# ASSOCIATION OF DIETARY INTAKE AND SLEEP QUALITY WITH GASTROINTESTINAL HEALTH IN INFORMATION TECHNOLOGY PROFESSIONALS AGED 21 TO 45 YEARS: A CROSS-SECTIONAL STUDY IN MUMBAI, INDIA

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## ABSTRACT

*BACKGROUND: The nature of work in the IT sector, which includes targets or deadlines, shift work, long work hours, project overload, and job insecurity due to layoffs, can cause high-stress levels among IT professionals. High-stress levels can cause disturbances in sleep patterns, leading to poor sleep quality and short sleep duration. Such disruptions in sleep and high stress levels have been linked to an increased risk of developing gastrointestinal diseases, obesity, and metabolic diseases. The current study assesses dietary intake, gastrointestinal health, and sleep quality among IT professionals and studies the association between gastrointestinal health, sleep quality, and dietary intake.*

*METHODS: A cross-sectional study was conducted on 198 IT professionals (120 males and 78 females) residing in Mumbai through a convenience sampling method. Anthropometric measurements, and dietary recall, were recorded. Gastrointestinal health was assessed using the Gastrointestinal Health Assessment Questionnaire and Sleep quality was assessed using the Pittsburgh Sleep Quality Index. The association of gastrointestinal health with sleep quality, and dietary intake was examined. Descriptive and bivariate analysis was performed.*

*RESULTS: Males had significantly higher weight and height and consumed more protein and carbohydrate (p-value = 0.000) than females. The study found that 30.30% had a high risk of gastrointestinal inflammation while 21.21% of participants were at high risk for gastric ailments. For small intestine ailments, 4.55% were at high risk and 11.11% at moderate risk; for colon ailments, 8.59% were at high risk and 11.11% at moderate risk. Gastric and colon function are significantly associated with sleep quality (p-value < 0.05). Gastrointestinal inflammation is significantly associated with sleep quality, energy, and protein intake (p-value < 0.05).*

*CONCLUSION: This study revealed that poor sleep quality, and inadequate nutritional intake is associated with increased gastrointestinal health risk. Gastric and colon function are significantly associated with sleep quality. Gastrointestinal inflammation is significantly associated with sleep quality and dietary intake. Most participants reported poor sleep quality with no significant difference between the male and female participants. Further research is needed to identify the underlying mechanisms and potential interventions to improve IT professionals' overall health and well-being.*

**Keywords:** *Gastrointestinal health, Sleep Quality, IT Professionals, Nutrition, Dietary Intake, Occupational Health*

## 1. INTRODUCTION

From humble beginnings at the bottom of value creation, the Indian Information Technology (IT) services sector has expanded to become an important figure in the global information and communications technology (ICT) market. It holds a 55% market share in the world's IT services industry [1]. Together with rapidly changing work cultures, this industry has also led to a rise in sedentary lifestyles, which is linked to a higher risk of non-communicable diseases (NCDs) and metabolic syndrome (MetS) [2]. Stress is high in IT professionals due to their character of work, targets or deadlines, shift work, long work hours, project overload, and job insecurity due to layoffs [3]. Circadian clock pathways alter endocrine signalling, gastrointestinal activity, inflammation, and metabolism. Patients with a known case of gastroesophageal reflux disease and irritable bowel syndrome may regularly face sleep difficulties [4]. Recent findings suggest that sleep dysfunction is associated with elevated proinflammatory cytokines (tumour necrosis factor-α, interleukin-1, and interleukin-6) which can have a prominent impact on gastrointestinal ailments. Sleep disturbance increases the risk of IBS, gastric distress, hepatic disease, inflammatory bowel disease and colorectal cancer [5]. Diet is a key modifiable factor affecting gastrointestinal health signifying the potential for therapeutic diet strategies. Diet can alleviate gastrointestinal tract symptoms in two ways: it can serve as probiotic and modulate the gut-brain axis, improving the psychological symptoms. The gut ecosystem provides a potential link between diet diversity, host metabolism and health , yet this mechanism is poorly understood [6].

### 1.1 Overview of Gastrointestinal Health and Disorders

“Gastrointestinal health” refers to the functions such as digestion, neuroendocrine regulation, immunoregulation, barrier, and motor systems of the gastrointestinal tract to operate efficiently [7]. It is also established that gut microbiota regulates each of these functions emphasizing its significance in both the maintenance of host well-being and the pathogenesis of several diseases [8].

Gastrointestinal Disorders (GIDs) can be classified into functional and structural disorders. When a patient has functional GID, medical investigations reveal motility issues despite the alimentary tract appearing normal. Along with non-complicated gastroesophageal reflux disease (GERD), there are several issues and symptoms, such as bloating, constipation, diarrhoea, gas, irritable bowel syndrome (IBS), nausea, and poisoning. Structural GIDs are characterized by both abnormal appearance and impaired motility. The structural GIDs include diverticular disease, hemorrhoids, inflammatory bowel disease (IBD), Crohn's disease (CD) and ulcerative colitis (UC), different forms of hepatitis, including autoimmune and viral ones, gastric and duodenal peptic ulcer disease and cholelithiasis with their complications, and complicated GERD (including Barrett's esophagus and esophageal strictures) [9].

### 1.2 Prevalence of Gastrointestinal Disorders

Functional gastrointestinal disorders (FGIDs) are defined by persistent or recurring gastrointestinal symptoms that lack a detectable underlying cause. These disorders present with a range of symptoms that persist over time, yet no structural or biochemical abnormalities can explain them. [10]. The most prevalent gastrointestinal disorders are functional dyspepsia (causing epigastric pain), bloating, and irritable bowel syndrome [11]. In a multinational study spanning 33 nations, 6 continents, and 73,076 adults, 40.3% of respondents to the Internet surveys and 20.7% of respondents to the household surveys fulfilled the diagnostic criteria for at least one FGID. Based on responses, women were more likely than men to have FGIDs [12].Limited data exist in India concerning the prevalence of FGID. One study found that the prevalence of FGIDs among Indian adults was 18%. [13]. To learn more about the prevalence of FGID in the Indian community further research is necessary.

### 1.3 Overview of Employment in IT Industry

IT professionals are provided with lucrative salary packages, foreign job opportunities, and a high standard of living on one hand but on the other, they grapple with strict deadlines and have to keep updated about the rapidly changing technology [14].

In software firms, teams are formed specifically for each project. Individuals are assessed based on both individual and team performance where they put pressure on each other to complete work in time [15]. A career in this industry is day by day characterized by tight deadlines, increasing stress, rising levels of customization, lengthy workdays, and serving clients in various time zones called "night here, morning there" syndrome (to cater to foreign countries' employees work at night) and deteriorating interpersonal bonds at the workplace [16],[17]. Additionally, employment in the IT sector is unstable. Employees may be let go or transferred at any time due to economic recession, project completion, or a decline in clients which creates job insecurity [18].

### 1.4 Overview of Sleep Quality and Gastrointestinal Health

Sleep quality refers to an individual's overall satisfaction with various aspects of their sleep experience.. The four components of sleep quality are wakefulness post-sleep, hours of sleep, time taken to fall asleep, and wakefulness during sleep [19]. Inadequate sleep can adversely affect social and professional efficiency throughout the day, elevate the risk of occupational and vehicle accidents, and negatively affect a person’s quality of life and general health [20].

In a study based in Finland, IT professionals reported that 16% of the participants had insomnia 37% had a sleep debt of at least one hour and 6% had a sleep debt of at least two hours [21]. Sleep quality studies on Indian IT professionals are limited and need further research.

Recent research indicates that variations in sleep patterns can alter the diversity of the gut microbiota, and conversely, changes in the gut microbiota can impact sleep quality. The gut microbiota might influence the regulation of sleep. [22]. Circadian desynchronization among shift workers has an adverse impact on digestive processes and the regulation of leptin and insulin. The occurrence of irritable bowel syndrome (IBS) shows a significant rise among shift workers, particularly those engaged in rotating shifts [23].

### 1.5 Diet and gastrointestinal health

Dietary intake of plant-based foods is linked to increased microbial diversity, a predominance of good, anti-inflammatory taxa, and decreased abundance of pathobionts. There are microbiota differences between omnivores, carnivores and vegetarians or vegans, which are probably caused by dietary intake of fibre and saturated fat. Fibre fermentation is a crucial step in the synthesis of short-chain fatty acids. On the other hand, pro-inflammatory lipopolysaccharide, which has been demonstrated to enhance the populations of bile-tolerant pathobionts like Bilophila, is linked to saturated animal fat [24].

An extensive population-based study with an extended follow-up period has shown a correlation between the development of Crohn's disease and consumption of highly processed foods [25].

Variety in food is beneficial to the diet's quality. A person's micronutrient adequacy and quality improves when they include a variety of foods in their diet; this has a positive impact on their intestinal microflora and their overall gastrointestinal health. In a study examining the connection between gut microbiota and dietary variety in a Chinese population, it was found that greater dietary variety scores were associated with greater microbial diversity and greater abundance of some potentially helpful bacteria at the expense of fewer potentially harmful bacteria. It concluded that a high variety dietary, therefore, should be recommended in our daily life [26].

Evidence of assessment of gastrointestinal health, sleep quality, and dietary intake in IT professionals is limited among the Indian population. Therefore this study was carried out to assess the association of diet, gastrointestinal health, and sleep quality to better understand the occupational health of IT professionals which is a fast-growing common profession these days. Examining how dietary habits, nutritional decisions, and the unique work-related obstacles that IT professionals encounter interact will be crucial to developing successful interventions that support their general well-being and efficiency.

## 2. METHODOLOGY

This cross-sectional study was conducted among 198 IT Professionals aged 21-45 years in Mumbai. The samples were recruited through a convenience sampling method. The Ethics Committee Approval was obtained from Inter System Biomedical Ethics Committee (ISBEC), before the commencement of the proposed study.

### 2.1 Inclusion Criteria

- Subjects employed in IT companies engaged in technical roles such as software development, system administration, network engineering, database management, etc.
- Subjects included both males and females aged 21 to 45 years.
- Residents of Mumbai
- Participants with regular daytime work schedules.

### 2.2 Exclusion Criteria

- Individuals with acute (food poisoning) and chronic gastrointestinal conditions (Gastroesophageal reflux disease (GERD), irritable bowel syndrome (IBS), Inflammatory bowel disease (IBD), Celiac disease, peptic ulcer, hiatal hernia, and cancer.
- Individuals with chronic sleep disorders (insomnia, sleep apnoea, narcolepsy, restless leg syndrome)
- Pregnant & Lactating women

### 2.3 Questionnaire

- Demographic details and anthropometric measurements (Weight and Height) were self-reported and BMI was calculated.
- To assess sleep quality validated tool Pittsburgh Sleep Quality Index (PSQI) was used. PSQI consists of 19 items questionnaire reported for the past 1 month. A score of (0-4) indicates good quality sleep and a score of (5-21) indicates poor quality sleep.
- To assess gastrointestinal health Gastrointestinal Health Assessment Questionnaire was used. This questionnaire asked to report the frequency of the symptoms from the past 4 months. The symptom frequency options were: No or Rarely, Occasionally, Often, and Frequently. It consisted of 4 sections which included Gastric function, GI inflammation, Small intestine & Colon function. Scoring: 0-4 (Low Risk), 5-8 (Moderate Risk), 9+ (High Risk) for assessing gastrointestinal health risk.
- 24-hour dietary recall was a subjective and retrospective method. It included time, quantity in household measure, and description of food and beverage consumed assessed using the personal interview method.

### 2.4 Data Analysis

Data analysis was performed using IBM SPSS (Statistical Package for Social Sciences) software (version 20). Descriptive statistics such as mean, frequency, percentage, and standard deviation were used. p-value of $< 0.05$ was considered statistically significant.

## 3. RESULT AND DISCUSSION

**Table 1:** Demographic characteristics of the study population

| Demographic Factors | Total (198) |
|---|---|

| | **n (%)** |
|---|---|
| **Gender** | |
| Male | 120 (60.6) |
| Female | 78 (39.4) |
| **Marital Status** | |
| Unmarried | 175 (88.4) |
| Married | 22 (11.1) |
| Divorced | 1 (0.5) |
| **Child Count** | |
| 0 | 189 (95.5) |
| 1 | 8 (4) |
| 2 | 1 (0.5) |
| **Type Of Shift** | |
| Morning | 171 (86.4) |
| Afternoon | 27 (13.6) |

*(Data represented in frequency and percentage)*

Table 1 shows that the study sample included 60.6% males and 39.4% females. In this study, the male-female ratio was 1.5:1. Most of the study samples were unmarried accounting for 88.4%. Only 11.1% of the total participants were married and 0.5% divorced. The majority of the participants reported having no children accounting for 95.5%, while 4% reported having one child and 0.5% having 2 children. Most participants worked the morning shift accounting for 86.4%, while 13.6% worked the afternoon shift.

**Table 2 :** Anthropometric Measurements of the Study Participants

| **Anthropometric Measurements** | **Total** (N= 198) | **Gender** | | **t value** | **p-value** |
|---|---|---|---|---|---|
| | | **Male** (n = 120) | **Female** (n = 78) | | |
| Height (cm) | 168.38 (9.65) | 173.43 ( 7.95) | 160.60 (6.29) | 12.616 | **0.000*** |
| Weight (Kg) | 67.52 (13.18) | 71.56 (12.72) | 61.30 (11.40) | 5.910 | **0.000*** |
| BMI ($kg/m^2$ ) | 23.74 (3.76) | 23.75 (3.67) | 23.72 (3.93) | 0.058 | 0.954 |

*Values reported in Mean (Standard Deviation)* *p < 0.05

The values of mean height, weight, and BMIs are shown in Table 4.2. An independent t-test was run to determine the differences in the anthropometry between participants. It was observed that males had significantly higher weight (p-value =0.000) and height (p-value = 0.000) than females. No significant difference in mean BMIs was found between males and females (indicated by p-value =0.954).

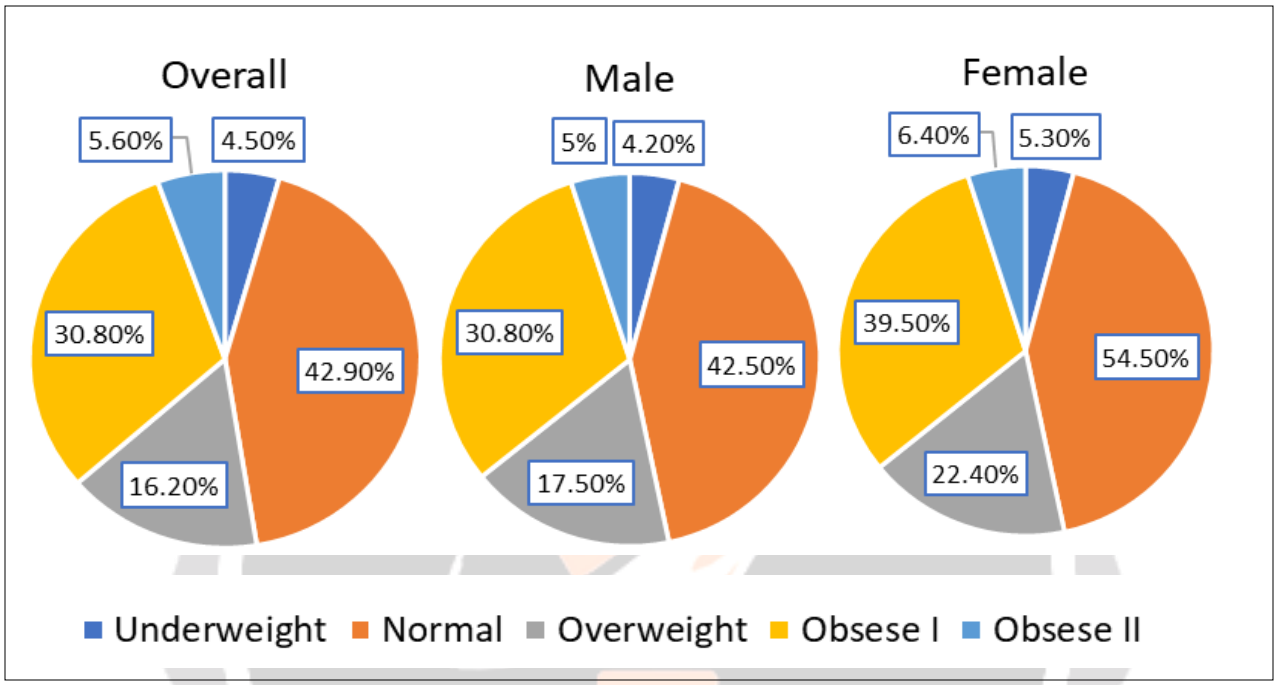


**Chart – 1** Classification of participants based on WHO-Asian BMI

*(Data presented in percentage (%))*

A minimum BMI value of 16.02 kg/m$^2$ and a maximum value of 37.37 kg/m$^2$ were seen while comparing the frequency distribution, as shown in Chart 1. It was seen that the majority of the population had an ideal BMI representing 42.90% (n = 85 ) followed by 30.80% obese I (n = 61), 16.2% overweight (n = 32), 5.6% obese II (n = 11) and 4.5% underweight (n = 9).

**Table-3** Macronutrient Intake in the Study Participants

| **Macronutrients** | **Male (n = 120)** | **RDA%** | **Female (n = 78)** | **RDA%** | **t-test value** | **p-value** |
|---|---|---|---|---|---|---|
| **Energy (Kcal)** | 1781 (246) | 84.41 | 1721 (248) | 103.67 | 1.645 | 0.102 |
| **Protein (g)** | 61.71 (20.45) | 114.28 | 56.73 (14.63) | 124.14 | 1.994 | **0.048*** |
| **Carbohydrate (g)** | 269.28 (40.93) | 207.14 | 257.28 (38.23) | 197.91 | 2.098 | **0.037*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Fat (g)** | 50.79 (10.73) | 203.16 | 51.76 (10.11) | 258.80 | -0.646 | 0.519 |

Mean (Standard deviation) *p<0.05

The difference between the mean values of energy and fat intake between males and females was not statistically significant (p-value = 0.102 & 0.519). The difference between the mean values of protein and carbohydrate intake between the male and female participants was statistically significant (p-value = 0.048 & 0.037). Males consumed a significantly higher intake of protein and carbohydrates than females. In contrast to our findings, a study conducted in the Thiruvananthapuram district by Renjini et al., 2009 to assess dietary intake among IT professionals reported that the mean energy intake by males was 2865 Kcal and for females, it was 1912 Kcal [18]. The mean protein intake in males was reported as 67.6 g and in females as 62.6g. The mean fat intake in males was reported as 36.8g and in females was 35.2g. The differences between our findings and the research conducted by Renjini et al. (2009) can be due to various factors. The temporal gap between the studies suggests a shift in dietary patterns over time influenced by evolving lifestyles, work environments, and nutrition awareness among IT professionals. Moreover differences in cultural influences, work culture, and socio-economic status can also contribute to the variations.

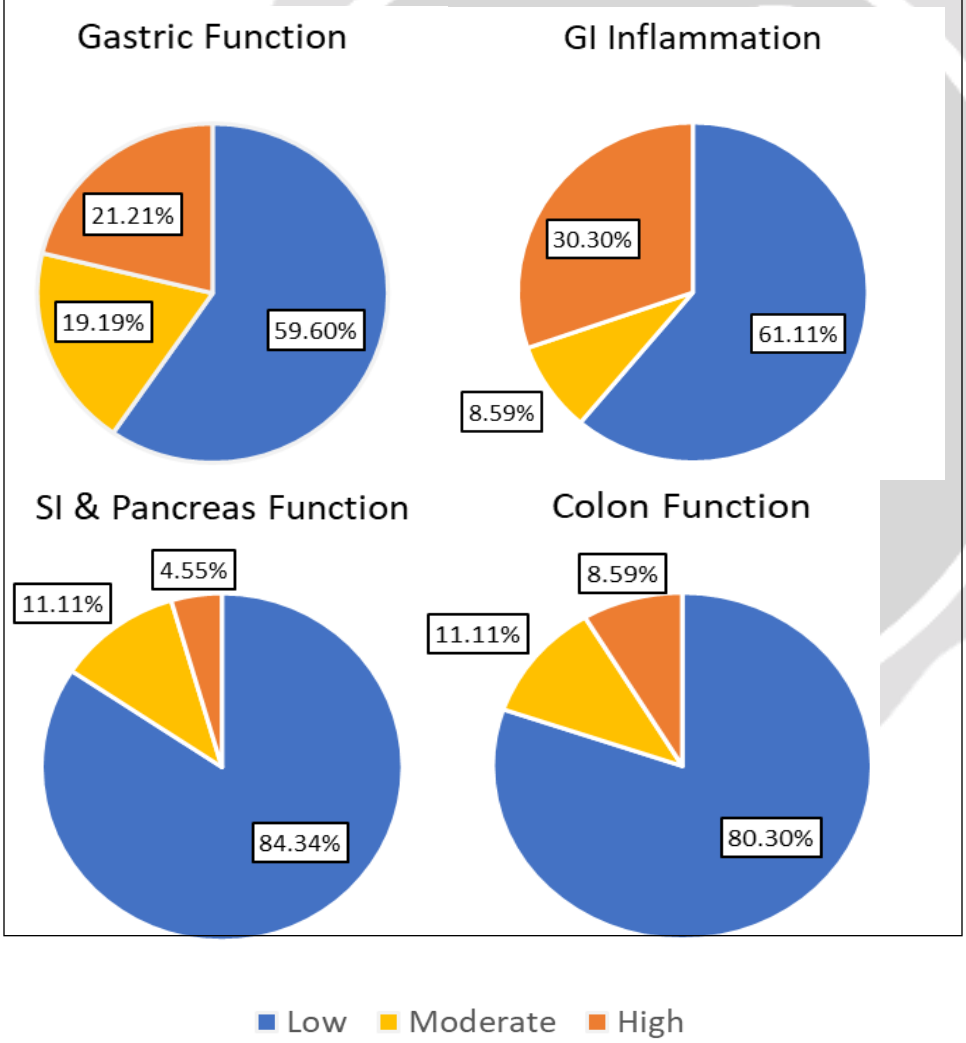


**Chart 2 :** Gastrointestinal Health Risk Among Study Participants *(Data represented in percentage (%))*The Gastrointestinal Health Assessment Questionnaire probed about gastrointestinal health aspects of how an individual has been feeling for the past four months. The questionnaire is divided into four sections analysing gastric function,

GI inflammation, small intestine, and colon function. All four sections have questions about the function of the respective gastrointestinal part. Participants were asked to respond to each question, and the final scores were added together to obtain gastrointestinal scores. A score between 0 to 4 indicates low risk, 5 to 8 moderate risk, and ≥9 as high risk of dysfunction for each of the four components. Among participants having gastric function discomfort, it was seen that 21.21% were at high risk and 19.19% were at moderate risk of gastric ailment. Gastrointestinal inflammation was higher among 30.30 % of the study population and 8.59% were at moderate risk of gastrointestinal ailment. 4.55% of the study population were at high risk while 11.11% were at moderate risk of small intestine ailment. 8.59% of the participants were at high risk, while 11.11% were at moderate risk of colon ailment.

**Table 4:** Gastrointestinal health scores among the study participants

| Items | Gender Distribution | Frequency n (%) | | | | p-value |
|---|---|---|---|---|---|---|
| | | Frequently | Often | Occasionally | No/ Rarely | |
| **Gastric Function** | | | | | | |
| Indigestion | Male | 3 (2.5) | 11 (9.2) | 39 (32.5) | 67 (55.8) | 0.918 |
| | Female | 1 (1.3) | 6 (7.7) | 26 (33.3) | 45 (57.7) | |
| Burping/Belching | Male | 1 (0.8) | 11 (9.2) | 41 (34.2) | 67 (55.8) | 0.384 |
| | Female | 3 (3.8) | 5 (6.4) | 23 (29.5) | 47(60.3) | |
| Spasms, cramping | Male | 2 (1.7) | 4 (3.3) | 22 (18.3) | 92 (76.7) | 0.739 |
| | Female | 2 (2.6) | 5 (6.4) | 14 (11.1) | 57 (73.1) | |
| Fullness, bloating | Male | 2 (1.7) | 9 (7.5) | 38 (31.7) | 71 (59.2) | 0.577 |
| | Female | 4 (5.1) | 5 (6.4) | 24 (30.8) | 45 (57.7) | |
| Bad taste in mouth | Male | 2 (1.7) | 6 (5.0) | 18 (15.0) | 94 (78.3) | 0.146 |
| | Female | 0 (0.0) | 3 (3.8) | 21 (26.9) | 54 (69.2) | |
| Indigestion | Male | 3 (2.5) | 11 (9.2) | 39 (32.5) | 67 (55.8) | 0.918 |
| | Female | 1 (1.3) | 6 (7.7) | 26 (33.3) | 45 (57.7) | |
| | Male | 2 (1.7) | 14 (11.7) | 31 (25.8) | 73 (60.8) | |

| Items | Gender Distribution | Frequency n (%) | | | | p-value |
|---|---|---|---|---|---|---|
| | | Frequently | Often | Occasionally | No/ Rarely | |
| **Gastric Function** | | | | | | |
| Indigestion | Male | 3 (2.5) | 11 (9.2) | 39 (32.5) | 67 (55.8) | 0.918 |
| | Female | 1 (1.3) | 6 (7.7) | 26 (33.3) | 45 (57.7) | |
| Small amounts fills stomach | Female | 4 (5.1) | 13 (16.7) | 21 (26.9) | 40 (51.3) | 0.319 |
| Skip meals | Male | 3 (2.5) | 12 (10.0) | 25 (20.8) | 80 (66.7) | **0.042*** |
| | Female | 3 (3.8) | 7 (9.0) | 30 (38.5) | 38 (48.7) | |

| Items | Gender Distribution | Frequency n (%) | | | | p-value |
|---|---|---|---|---|---|---|
| | | Frequently | Often | Occasionally | No/ Rarely | |
| **GI Inflammation** | | | | | | |
| Emotions aggravate stomach | Male | 1 (0.8) | 6 (5.0) | 20 (16.7) | 93 (77.5) | 0.416 |
| | Female | 2 (2.6) | 2 (2.6) | 18 (23.1) | 56 (71.8) | |
| Hungry in an hour after a good-sized meal | Male | 5 (4.2) | 13 (10.8) | 28 (23.3) | 74 (61.7) | 0.094 |
| | Female | 0 (0.0) | 7 (9.0) | 28 (35.9) | 43 (55.1) | |
| Stomach pain after 1-4 hours of eating | Male | 1 (0.8) | 6 (5.0) | 16 (13.3) | 97 (80.8) | 0.341 |
| | Female | 1 (1.3) | 3 (3.8) | 18 (23.1) | 56 (71.8) | |
| Stomach pain relieved | Male | 0 (0.0) | 8 (6.7) | 18 (15.0) | 94 (78.3) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| on taking antacids | Female | 0 (0.0) | 4 (5.1) | 14 (17.9) | 60 (76.9) | 0.798 |
| Burning sensation in lower chest | Male | 1 (0.8) | 12 (10.0) | 14 (11.7) | 93 (77.5) | 0.140 |
| | Female | 0 (0.0) | 3 (3.8) | 16 (20.5) | 59 (76.8) | |
| Spicy and fatty food leads to stomach pain | Male | 5 (2.5) | 13 (10.8) | 27 (22.5) | 75 (62.5) | 0.281 |
| | Female | 2 (2.6) | 3 (3.8) | 17 (21.8) | 56 (71.8) | |
| Nausea while eating | Male | 1 (0.8) | 6 (5.0) | 14 (11.7) | 99 (82.5) | 0.791 |
| | Female | 2 (2.6) | 4 (5.1) | 10 (12.8) | 62 (79.5) | |
| Difficulty swallowing | Male | 1 (0.8) | 3 (2.5) | 11 (9.2) | 105 (87.5) | 0.795 |
| | Female | 0 (0.0) | 1 (1.3) | 7 (9.0) | 70 (89.7) | |

| Items | Gender Distribution | Frequency n (%) | | | | p-value |
|---|---|---|---|---|---|---|
| | | Frequently | Often | Occasionally | No/ Rarely | |
| **Small Intestine Function** | | | | | | |
| Pain under left rib cage | Male | 0 (0.0) | 1 (0.8) | 12 (10.0) | 107 (89.2) | 0.335 |
| | Female | 0 (0.0) | 3 (3.8) | 8 (10.3) | 67 (85.9) | |
| Delayed fullness | Male | 2 (1.7) | 4 (3.3) | 15 (12.5) | 99 (82.5) | 0.405 |
| | Female | 0 (0.0) | 2 (2.6) | 15 (19.2) | 61 (78.2) | |
| Discomfort relieved by passage of gas | Male | 3 (2.5) | 4 (3.3) | 18 (15.0) | 95 (79.2) | 0.313 |
| | Female | 1 (1.3) | 4 (5.1) | 19 (24.4) | 54 (69.2) | |
| Specific food | Male | 1 (0.8) | 7 (5.8) | 20 (16.7) | 92 (76.7) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| aggravates indigestion | Female | 0 (0.0) | 4 (5.1) | 22 (28.2) | 52 (66.7) | 0.230 |
| Stool consistency changes | Male | 4 (3.3) | 7 (5.8) | 18 (15.0) | 91 (75.8) | 0.324 |
| | Female | 2 (2.6) | 4 (5.1) | 20 (25.6) | 52 (66.7) | |
| Undigested food in stool | Male | 2 (1.7) | 4 (3.3) | 16 (13.3) | 98 (81.7) | 0.063 |
| | Female | 0 (0.0) | 0 (0.0) | 20 (25.6) | 58 (74.4) | |
| 3 or more bowel movements daily | Male | 3 (2.5) | 8 (6.7) | 22 (18.3) | 87 (72.5) | 0.559 |
| | Female | 1 (1.3) | 2 (2.6) | 15 (19.2) | 60 (76.9) | |
| Diarrhoea | Male | 1 (0.8) | 3 (2.5) | 17 (14.2) | 99 (82.5) | 0.810 |
| | Female | 0 (0.0) | 2 (2.6) | 9 (11.5) | 67 (85.9) | |
| Bowel movement shortly after eating | Male | 4 (3.3) | 4 (3.3) | 18 (15.0) | 94 (78.3) | 0.706 |
| | Female | 2 (2.6) | 1 (1.3) | 15 (19.2) | 60 (76.9) | |
| Items | Gender Distribution | Frequency n (%) | | | | p-value |
| | | Frequently | Often | Occasionally | No/ Rarely | |
| **Colon Function** | | | | | | |
| Colon discomfort | Male | 3 (2.5) | 3 (2.5) | 15 (12.5) | 99 (82.5) | 0.644 |
| | Female | 1 (1.3) | 4 (5.1) | 12 (15.4) | 61 (78.2) | |
| Constipated | Male | 2 (1.7) | 7 (5.8) | 23 (19.2) | 88 (73.3) | 0.921 |
| | Female | 2 (2.6) | 6 (7.7) | 15 (19.2) | 55 (70.5) | |
| | Male | 2 (1.7) | 6 (5.0) | 8 (6.7) | 104 (86.7) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Mucus in stool | Female | 0 (0.0) | 3 (3.8) | 9 (11.5) | 66 (84.6) | 0.429 |
| Alternate constipation and diarrhoea | Male | 1 (0.8) | 3 (2.5) | 16 (13.3) | 100 (83.3) | 0.973 |
| | Female | 1 (1.3) | 2 (2.6) | 9 (11.5) | 66 (84.6) | |
| Rectal pain | Male | 1 (0.8) | 7 (5.8) | 20 (16.7) | 92 (76.7) | 0.858 |
| | Female | 1 (1.3) | 3 (3.8) | 11 (14.1) | 63 (80.8) | |
| No urge for bowel movement | Male | 18 (15.0) | 0 (0.0) | 0 (0.0) | 102 (85.0) | 0.941 |
| | Female | 12 (15.4) | 0 (0.0) | 0 (0.0) | 66 (84.6) | |
| Continual urge for bowel movement | Male | 13 (10.8) | 0 (0.0) | 0 (0.0) | 107 (59.1) | 0.161 |
| | Female | 4 (5.1) | 0 (0.0) | 0 (0.0) | 74 (74.9) | |

Frequency (Percentage) *p<0.05

Table 4 represents the frequency distribution of gastrointestinal health scores among the male and female study participants. It is divided into four sections. Under gastric function discomfort, it was seen that for indigestion majority reported no or rare occurrences (55.8 % in males and 57.7% in females), while 32.5% of males and 33.3% of females reported occasional occurrences. Similar to indigestion, bloating, and burping/belching were most commonly reported as occurring occasionally among 34.2% & 31.7% in males and 33.3% & 30.8 % in females respectively. Spasms and cramping were reported in fewer individuals reporting occasional occurrences among 18.3 % of males and 11.1% of females. Experiencing early satiety and skipping meals behavior was most commonly reported as occasional with 25.8% and 20.8% of males and 26.9% and 38.5% of females respectively. of the study population respectively. Bad taste in the mouth was reported less frequently overall, with occasional occurrence in 15% of males and 26.9% of females of the study population. It was observed that females had a significantly higher tendency to skip meals in comparison to males as evidenced by a p-value of 0.042. A study comparing food eating patterns among males and females reported that females miss meals more often than males. Young females typically watch what they eat more carefully than young males, and they also tend to snack less. Gender differences in eating behaviour could be explained by hormonal regulation of appetite, which affects both peripheral and central signals involved in feeding behaviour feedback [27]. There was no significant difference between males and females for gastric symptoms of indigestion, belching, cramps, bloating, early satiety, and bad taste in the mouth as evidenced by a p-value > 0.05.

Under gastrointestinal inflammation, it was seen that emotions aggravating gastric symptoms were most commonly reported as never or rarely (77.5% in males and 71.8% in females), followed by occasionally (16.7% in males and 23.1% in females) and often (9.2% in males and 7.7% in females). Similarly feeling hungry after a good-sized meal, stomach pain after eating, and stomach pain relieved with the use of antacids were reported most commonly as occasionally. Notably, these occurrences were more prevalent in females at 35.9%, 23.1%, and 17.9% respectively as compared to males at 23.3%, 13.3%, and 15%. However, there was no significant difference in these symptoms between males and females as evidenced by a p-value > of 0.05. Similarly, a burning sensation in the chest and spicy and fatty food intake leading to stomach pain were commonly seen occurring occasionally (11.7% and 22.5% in males) (20.5% and 22.5% in females), and often (10% and 10.8 % in males )(3.8% and 3.8%) respectively. Nausea while eating and difficulty in swallowing are reported less commonly overall with occasional occurrence. A

burning sensation in the chest and spicy and fatty food intake leading to stomach pain were reported often. A higher prevalence among males at 10% and 10.8% as compared to females at 3.8% and 3.8% respectively. However, there was no significant difference between males and females reporting gastrointestinal inflammation symptoms evidenced by a p-value > 0.05.

Under small intestine function, it was seen that pain under the left rib cage was reported occasionally (10% in males & 10.3% in females), and the vast majority reported never or rarely (80.8% in males & 71.8% in females). Similarly, delayed fullness and discomfort relieved by the passage of gas are most commonly reported as occurring occasionally (12.5 % & 15% in males ) (19.2% and 24.4%) respectively, while instances of specific food aggravating indigestion and changes in stool consistency occurring occasionally (16.7% and 15% in males) (28.2% and 25.6% in females respectively) and often (5.8% 5.8% in males and 5.1 & 5.1% in females respectively). Having three or more bowel movements daily, diarrhea, and bowel movements shortly after eating are reported as occasional occurrences (18.3%, 14.2% & 15% in males) (19.2%, 11.5%, and 19.2%) respectively. There was no significant difference between males and females reporting gastrointestinal symptoms evidenced by a p-value > 0.05.

Under colon function, it was seen that colon discomfort was predominantly reported as occasionally (12.5% in males & 15.4% in females). Similarly, constipation and rectal pain were reported as occurring occasionally (19.2% and 16.7% in males) (19.2% and 14.1% in females respectively) and often (5.8% & 5.8% in males) (7.7% and 3.8% in females respectively). Mucus in stool is reported occasionally (6.7% in males & 11.5% in females) and often (5% in males & 3.8% in females). Similarly, alternating between constipation and diarrhea are reported with similar frequencies across occasional and often occurrences. There was no significant difference between males and females reporting colon dysfunction symptoms evidenced by a p-value > 0.05.

A study conducted in Korea among nurses reported that postprandial fullness (27.7%), bloating (25.8%), abdominal pain (17.6%), diarrhea/constipation (26.6%), and abdominal pain (17.6%) were among the symptoms that respondents rated as "often" or "very often" [28].

Similar findings were observed in a study on gastrointestinal health in Turkey among nurses. 48.2 percent of the nurses reported having heartburn in the previous three months, 41.7% reported having diarrhea or constipation, 44.1% reported abdominal distention, 33.5% reported postprandial bloating, 25.9 percent reported dysphagia, 25.3 percent reported abdominal pain and fewer than three weekly defecations, 22.9 percent reported hard or lumpy defecation, 21.2% reported early feelings of satiety, 17.1 percent reported nausea, 14.7 percent reported having more than three defecations per day, 13.6 percent reported feeling an urgent urge to urinate, 11.7% reported profuse or watery defecation, 8.8 percent reported vomiting, 6.5 percent reported feeling of anal obstruction, and 5.3% reported fecal incontinence issues frequently or very frequently. It has been noted that individuals who switch to a fast-food diet frequently develop GI disorders. Depending on the intensity of service, it has been reported that nurses take up fast food, low-quality food, or irregular eating habits for a variety of reasons, including extended standing, shift work, an overwhelming workload, time constraints, challenging or complex tasks, insomnia, and insufficient rest breaks during shifts [29]. Similarly, IT professionals facing comparable challenges in their role may also have similar eating habit.

**Table 5 :** Mean Gastrointestinal Health Scores of the Study Participants according to Gender

| Mean Gastrointestinal Health Scores | Total (n = 198) | Gender | | t-value | p-value |
|---|---|---|---|---|---|
| | | Male (n = 120) | Female (n = 78) | | |
| Gastric Function | 5.42 (6.68) | 5.02 (6.01) | 6.04 (7.60) | -1.001 | 0.319 |

| | | | | | |
|---|---|---|---|---|---|
| GI Inflammation | 6.40 (8.96) | 6.73 (9.50) | 5.90 (8.09) | 0.663 | 0.508 |
| Small intestine function | 3.85 (6.76) | 4.03 (7.71) | 3.58 (4.99) | 0.506 | 0.614 |
| Colon function | 4.05 (7.81) | 4.22 (8.43) | 3.79 (6.79) | 0.388 | 0.699 |

Mean Value (Standard Deviation)

The mean gastrointestinal health scores across domains such as gastric function, GI inflammation, small intestine, and colon function were compared based on gender revealing no statistical differences. For gastric function, females showed a higher mean score of 6.04 as compared to males of 5.02 but the difference was not statistically significant (p-value = 0.319). Similarly, no statistically significant differences were observed between males and females in GI inflammation, small intestine and colon function with males and females exhibiting comparable mean scores across these domains (p-value > 0.05).

**Table 6 :** Classification of Sleep Quality in the study participants according to Gender

| Overall Sleep Quality | Total (N= 198) | Gender | | $\chi 2$ test | p-value |
|---|---|---|---|---|---|
| | | Male (n = 120) | Female (n = 78) | | |
| Good quality (<5) | 83 (41.9) | 47 (39.2) | 36 (46.2) | 0.948 | 0.330 |
| Poor quality (≥ 5) | 115 (58.1) | 73 (60.8) | 42 (53.8) | | |

*(Data represented in frequency and percentage)*

Table 6 represents the overall sleep quality measured using PSQI which is a widely used tool to assess sleep quality, with scores ranging from 0 to 21, where a score of less than 5 indicates good quality sleep, and a score of 5 and above indicates poor quality sleep. Of the total sample, (N = 198), the majority of participants reported poor quality sleep 115 participants (58.1%) of which 73 participants were male (60.8%) and 42 participants were female (53.8%), while 83 participants (41.9%) reported good quality sleep, males being n = 47 (39.2%) and females n = 36 (46.2%). The difference in sleep quality between males and females was not statistically significant as indicated by the p-value of 0.330. The proportion of individuals who reported poor sleep quality was slightly greater among males (60.8%) than females (53.8%). The increased proportion of poor sleep quality among study participants can be due to demands related to the job that include long hours, mental endurance, problem-solving skills, and positive work perceptions like job control and the significance of the respondents' own work in their lives [21].

Similar findings for sleep quality were observed in a study that evaluated sleep quality using the Pittsburgh sleep quality index among IT professionals. It reported that 70 % of the study participants experienced poor sleep quality, a proportion slightly higher than what was identified in our study as 58.1% but in a similar trend as reporting a higher percentage of poor sleep quality overall [30].

**Table 7 :** Association between Gastrointestinal Health and Dietary intake in Study Participants

| | **Gastrointestinal Health** | | |
|---|---|---|---|

| Nutrients | Low risk | Moderate risk | High risk | f- value | p-value |
|---|---|---|---|---|---|
| | **Gastric Function** | | | | |
| **Energy (Kcal)** | 1775 (217) | 1756 (261) | 1709 (309) | 1.093 | 0.337 |
| **Protein (g)** | 60.70 (14.89) | 59.44 (28.49) | 57.35 (16.46) | 0.512 | 0.600 |
| **Carbohydrate (g)** | 267.15 (36.03) | 266.14 (45.22) | 255.83 (46.08) | 1.267 | 0.284 |
| **Fat (g)** | 51.53 (10.05) | 50.51 (10.49) | 50.75 (11.78) | 0.177 | 0.838 |
| | **Gastrointestinal Inflammation** | | | | |
| **Energy (Kcal)** | 1776 (238) | 1610 (255) | 1763 (255) | 3.439 | **0.034*** |
| **Protein (g)** | 60.87 (14.84) | 46.27 (11.71) | 61.31 (24.50) | 5.155 | **0.007*** |
| **Carbohydrate (g)** | 266.83 (40.27) | 253.22 (40.34) | 263.18 (40.14) | 0.903 | 0.407 |
| **Fat (g)** | 51.66 (9.48) | 45.75 (11.07) | 51.72 (11.88) | 2.523 | 0.083 |
| | **Small Intestine Function** | | | | |
| **Energy (Kcal)** | 1764 (247) | 1725 (263) | 1716 (253) | 0.381 | 0.684 |
| **Protein (g)** | 60.33 (19.08) | 57.45 (15.86) | 54.60 (12.70) | 0.598 | 0.551 |
| **Carbohydrate (g)** | 264.67 (40.73) | 265.57 (36.12) | 259.87 (44.25) | 0.068 | 0.934 |
| **Fat (g)** | 51.59 (10.39) | 48.07 (11.35) | 50.89 (9.76) | 1.101 | 0.335 |
| | **Colon Function** | | | | |
| **Energy (Kcal)** | 1759 (237) | 1831 (304) | 1648 (251) | 2.683 | 0.071 |
| **Protein (g)** | 59.65 (18.97) | 64.95 (18.42) | 53.92 (11.96) | 1.730 | 0.180 |

| | | | | | |
|---|---|---|---|---|---|
| **Carbohydrate (g)** | 265.16 (39.47) | 268.37 (42.20) | 253.88 (45.33) | 0.714 | 0.491 |
| **Fat (g)** | 51.12 (10.20) | 46.29 (6.85) | 55.32 (13.21) | 3.673 | **0.027*** |

Mean (Standard deviation) *p<0.05

Table 7 illustrates the association between dietary intake and 4 domains of gastrointestinal health: gastric function, GI inflammation, small intestine, and colon function among study participants. ANOVA test was conducted to examine the association between gastrointestinal health and dietary intake. There were no statistically significant differences in energy (kcal), protein (g), carbohydrate (g), and fat intake (g) among individuals with different levels of gastric and small intestine function risk (low, moderate, and high) as evidenced by p-values > 0.05. Statistically significant differences were observed in energy and protein intake among participants with varying gastrointestinal inflammation risks as evidenced by p-values of 0.034 and 0.007 respectively. Study participants with moderate GI inflammation risk had significantly lower energy and protein intake as compared to those with low GI inflammation risk. No significant differences were observed in carbohydrate and fat intake among participants with different levels of GI inflammation risk. There was a statistically significant difference in fat intake among participants with different levels of colon function risk as evidenced by a p-value of 0.027. No significant differences were observed in energy, protein, and carbohydrate intake among participants with different levels of colon function risk.

In contrast to our findings, a study conducted in Iran among adults to assess the association between dietary macronutrient intake and uninvestigated dyspepsia reported that individuals with uninvestigated dyspepsia had a significantly lower intake of carbohydrates and a significantly higher intake of fats as compared to those without uninvestigated dyspepsia [31].

**Table 8 :** Association between gastrointestinal health and sleep quality in Study Participants

| **Sleep Quality** | **Gastrointestinal Health** | | | **Total** | **χ2 value** | **p-value** |
|---|---|---|---|---|---|---|
| | **Low risk** | **Moderate risk** | **High risk** | | | |
| | **Gastric Function** | | | | | |
| **Good Quality** | 62 (52.5) | 11 (28.9) | 10 (23.8) | 83 (41.9) | 13.753 | **0.001*** |
| **Poor quality** | 56 (47.5) | 27 (71.1) | 32 (76.2) | 115 (58.1) | | |
| | **Gastrointestinal Inflammation** | | | | | |
| **Good Quality** | 64 (52.9) | 8 (47.1) | 11 (18.3) | 83 (41.9) | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Poor quality** | 57 (47.1) | 9 (52.9) | 49 (81.7) | 115 (58.1) | 19.878 | **0.000*** |
| | **Small Intestine & Pancreas Function** | | | | | |
| **Good Quality** | 76 (45.5) | 5 (22.7) | 2 (22.2) | 83 (41.9) | 5.646 | 0.059 |
| **Poor quality** | 91 (54.5) | 17 (77.3) | 7 (77.8) | 115 (58.1) | | |
| | **Colon Function** | | | | | |
| **Good Quality** | 74 (46.5) | 7 (31.8) | 2 (11.8) | 83 (41.9) | 8.666 | **0.013*** |
| **Poor quality** | 85 (53.5) | 15 (68.2) | 15 (88.2) | 115 (58.1) | | |

Mean (Standard deviation) *p<0.05

Table 8 illustrates the association between sleep quality and 4 domains of gastrointestinal health: gastric function, GI inflammation, small intestine, and colon function among study participants. Chi-square tests examined the association between gastrointestinal health and sleep quality. Gastric function, GI inflammation, and colon function had a statistically significant association with sleep quality as evidenced by p-values of 0.001, 0.000, and 0.013 respectively. Study participants with poor sleep quality had a moderate to high risk of gastrointestinal inflammation, and gastric and colon dysfunction than those with good sleep quality. The small intestine function did not have a statistically significant association with sleep quality as evidenced by a p-value of 0.059.

A study conducted in Turkey among patients diagnosed with gastritis reported that compared to individuals with good sleep quality, those with poor sleep quality had a 6.935 times higher prevalence of gastritis [32].

Consistent with our findings, a study conducted in Korea demonstrated that sleep disruptions and poor sleep quality were associated with digestive symptoms (abdominal pain, acid regurgitation, abdominal distension and eructation) among 40 to 60 year old adults [33].

Similar associations between gastrointestinal health and sleep quality were seen in a cross-sectional study conducted among midwives in China. They observed a bi-directional association between sleep quality and gut health among midwives. The gut-brain axis theory postulates a two-way communication between the gut and brain. The study found that midwives experiencing gut health issues were more likely to suffer from poor sleep quality and vice-versa. The production of sleep-regulating compounds such as neurotransmitters like serotonin produced by the gut plays a crucial role in regulating sleep. In addition, gut health is closely linked to the immune system and inflammation. Chronic inflammation in the gut can trigger a systemic inflammatory response that is associated with the development of sleep disorders. Inflammatory molecules can interfere with the sleep-wake cycle and disrupt the circadian rhythm, leading to poor sleep quality. Moreover, disruptions in gut health can manifest as abdominal discomfort and pain, which can further exacerbate difficulties in falling and staying asleep [34].

## 4. CONCLUSION

This study revealed that poor sleep quality and inadequate nutritional intake are associated with increased gastrointestinal health risk. Gastric and colon function are significantly associated with sleep quality. Gastrointestinal inflammation is significantly associated with sleep quality and dietary intake. The majority of participants reported poor sleep quality with no statistically significant difference between the male and female

participants. Further research is needed to identify the underlying mechanisms and potential interventions to improve the overall health and well-being of IT professionals.

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