms of stress and depression	Patient Health Questionnaire- 9 (PHQ-9)
Physical activity Type and amount of activity involved at work Number of days and hours of intentional physical activity	General Practice Physical Activity Questionnaire (GPPAQ)

Ethical approval was obtained from Intersytem Biomedica Ehtics Committee (ISBEC), Mumbai. Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 20. The associations between categorical variables were assessed using chi square test. Linear regression was used to predict the independent association of Addictions, Anthropometry, Dietary pattern, Physical activity and Sleep on the odds of having IBS. Significance for all the statistical measure was determined at 0.05 level.

4.Results / Discussion

Demographic and Socioeconomic status: The prevalence of IBS was found to be higher among females than in

males (p=0.009). This finding was similar to what Nagaonkar et al., 2018[10] had found but was quite the opposite of what Makharia et al., 2011[11]. When age groups were taken in consideration the highest prevalence of IBS was found among the younger population of 18-25 years (p=0.008) followed by the 26-30 age group. This was in sync with the findings of Makharia et al., 2011[11] and Ferreira A.I., 2020[6], where a younger prevalence of IBS was seen (Table 2).

Table 2: Comparing age and gender between participants with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
Gender					
Female	121 (56.50)	107 (54)	14 (87.50)	6.745	0.009
Male	93 (43.50)	91 (46)	2 (12.50)		
Age group (in years)					
18-25	100 (46.70)	86 (43.40)	14 (87.50)		
26-30	68 (31.80)	66 (33.30)	2 (12.50)	11.891	0.008
31-40	18 (8.40)	18 (9.10)	0 (0)		
41-45	28 (13.10)	28 (14.10)	0 (0)		

Anthropometric measures: A surprising finding was that 75% of the positive cases of IBS were from the Normal BMI category, higher than the other categories (p=0.003), followed by the overweight category. When waist to height ratio was compared, both normal and high categories had equal number of cases. This was as conflicting as it was in the literature where there was no clear evidence of anthropometric measurements playing a role in the etiology of IBS (Yinting Guo et al., 2014; O. Pickett- Blakely, 2014)[12][13] (Table 3).

Table 3: Comparing BMI, Waist circumference and height ratio between participants with and without IBS

Variable	Overall (n=214)	W/O IBS (n=198)	With IBS (n=16)	Chi square	p value
BMI (kg/m2)					
(18.5- 22.9) Normal	79 (36.9)	67 (33.8)	12 (75.0)		
(23-24.9) Overweight	46 (21.5)	42 (21.2)	4 (25.0)	14.085	0.003
(25-29.9) Pre obese	62 (29.0)	62 (31.3)	0 (0.0)		
(>30) Obese	27 (12.6)	27 (13.6)	0 (0.0)		
Waist to height ratio					
Normal	90 (42.1)	82 (41.4)	8 (50.0)	0.448	0.503
High	124 (57.9)	116 (58.6)	8 (50.0)		

Addictions, Eating habits and food item consumption frequency: The tendency of avoiding certain ingredients because they caused some or the other gastrointestinal symptom was seen to be very high in the IBS patients (p=0.001). The majority of the IBS positive individuals were non smokers. The same was for alcohol consumption and tobacco chewing. However, there have been evidence of regular smoking and alcohol consumption of being risk factors in the studies conducted by Basandra and Divyansh, 2014[14] among Medical college students in Delhi and Hajishafiee et al., 2020[15] in Iranian adults. Water consumption was seen to be fairly distributed among the number of participants with and without IBS. The association of water consumption with IBS has been an area where not much evidence is found, as stated by Salari-Moghaddam et al., 2020[16] (Table 4).

Table 4: Comparing addictions and water consumption between participants with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
Avoiding certain ingredients					
No	164 (76.6)	158 (79.8)	6 (37.5)	4.792	0.001
Yes	50 (23.4)	40 (20.2)	10 (62.5)		
Smoking status					
No	194 (90.7)	180 (90.9)	14 (87.5)	0.203	0.652
Yes	20 (9.3)	18 (9.1)	2 (12.5)		
Alcohol consumption					
No	174 (81.3)	160 (80.8)	14 (87.5)	0.436	0.509
Yes	40 (18.7)	38 (19.2)	2 (12.5)		
Water consumption/d					
0-1 litres	8 (3.7)	8 (4.0)	0 (0)		
1-2 litres	72 (33.6)	66 (33.3)	6 (37.5)	2.33	0.507
2-3 litres	82 (38.3)	74 (37.4)	8 (50.0)		
>3 litres	52 (24.3)	50 (25.3)	2 (12.5)		

The Food Frequency Questionnaire showed that some habits were significantly different among the groups and thus may be contributing factors in the development of IBS. Breakfast cereals were consumed more frequently by the IBS positive group as compared to the IBS negative group (p=0.000). When pulse preparations were compared, the IBS group consumed these proteins lesser than the IBS normal group (p=0.003), same was for fruits like Apples (p=0.000), Bananas (p=0.010), Oranges (p=0.001) and Grapes (p=0.011). Consumption of milk products like curd and processed cheese were found to be higher among the IBS individuals (p=0.016). Refined flour products and

simple carbohydrates like Biscuits (p=0.041) and Cakes (p=0.000) were consumed more frequently by the IBS group than the normal group. This trend was similar for Chaats (p=0.012), Ice creams (p=0.000), Chocolates (p=0.006) and beverages like Coffee (p=0.049) and Soft drinks (p=0.038). These findings depict that the IBS group indulged into more junk food and unhealthy food consumption and lesser fruits and plant protein consumption than the normal individuals.

The patterns of eating that are evident from this study are similar to those studied by Portincasa et al., 2017[17] where he had shown that uncontrolled dietary intake of carbohydrates and fatty foods as well as caffeine and spicy preparations have been implicated to induce symptoms of IBS. Low fibre, high refined carbohydrates and a high fat 'Western type' diet have also been considered to influence the gut microbiota and subsequent symptoms generation of IBS by Esmaillzadeh et al., 2013[18]. Pickett Blakely, 2014[13] had called wheat, fructose and dairy as the 'culprit foods' which have not been studied very widely but are

proposed to be triggering symptoms and that can be very clearly seen from the present study as well. Diet and improper eating habits have been blamed to be the causative factors of IBS by many other researchers as well in their studies like Yinting Guo et al., 2014[12], who talked about eating outside, Basandra & Divyansh, 2014[14] mentioned specifically about fatty food intakes and Yu Bin Guo et al., 2015[8] revealed that irregular eating timings initiated IBS like symptoms. Hajishafiee et al., 2020[15] in his healthy lifestyle score study also had shown that those who scored higher on dietary habits and regular eating had lower odds of having IBS. Torres et al., 2018[19] studied a huge sample of 36,448 and took 24 hour dietary recalls which showed that protein and fruits intake was lower in those having IBS, as opposed to that their spicy food intake and caffeine consumption was higher.

When eating habits were compared, skipping at least one major meal (p=0.000) and replacing a full meal with an energy bar (p=0.029), were more frequent and common in the IBS group than the normal (Table 5).

Table 5: Significant differences in the eating habits between those with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
How often do you indulge in the following practices?					
Skip at least one of your major meals (Lunch/Dinner)					
Once/ month or lesser	142 (66.4)	132 (66.7)	10 (62.5)		
Twice/ month	50 (23.4)	48 (24.2)	2 (12.5)	22.955	0.000
Once/ wk	8 (3.7)	4 (2)	4 (25.0)		
2-4 times/ wk	14 (6.5)	14 (7.1)	0 (0)		
Eat a health bar/energy bar instead of a meal					
Once/ month or lesser	180 (84.1)	170 (85.9)	10 (62.5)		
Twice/ month	26 (12.1)	20 (10.1)	6 (37.5)	10.754	0.029
Once/ wk	4 (1.9)	4 (2)	0 (0)		
2-4 times/ wk	4 (1.9)	4 (2)	0 (0)		

Bowel habits and symptoms of IBS: When the participants of the study were asked about their perception of bowel habits, 62.5% reported it to be alternating between diarrhea and constipation, the next most common was feeling constipated by 25% of the participants with IBS (p=0.002). Here an alternating or mixed type of IBS

was seen to be the most prevalent, and this finding differed from the World Gastroenterology Organization's 2020 report, which stated it to be equally divided among all the IBS types, which are Diarrhea or Constipation predominant and Mixed (Table 6).

Table 6: Comparing bowel habits between participants with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
Perception of bowel habit					
Normal	160 (74.8)	160 (80.8)	0 (0)		
Constipated	30 (14)	26 (13.1)	4 (25)	85.037	0.002
Diarrhea	2 (0.9)	0 (0)	2 (12.5)		
Alternating	22 (10.3)	12 (6.1)	10 (62.5)		

Sleeping habits, duration and latency: The difference in sleep latency showed that individuals without IBS took lesser time to fall asleep than those with IBS. However, when individuals were asked to rate their overall sleep quality only 12.5% of IBS patients rated it to be very good as opposed to 50% of the patients who rated it to be poor

or very poor (p=0.001). This was further supported by the fact that 100% of the IBS patients had poor sleep quality because they scored less than based on PSQI score (p=0.001). Poor sleep has been earlier also proven to exacerbate next day symptoms by Buchanann et al., 2014[20] (Table 7).

Table 7: Comparing sleep latency and PSQI score between participants with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
Sleep latency					
<20 mins	90 (42.1)	84 (42.4)	6 (37.5)	5.956	0.114
20-30 mins	86 (40.1)	82 (41.4)	4 (25)		
30-60 mins	20 (9.3)	16 (8.1)	4 (25)		
>1 hour	18 (8.4)	16 (8.1)	2 (12.5)		
PSQI Score					
Good sleep quality (</=5)	12 (5.6)	12 (5)	0 (0.0)	49.087	0.001
Poor sleep quality (>5)	202 (94.4)	186 (95)	16 (100)		

Stress and depressive symptoms: The participants without IBS were most concentrated in the minimum or no depression category of the PHQ 9 score, followed by mild depression. While the participants with IBS had their majority in the mild depression followed by moderate and moderately severe categories (p=0.004). The disorder of the 'irritable gut' thus has been rightly said to be combined with an 'irritable brain' by Qin et al., 2014[21] (Table 8).

Table 8: Comparing PHQ 9 score between participants with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
PHQ 9 Score					
Minimum or none (0-4)	80 (37.4)	78 (39.3)	2 (12.5)		
Mild depression (5-9)	72 (33.7)	64 (32.3)	8 (50)		
Moderate depression (10-14)	50 (23.4)	46 (23.2)	4 (25)	38.077	0.004
Moderately severe (15-19)	10 (34.6)	8 (4.2)	2 (12.5)		
Severe (20-27)	2 (0.9)	2 (1)	0 (0)		

Type and duration of physical activity: The comparison between GPPAQ score (p=0.006) made physical activity, a distinguished feature of the normal population over the IBS individuals. Here, it shows that being sedentary or physically inactive can be a risk factor of IBS. Johannesson et al., 2018[22] had clearly stated in his research that moderate physical activity improved IBS symptoms. A positive association was observed between sedentary behaviors and the occurrence of IBS by Sadeghian et al., 2018[32] as well (Table 9).

Table 9: Comparing GPPAQ score between participants with and without IBS

Variable	Overall (n=214)	Without IBS (n=198)	With IBS (n=16)	Chi square	p value
GPPAQ Score					
Sedentary (0)	4 (1.9)	4 (2.0)	0 (0.0)		
Moderately inactive (1-3)	46 (21.5)	44 (22.2)	12 (75)	30.561	0.006
Moderately active (4-6)	64 (29.9)	54 (27.3)	2 (12.5)		
Active (>6)	114 (46.7)	96 (48.5)	2 (12.5)		

Linear Regression analysis: A linear regression was performed to ascertain the effects of Anthropometric indicators, Physical Activity, Sleep quality, Eating habits and Addictions on the likelihood of participants having IBS. The linear regression model was statistically significant when, $\chi^2 (13) = 42.220$, and p value is <0.05. The model explained 43.4% (Nagelkerke R^2) of the variance in IBS and correctly classified 93.5% (accuracy) of the cases. A sensitivity of 99% participants were correctly predicted by the model. A specificity from these results we can see that a lower PSQI Score (p=0.012), Larger waist circumference (p=0.001), Certain foods being triggers to GI symptoms and thus avoiding them (p=0.006), Consuming alcohol (p=0.042) added significantly to the model/prediction, but other variables did not add significantly to the model (Table 10).

Table 10: Linear Regression of study variables and occurrence of IBS

Variable	Exp. B	Sig.
PSQI Score	1.335	0.012
Waist (in cm)	0.000	0.001
Avoiding certain ingredients	10.277	0.006
Consuming alcohol	0.363	0.042

5. Conclusion

Thus, it can be concluded that, the prevalence of IBS is 7.5%, demographically; the female gender and the younger age group are more prone to IBS, as also the Upper Middle and the Upper socioeconomic categories. Having a larger waist circumference is a risk factor of IBS. Individuals with IBS, avoided a number of food ingredients because they triggered certain gastrointestinal symptoms. However, they consumed more junk food and high calorie snacks and ate lesser fruits and plant proteins compared to their healthy counterparts. Skipping of meals and replacing them with calorie dense snacks was also more common among them. Feeling of constipation followed by alternating between diarrhea and constipation was reported to be prominently felt by the IBS group and their average stool frequency was also lesser than the non IBS group. Sleep quality was found to be poorer in this group and depression was revealed to be more severe in the IBS individuals. Physical activity was also found to be less intentional and less frequent among these. Poor sleep, depressive symptoms and low physical activity are all seen to be playing a role in the occurrence of IBS.

6. Future Scope

The findings of the present research can be potential in raising awareness of the implications of poor lifestyle habits on gut health. The lifestyle risk factors thus found to be playing role should be further investigated to be a useful compilation in tracing the etiology of IBS and it may help design better treatment strategies and estimate the prognosis. The present study can be extrapolated to a larger sample size as it was limited to a selected short subset of the Indian population. Convenience sampling method was used due to limitations for this study, whereas other random methods can be more reliable. As also an interview method of data collection can be a better way of data collection compared to the electronic self reported questionnaire used in this study.

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Authors Profile

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