



# International Journal of Home Science

ISSN: 2395-7476

IJHS 2024; 10(2): 162-168

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Received: 16-05-2024

Accepted: 17-06-2024

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## Compliance and efficacy of low FODMAP diet on gut health among selected patients with GI disorders

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### Abstract

The gut is a vital organ that has a big impact on our general health. Diet and lifestyle have been identified as important contributors to gastrointestinal disorders. Nutrition, especially macronutrients like carbohydrates, fats, prebiotics and probiotics, significantly impacts gut microbiota diversity and function. This study investigates the effects of dietary and lifestyle modifications on functional gastrointestinal disorders (FGIDs), focusing on the Low FODMAP diet's efficacy in the management of these conditions. The study involved 140 patients from specialized gastrointestinal clinic and hospital in Coimbatore, selected through purposive sampling. Data was collected using interview schedule that included medical, demographic details and anthropometric measurements. Dietary habits and lifestyle practices were assessed using three-day dietary recalls, food frequency and evaluations of physical activity, dining out habits, and sleep patterns. Among the 140 patients, 56 participated in a 15-day Low FODMAP diet intervention, with pre and post-counselling evaluations. The study identified that younger adults aged between 25-35 years showed more incidents of FGIDs and gastroesophageal reflux disease was the most common FGID with abdominal pain being the prevalent symptom. Spicy foods were common symptom triggers, while traditional fermented foods like dosa, idli, and curd were frequently consumed. The intervention showed significant improvements in dietary compliance and food choices among the 56 participants, underscoring the Low FODMAP diet effectiveness in managing FGIDs. The study concludes that dietary modifications, including increased intake of Low FODMAP foods, probiotics, and prebiotics, along with mindful use of spices, can effectively reduce symptoms and improve the management of FGIDs.

**Keywords:** Functional gastrointestinal Disorders, medical details, dietary habits, lifestyle practices, Low FODMAP foods, diet counselling

### 1. Introduction

The gut, a crucial organ influencing overall health, encompasses various components such as digestion, absorption, and a diverse microbiota. Environmental and host-dependent factors significantly impact the gut microbiota, thereby affecting health and disease beyond physical well-being. Nutrition plays a significant role in shaping the gut microbiota, with macronutrients like lipids, proteins, prebiotics, probiotics, and carbohydrates influencing its diversity and function. Diet-induced alterations in the gut microbiome can disrupt its equilibrium, potentially leading to gastrointestinal (GI) disorders and systemic diseases, highlighting the importance of dietary interventions in managing gut health.

Factors such as genetics, diet, antibiotics, and lifestyle choices dynamically influence the gut microbiota throughout life. Antibiotic use, in particular, can have long-term consequences on gut health, emphasizing the need for holistic approaches to maintain microbial balance. Lifestyle factors like exercise also impact gut microbiota composition, underscoring the interconnectedness between lifestyle choices and gut health. These factors cause gut dysbiosis which over time leads to GI disorders.

Functional gastrointestinal disorders (FGIDs) are group of GI disorders with chronic gastrointestinal symptoms, which represent a significant global health burden, affecting over forty percent of adults worldwide, with varying prevalence rates across demographics and regions. Common FGIDs include irritable bowel syndrome (IBS), gastroesophageal reflux disease (GERD), and functional constipation, highlighting the diverse spectrum of disorders encompassed by FGIDs.

Effective management strategies, including dietary modifications such as fermented foods and Low FODMAP diets, offer promising avenues for improving gut health and alleviating symptoms associated with gastrointestinal disorders. Proper education and support are crucial for successful adherence to dietary interventions, emphasizing the importance of comprehensive approaches in managing FGIDs and promoting overall gastrointestinal health.

Research has consistently demonstrated the effectiveness of a Low FODMAP diet in managing gastrointestinal symptoms across various study designs. Observational studies by Prince *et al.* (2016) [14] and Seamark (2021) [15] showed significant symptom relief, improved stool consistency, and reduced healthcare utilization. Randomized trials by Turco *et al.* (2018) [23] and systematic reviews by Peng *et al.* (2022) [13] confirmed these findings, highlighting reductions in abdominal pain and bloating, with notable improvements in quality of life, especially in patients with IBS and IBD. Whelan & Staudacher (2022) [24] emphasized the diet's short-term benefits, with emerging evidence supporting long-term effectiveness through structured reintroduction and personalization. These studies collectively show the Low FODMAP diet as an approach for managing functional gastrointestinal disorders.

The need of the study is to gain knowledge on Low FODMAP and create awareness and educate the patients on the diet to in cooperate it in their daily dietary routine, with the objectives of the study is to, Study the pattern of Functional Gastrointestinal Disorders and the medical details among the selected patients.

Assess the dietary and the lifestyle pattern among the selected patients.

Evaluate the compliance of Low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols diet counselling among the selected patients.

## 2. Methodology

### Selection of the patients

Due approval was obtained for the study from the Institutional Human Ethics Committee. The study focused on specialty clinics and hospitals for gastrointestinal disorders in Coimbatore district. Data collection was conducted at SG Gastro Care Clinic and VGM Gastro Centre, Multispecialty Hospital. Permission was obtained from ten specialty clinics and hospitals in urban areas of Coimbatore through personal outreach, ultimately selecting two facilities for data collection. Purposive sampling method was employed to select patients meeting specific inclusion criteria, resulting in a total of 140 patients interviewed.

### Studying the background information and medical history of the selected patients

Structured interviews were conducted to gather demographic details, socioeconomic status, and medical history of the selected patients. This included information on gastrointestinal disorders, treatment received, and comorbidities such as hypertension and diabetes. Standard criteria such as Rome IV criteria were used to assess

symptoms and stool abnormalities. Medical information was collected to understand the patient's medical condition and analyse symptoms.

### Assessment of anthropometry details of the selected patients

Anthropometric data, including height, weight, Body Mass Index (BMI), waist measurements, and hip measurements, were obtained to assess nutritional status and risk of central obesity. Measurements were conducted using standardized techniques and equipment, and BMI was calculated based on weight and height measurements.

### Eliciting details on diet pattern and lifestyle practices of the selected patients

Information on diet preferences, food allergies, and food triggers for symptoms, frequency of dining out, and types of food eateries were collected through structured interviews and dietary recall methods. Lifestyle practices such as sleep patterns, physical activity, smoking, and alcohol consumption were also assessed.

### Counselling and evaluation of low FODMAP diet compliance

Patients were counselled on a low FODMAP diet through a comprehensive PowerPoint presentation covering various aspects such as fermentation techniques, choice of spices, food product selection, and low FODMAP foods. Fifty-six patients gave consent to follow a low FODMAP diet for 15 days as part of the intervention group. Post counselling evaluation scored the changes in dietary habits through questionnaires. Compliance and effectiveness of the intervention were analysed to assess the impact of the low FODMAP diet on gastrointestinal symptoms and overall health.

### Consolidation and statistical analysis

Using SPSS software, the data were edited and coded before being used in the statistical analysis. Using statistical methods such as correlation and paired t-test was performed and analysed. The data was interpreted and conclusions were drawn using these statistical tools.

## 3. Results

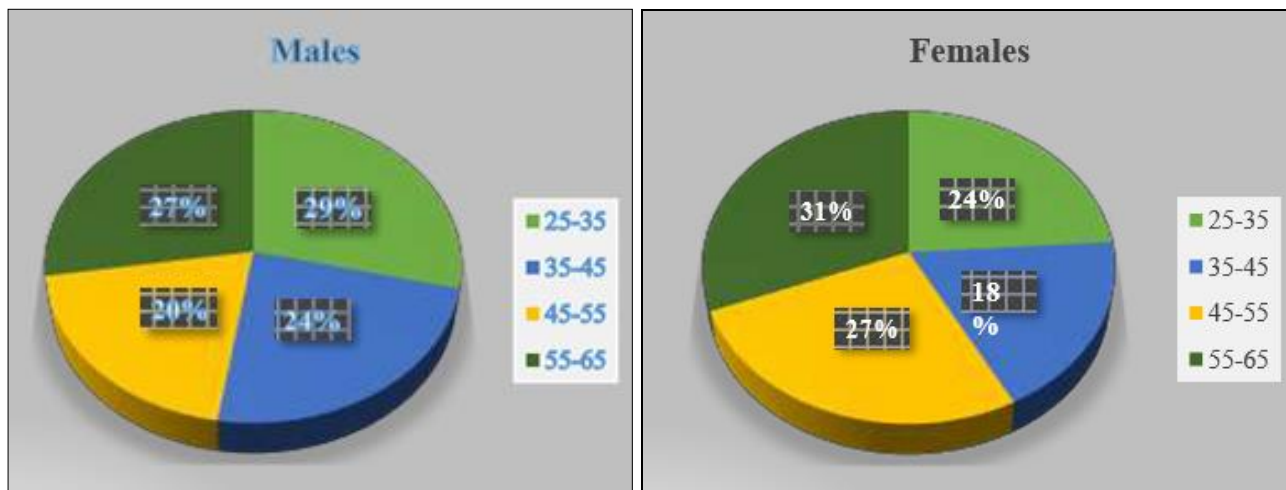
### Background details of the selected patients

The results pertaining to background details of the patients is presented below:

**Table 1:** Age and Gender distribution

Age (years)	Gender	
	Males (N=80)	Females (N=60)
25-35	23	17
35-45	19	13
45-55	16	19
55-65	22	11

The results pertaining to age and gender distribution of the patients is discussed below



**Fig 1:** Age and gender distribution of the selected patients

Among the 140 patients studied, 23 males and 17 females were in the younger age group of 25-35 years pointing out that FGIDs incidents are higher among this group, highlighting the impact of faulty dietary habits and lifestyle changes. The patients in the age group of 55-65 years also showed significant FGID prevalence, reflecting age-related declines in gut function.

Education status of the patients shows 76 were graduates. Traditional gender roles were evident, with 35 females as

homemakers and 39 males as private employees and 61% of patients fell into the lower income group (25,000-50,000/-), highlighting a strong correlation between FGIDs and financial circumstances, as supported by Sperber's (2020) [18] study.

**Anthropometry details of the selected patients**

Anthropometry details such as the BMI and WHR of the selected patients is given below:

**Table 2:** Anthropometry details of the selected patients

Nutritional Status *	Body mass Index (WHO, 2010)		Gender		Correlation	
	BMI ranges (kg/m <sup>2</sup> )	Gender		Correlation (r)	Sig. (P)	
		Males (N=80)	Females (N=60)			
Underweight	<18.4	1	3	-0.048	0.713	
Normal weight	18.5 to 24.9	26	24			
Overweight	25.0 to 29.9	48	25			
Moderately Obese	30.0 to 34.9	1	6			
Severely Obese	35.0 to 39.9	2	Nil			
Morbidly Obese	≥40.0	2	Nil			
<b>Waist Hip Ratio (WHO,2008)</b>						
Low	0.95 or lower/0.80 or lower	31	3	0.122	0.353	
Normal	0.96-1.0/0.81-0.85	11	11			
High	1.0 or high/0.86 or high	38	46			

Forty-eight males and 25 females were overweight, with two males morbidly obese. Significant differences in BMI and WHR were observed between genders, highlighting variations in body composition and metabolism (Tambucci, 2019) [19]. Similarly, 60% of patients had a high WHR, more prevalent among females, linked to sedentary lifestyles. These findings underscore a strong association between higher BMI/WHR

and FGIDs (Mahadeva, 2023) [9].

**Details on GI disorders of the selected patients**

Medical details such as the type of FGIDs, symptoms experienced and presence of comorbidities of the selected patients is presented below:

**Table 3:** Type of FGIDs among the selected patients

FGIDs	Gender	
	Males (N=80)	Females (N=60)
Gastric ulcers	4	5
Irritable bowel syndrome	11	4
Haemorrhoids	12	2
GERD-Gastroesophageal Reflux Disease	34	37
Gastritis	17	9
Irritable bowel disease	2	3

The prevalence of GERD, affecting 34 of males and 37 of females, with a higher incidence in females is seen, likely due

to hormonal and anatomical differences (Fass, 2019) [5].

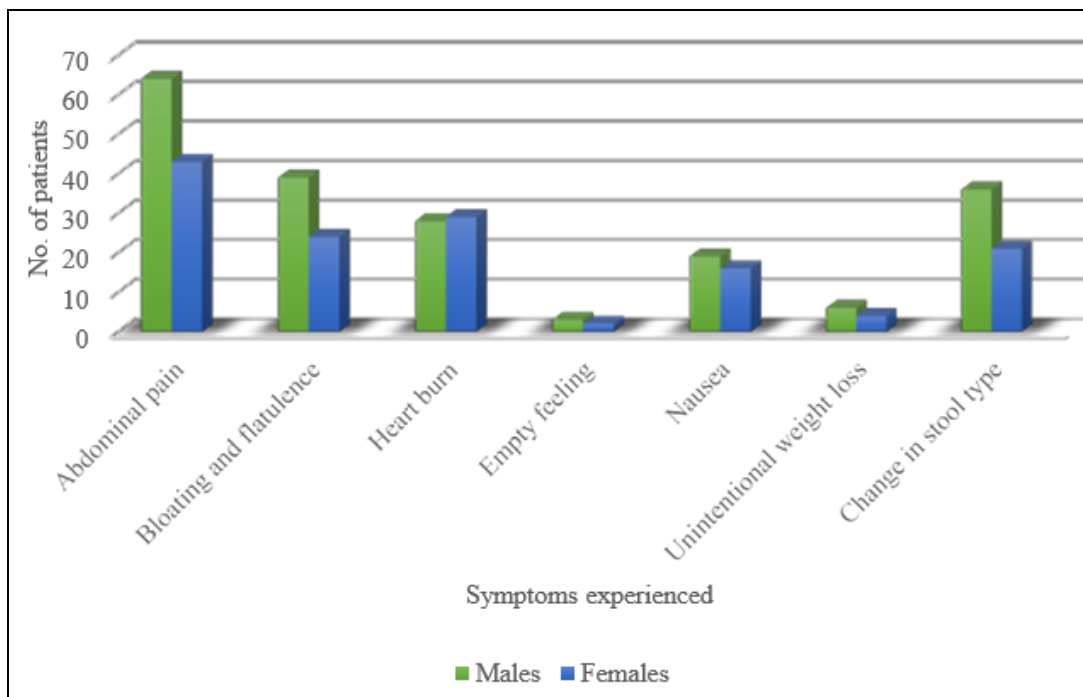


Fig 2: Symptoms experienced by the selected patients

Abdominal pain was the most common symptom in both genders, reported by 64 males and 43 females, followed by bloating and changes in stool type. Other prevalent FGIDs

included gastritis, hemorrhoids, and IBS in males, and gastritis, gastric ulcers, and IBS in females.

Table 4: Duration of FGIDs

Duration of FGIDs			ANOVA		
Duration	Gender		Mean	F	Sig.
	Males (N=80)	Females (N=60)			
1-3 years	67	54	35.793	3.812	0.003
3-6 years	9	4			
> 6 years	4	2			

Sixty-seven males and 54 females of the patients were having a duration of 1-3 years. Chelimsky (2012) [2] underscores the chronicity of FGIDs, emphasizing the importance of effective management strategies to control symptoms and improve quality of life. The significant F-value indicates that the duration of GI conditions may influence the severity or occurrence of FGIDs, highlighting the need for tailored interventions based on the duration of the condition. Forty-four among the 140 (29%) selected patients had

comorbidities. Diabetes mellitus is the most prevalent comorbidity among both male patients (16) and female patients (8), indicating a significant burden of diabetes in the population studied.

**Dietary pattern of the selected patients**

Dietary pattern such as the dietary habits, common foods that trigger FGID’s, consumption of Low FODMAP foods and herbal drinks of the selected patients are given below:

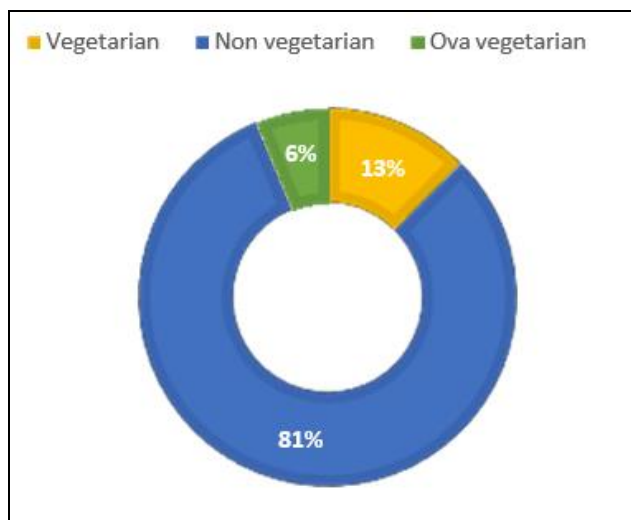


Fig 3: Dietary habits among the selected patients

Sixty-five males and 47 female patients were non-vegetarians, while an equal number of ten patients were vegetarians. Sidhu (2023) [16] states that eating a vegetarian diet is advantageous

in the development of helpful bacteria like lactobacillus and bifid bacterium to maintain gut health.

**Table 5:** Common foods which trigger FGID's

Type of foods	Gender	
	Males (N=80)	Females (N=60)
Spicy foods	64	46
Fatty foods	13	11
Caffeine	4	4
Alcohol	6	Nil
High-fiber foods	Nil	1
Gluten foods	1	Nil
Lactose foods	1	2

Spicy foods, integral to South Indian cuisine, were identified as triggering FGIDs in 64 males and 46 females, reflecting their impact beyond flavour and cultural significance (Krishna, 2019) [8]. Fatty meals were the second most

common trigger, affecting 13 males and 11 females. These findings align with Chen (2020) [3], who observed a strong association between spicy food consumption and FGID symptom severity and relapses.

**Table 6:** Consumption of Low FODMAP foods

Foods	Frequency (N=40)				
	Daily	Weekly	Monthly	Fortnightly	Occasionally
<b>Traditional fermented foods</b>					
Fermented breakfast foods	4	36	10	8	44
Fermented lunch foods	Nil	1	12	12	40
Fermented koozh	Nil	Nil	3	1	14
<b>Fermented drinks</b>					
Sweet fermented drinks	Nil	2	2	2	28
Butter milk	2	38	52	12	32
Curd	13	87	9	12	14
<b>Commercial products</b>					
Yakult	Nil	Nil	2	1	8
Probiotic gummies	Nil	Nil	Nil	Nil	3
Yogurt	Nil	Nil	Nil	Nil	4
Tofu	Nil	Nil	Nil	Nil	2

Traditional fermented foods are commonly consumed, with 23 patients consuming fermented breakfast items and 13 consuming fermented lunch items weekly, monthly, or occasionally. Fermented drinks, such as curd and buttermilk, are consumed by 75 patients, while commercial fermented products are rarely consumed. These variations in consumption may be influenced by personal preferences, cultural practices, and dietary restrictions.

**Lifestyle practices of the selected patients**

Lifestyle practices such as the type of smoking and alcohol habits and sleep pattern of the selected patients is given below:

**Table 7:** Smoking and alcohol habits

Duration	Males (N=23)	
	Smoking (N=10)	Alcohol consumption (N=35)
3-5 years	3	8
>5 years	7	27

Among the 80 male patients, 10 practiced smoking and 35 consumed alcohols with 27 having consumed alcohol for over five years. Long-term smoking and alcohol consumption, as discussed by Ohlsson (2017) [12], are associated with adverse health outcomes and may trigger FGID symptoms. Forty-nine males and 37 female patients slept 7-8 hours daily and 23 females sleeping only six hours. The bidirectional link between sleep disturbances and FGIDs, suggests that

maintaining a healthy sleep schedule is crucial for managing FGIDs.

Among the 140 patients, 53 engaged in daily physical activity, with walking/jogging being the most common (28 males, 12 females). Males were more likely to engage in longer duration activities (45-60 minutes or more), while both genders preferred moderate-intensity activities (15-30 minutes), supporting Merrick (2013) on the positive health impacts of moderate exercise.

**Table 8:** Correlation between GI disorders and dietary habits, common food triggers, physical activity, dining out, smoking and alcohol consumption.

Variable	Correlation (r)	Sig. (p)
GI disorders and diet habits	0.049	0.566
GI disorders and food triggers	0.061	0.471
GI disorders and smoking	-0.001	0.05
GI disorders and alcohol consumption	0.375	<0.001
GI disorders and physical activity	0.048	0.575

A negative correlation was found between GI problems, smoking, whereas a positive correlation was found between GI conditions and dietary practices, common food triggers, consumption of alcohol, and physical activity. The lack of significance in the correlation was attributed to the unequal distribution of patients among the various variables.

### Evaluation of Low FODMAP diet

Mean nutrient intake of the subsample of fifty-six patients and their post dietary compliance evaluation is presented below: Both males and females had intakes below the Recommended Dietary Allowance (RDA) for all the nutrients namely macronutrients and micronutrients, indicating a deficiency in their diets. Macronutrients deficiency of energy protein and fiber was observed among both the groups and minerals, including vitamin C, vitamin B2, vitamin B3, zinc, selenium, and magnesium, were consumed insufficiently, leading to deficiencies in comparison to the RDA (2024).

**Table 9:** Post dietary compliance modifications

Modifications	Patients
Made better food choices	26
Avoidance of irritating foods	17
Made better lifestyle choices	5
Avoidance of outside foods	4
Made no changes	4

Twenty-six patients showed positive efforts in improving diet quality, while 17 avoided irritating foods, and four opted to avoid outside foods, reflecting awareness and willingness to modify diet to manage GI symptoms. However, four patients made no changes, implying either satisfaction with their current habits or a lack of willingness to modify their diet.

**Table 10:** Pre and post dietary compliance of Low FODMAP foods

Scores range	Pre compliance N=56		Post compliance N=56		Pre and post dietary compliance (T-Test)	
	Males	Females	Males	Females	T	DF
>6	1	Nil	Nil	Nil	-26.062	55
6-12	14	9	2	Nil		
12-18	9	10	10	5		
18-24	8	5	13	12		
24-30	Nil	Nil	7	7		

Positive improvements in dietary compliance with Low FODMAP foods post-intervention was observed as evidenced by increased scores, particularly among male patients. Effective counselling and follow-up led to enhanced knowledge, attitude, and practice regarding low FODMAP foods, as indicated by the paired sample t-test showing decreasing means between pre and post dietary compliance assessments. These findings underscore the effectiveness of intervention strategies in promoting dietary modifications for managing FGIDs.

### 4. Conclusion

Understanding the relationship between diet patterns, medical information, and lifestyle choices among patients with GI diseases has been gained from the study. Dietary intervention and lifestyle modification's importance in the management of FGIDs is emphasized. FGIDs are more common among the younger age group and faulty dietary habits such as consumption of processed foods, increased frequency of dining out and sedentary lifestyle are the probable causes. Through this study it was identified that modification of dietary habits by consuming more of Low FODMAP foods, probiotics and prebiotics along with conscious use of spices help in reducing symptoms and helps in better management of FGIDs.

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