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Dietary and Physical Activity Factors Concerning Bowel Movement Frequency among Undergraduate Students during Covid-19 Pandemic

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Abstract

This study explored the association between lifestyle and bowel movement frequency among students. A cross-sectional study was employed using a structured questionnaire that was administered via an online platform. A total of 363 participants were involved in this study, where 77.4% (n=281) were female while 72.2% (n=262) of them did not experience constipation. Further investigation found that calories, dietary fibre, drink consumption, and physical activity level were associated with bowel movement frequency. This study showed that a good nutrient intake and adequate physical activity would improve bowel movement frequency even though restricted movement due to the COVID-19 pandemic.

Keywords: bowel movement; dietary intake; physical activity; COVID-19

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1.0 Introduction

In December 2019, pneumonia caused by a novel coronavirus (2019-nCoV) was reported in Wuhan, China (Zhu et al., 2020). The number of cases rapidly grew, and the World Health Organization proclaimed a COVID-19 pandemic on 11 March 2020 (WHO, 2020). Since then, human health has been significantly impacted by the COVID-19 outbreak, resulting in lifestyle changes such as social isolation at home, physical inactivity, weight gain, behavioural addiction problems, inadequate sunshine exposure, social withdrawal in public, and buying modifications (Di Renzo et al., 2020; Lippi & Plebani, 2020).

Constipation is characterised by a decrease in faeces frequency, often three or fewer times per week. It is known to be brought on by insufficient dietary fibre intake (Forootan et al., 2018) and sedentary behaviour, which both increased during the pandemic. Canello et al. (2020) found that during the lockdown, 50% and 18% of the total group reported reduced physical activity hours and becoming inactive, respectively. On the other hand, 27% of the 218 subjects who were sedentary before the installation of restrictive measures (inactive) began exercising. WHO recommends at least 150 minutes of moderate physical activity and 75 minutes of strenuous physical activity weekly. According to Abd Rahman (2020), consumers have encountered several obstacles when attempting to enter a food store or

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supermarket. As a result, people's daily consumption of fresh foods such as fruits, vegetables, and raw meals tends to drop. Constipation has been linked to a lack of fibre in the diet. Thus, this study aimed to i) determine the dietary intake, physical activity level, and bowel movement frequency, and ii) to identify the association between dietary intake and physical activity level to bowel movement frequency among undergraduate students.

2.0 Literature Review

2.1 Bowel movement frequency

Constipation is a gastrointestinal condition primarily characterised by symptoms (Patimah et al., 2017) and frequently refers to the experience of poorly bowel movement (Rao & Go, 2010). When assessing constipation, it is crucial to define regular bowel habits. A stool frequency of 3 to 21 times per week is considered normal in the Western population (Heaton et al., 1992). This was the basis for a prior frequency-based definition of constipation, which said that a stool frequency of fewer than three times per week was considered constipation. This definition, however, may not be universally applicable in other parts of the world, including Asia, as several studies have demonstrated that the frequency of defecation is higher in several Asian groups. For example, the study by Fang, Lu, & Pan (2001) on the Chinese population in Beijing indicated that the mean frequency of stooling is higher (7.09/week). The prevalence of constipation among university students was 5.45% among college and university students in North China (Dong et al., 2013). According to Ilyas et al. (2020), in a cross-sectional survey conducted in Karachi, Pakistan, the prevalence of medical university students was 36.3%.

2.2 Factors that influence bowel movement frequency

Numerous causes and associated factors are generally related to bowel movements. Age, gender, socioeconomic status, body mass index (BMI), smoking, dietary intake, and physical activity are positively associated with low frequent bowel movements (World Gastroenterology Organisation Global Guidelines constipation-a global perspective, 2012).

The study by Mazlyn et al. (2013) revealed weak, positive correlations between defecation frequency and dietary fibre intake. Another study also reported the same result, the respondents who consumed vegetables more than three spoons per day had a lower prevalence of constipation compared to participants with less vegetable intake (Verkuijl et al., 2020). However, even though a high fibre intake could help manage mild to moderate constipation, it is not always beneficial to people with severe constipation (Watanabe et al., 2004). Another study also reported a similar result where a high fibre intake is positively associated with a weekly number of bowel movements for both genders (Sanjoaquin et al., 2003). Based on the meta-analysis (Yang et al., 2012) and a large-population case-control study (Roma et al., 1999), the researcher discovered that a high fibre diet could enhance stool frequency in constipated individuals and independently negatively associated with the prevalence of constipation.

A study done by Sanjoaquin et al. (2003) found that physical activity was positively associated with bowel movements frequency for both genders ($P < 0.001$). On the contrary, a study by Mazlyn et al. (2013) found that the defecation frequency was not associated with physical activity levels ($P = 0.181$, $P > 0.05$). Therefore, physical activity is frequently advocated as a first-line treatment. However, there is little evidence of its effectiveness (Johanson & Kralstein, 2007).

3.0 Methodology

This study was conducted using a cross-sectional method. The data was collected using a structured questionnaire consisting of three parts which are Section A (sociodemographic characteristics), Section B (Food Frequency Questionnaire, FFQ), and Section C (International Physical Activity Questionnaire, IPAQ) which was administered via an online platform. The data in Section A include gender, race, age, department of study, self-reported weight, self-reported height, and bowel movement frequency. Section B of a validated FFQ measures the respondent's frequency of dietary intake for the past 12 months. FFQ consists of 164 foods with 14 categories. This FFQ consists of 3 consumption frequencies: daily, weekly, and monthly. The participants were needed to put the total serving each time the foods were consumed. The standard serving size was provided for each food listed in the FFQ. The daily energy and other nutrient intake were calculated from FFQ. IPAQ in Section C measures the respondent's physical activity in the last seven days. IPAQ consists of seven questions that measure the types and intensity of physical activity and sitting time (Lee et al., 2011).

Full-time undergraduate students aged eighteen to twenty-eight were selected. In contrast, for students who had chronic diseases; on any products, supplements, or medication that is known can influence bowel movements; the presence of red flag signs for bowel habits such as unexplained weight loss; rectal bleeding; diagnosis with IBS; family history of colorectal cancer or ovarian cancer; underlying previous abdominal or pelvic surgery; and women that had obstetric history were excluded from this study.

Convenience sampling was employed for potential respondents available to participate in this study in January 2022. Krecjic & Morgan's (1970) method with a 95% confidence level and a 5% margin of error was used to calculate the minimum sample size of 363 participants among the Faculty of Business and Management undergraduate students. Descriptive analysis was deployed to determine the bowel movement frequency, dietary intake, and physical activity level. An Independent t-test was used to dictate the significant difference in mean value between male and female participants for BMI, fibre intake, water consumption, and physical activity score. The Chi-square test was used to identify the association between bowel movement with dietary intake and physical activity level. This study obtained ethical clearance from the Research Ethics Committee (REC) Universiti Teknologi MARA with reference number REC/12/2021 (UG/MR/1122).

4.0 Findings

4.1 Demographic characteristics of participants

Table 1. Demographic background of the participants (n=363)

Variables	n (%)	Mean ± SD
Gender		
Male	82 (22.6%)	
Female	281 (77.4%)	
Race		
Malay	334 (92.0%)	
Sabah Bumiputera	11 (3.0%)	
Sarawak Bumiputera	18 (5.0%)	
Age, years		22.3 ± 0.6
Department		
DEFS	94 (25.9%)	
DEMS	75 (20.7%)	
DIBMS	105 (28.9%)	
DTSCMS	89 (24.5%)	

*DEFS: Department of Economics and Financial Studies; DEMS: Department of Entrepreneurship and Marketing Studies; DIBMS: Department of International Business and Management Studies; DTSCMS: Department of Technology and Supply Chain Management Studies.

Table 1. shows the sociodemographic background of the participants, who are undergraduate students from the Faculty of Business and Management at UiTM Puncak Alam. A total of 363 participants fulfilled the inclusion and exclusion criteria and were involved in this study, where 22.6% were male, and 77.4% were female. Most of them were Malays, followed by Sarawak Bumiputera and Sabah Bumiputera with 94.0%, 5.0% and 3.0% respectively. The mean age of these undergraduate students was 22.3 ± 0.6 years old and ranged from 20 to 26 years old. The participants varied from 20.7 to 28.9% out of four different departments.

4.2 Anthropometric measurements and smoking status of participants

Table 2. Anthropometric measurements of the respondents

Variables	Male (Mean ± SD)	Female (Mean ± SD)	Total (Mean ± SD)	p-value	Percentage
Height, m	1.66 ± 0.06	1.62 ± 0.06	1.63 ± 0.06		
Weight, kg	64.77 ± 12.44	60.29 ± 11.42	61.30 ± 11.79		
BMI, kgm ⁻²	23.59 ± 4.54	22.75 ± 4.28	22.94 ± 4.35	0.04 ^a	
BMI category	Male, n	Female, n	Total, n		
Underweight (< 18.5 kgm ⁻²)	2	22	24		6.6%
Normal (18.5 – 24.9 kgm ⁻²)	56	197	253		69.7%
Overweight (25.0 – 29.9 kgm ⁻²)	17	37	54		14.9%
Obesity Class I (30.0 – 34.9 kgm ⁻²)	3	23	26		7.2%
Obesity Class II (35.0 – 39.9 kgm ⁻²)	4	2	6		1.6%

^aIndependent t-test, statistically significant at p<0.05

The classification of the weight status of the participants is displayed in Table 2. The mean BMI was statistically significantly higher in males than females. It was found that most participants had normal BMI status (69.7%). However, 23.7% of them were overweight and obese, while 6.6% of them were underweight.

4.3 Dietary intake and physical activity level of participants

Table 3. Dietary intake, physical activity level and cigarette smoking status of the respondents

Variables	Male	Female	Total	p-value	Percentage
Energy, kcal/day	2334.50 ± 488.28	2082.74 ± 467.24	2139.61 ± 483.04		
Classification, n					
Low (less than 80%)	7	16	23		6.3%
Adequate (80 to 120%)	61	175	236		65.0%
Excessive (more than 120%)	14	90	104		28.7%
Protein, g/day	109.83 ± 21.93	102.49 ± 20.84	104.14 ± 21.29		
Classification, n					

Low (less than 10% TEI)	64	279	343	94.5%
Adequate (10 to 20% TEI)	18	2	20	5.5%
Carbohydrate, g/day	326.48 ± 72.28	283.16 ± 73.35	292.90 ± 75.20	
Classification, n				
Low (less than 50% TEI)	28	12	40	11.0%
Adequate (50 to 65% TEI)	53	267	320	88.2%
Excessive (More than 65% TEI)	1	2	3	0.8%
Fat, g/day	62.67 ± 17.02	57.53 ± 14.37	58.70 ± 15.10	
Classification, n				
Adequate (25 to 30% TEI)	16	5	21	5.8%
Excessive (more than 30% TEI)	66	276	342	94.2%
Fibre, g/day	7.26 ± 6.45	7.04 ± 6.38	7.10 ± 6.40	0.22
Classification, n				
Low (less than 20g)	75	251	326	89.8%
Adequate (more than 20g)	7	30	37	10.2%
Water, ml/day	1487.80 ± 582.21	1462.63 ± 554.25	1475.70 ± 566.21	0.81
Classification, n				
Low (less than 1,500ml)	61	100	161	44.4%
Adequate (more than 1,500ml)	21	181	202	55.6%
Physical activity, MET-min/week	1022.20 ± 907.25	797.66 ± 641.44	848.38 ± 715.03	0.03 ^a
Physical activity category				
Inactive (less than 600 MET-min/week)	68	112	180	49.6%
Minimally active (600 to 1,500 MET-min/week)	9	150	159	43.8%
HEPA active (more than 1,500 MET-min/week)	5	19	24	6.6%

*TEI: Total daily energy intake; MET: Metabolic equivalent of task; HEPA: Health enhancing physical activity

^aIndependent t-test, statistically significant at p<0.05

Table 3. presents the participants' dietary intake and physical activity status. It shows that the intake of energy, carbohydrates, protein, and fat was higher in males than females. In addition, 65.0% of the participants took adequate energy (80 to 120% of energy requirement) while 6.3% and 28.7% took less and excessive than their requirements, respectively.

The adequacy of macronutrients was determined based on the average macronutrient distribution range (AMRD). For protein, the adequate range is between 10 to 20% of the total energy requirement. It was found that most of the participants consumed inadequate protein in their diet. The AMRD for carbohydrates is 55 to 60%. 88.2% of the participants had adequate carbohydrates in their diet, while 11.0% consumed low carbohydrates and 0.8% took in excess. The AMRD for fat is 25 to 30%. Most participants took excessive fat in their diet with 94.2% of them.

For dietary fibre intake, males and females took less fibre than the requirement, with a total mean intake of 7.10 ± 6.40 g/day. Barely 10.2% of the participants consumed fibre more than the recommendation of 20.0 g/day. It is recommended to take water more than 1,500 ml each day. More than half (55.6%) of the participants achieved this requirement.

Meanwhile, it was found that males were significantly more active in physical activity levels compared to females. Overall, only 6.6% of the participants were categorised as physically active. Half (49.6%) of the participants were inactive, and 43.8% were minimally active.

4.4 Bowel movement frequency of participants

Table 4. Bowel movement frequency of the respondents

Variables	Male	Female	Total	p value	percentage
Bowel movement frequency, time(s)/week	4.68 ± 2.27	4.67 ± 2.44	4.67 ± 2.40	0.95	
Category, n					
Constipation (less than 3 times per week)	22	79	101		27.8%
Normal (3 and more times per week)	60	202	262		72.2%

The bowel movement frequency of the participants is shown in Table 4. The mean frequency was 4.67 ± 2.40. However, the mean frequency between gender was not shown as any statistically significant difference. From the definition of healthy bowel movement, most (72.2%) participants had normal bowel movement frequency, while 27.8% experienced constipation.

4.5 Association of dietary intake and physical activity level to bowel movement frequency

Table 5. Association of bowel movement frequency association to dietary intake and physical activity

Variable	Bowel movement frequency		X ² statistic	p-value
	< 3 times/week n (%)	> 3 times/week n (%)		
Energy intake				
Less than 80%	6 (26.1%)	17 (73.9%)	30.292	0.00
80 to 120%	45 (19.1%)	191 (80.9%)		
More than 120%	50 (48.1%)	54 (51.9%)		
Fibre intake				
Less than 20g	97 (29.8%)	229 (70.2%)	5.938	0.015
More than 20g	4 (10.8%)	33 (26.7%)		
Water intake				
Less than 1,500ml	78 (48.4%)	83 (51.6%)	61.277	0.00
More than 1,500ml	23 (11.4%)	179 (88.6%)		
Physical activity level				
Inactive	69 (38.3%)	111 (61.7%)	19.982	0.00
Minimally active	29 (18.2%)	130 (81.8%)		
HEPA active	3 (12.5%)	21 (87.5%)		

^bChi-Square Test

The Chi-square test was deployed to investigate the association between bowel movement with dietary intake and physical activity level. Table 5. depicts the findings. Energy intake ($p=0.00$), fibre intake ($p=0.015$), water intake ($p=0.00$), and physical activity level ($p=0.00$) had a significant association with bowel movement frequency.

5.0 Discussion

5.1 Prevalence of constipation

Many factors contribute to constipation. The prevalence of constipation in the general adult population ranges from 2.5% to 79.0% (Mugie et al., 2011). According to Schuster et al. (2015), constipation is a highly prevalent issue among older adults and the elderly. Constipation was a concern among tertiary education students (16.2%) in a study conducted by Lim et al. (2016). In this study, 27.8% of participants reported having bowel movements less than three times weekly. This finding was consistent with other studies that reported the prevalence of constipation among university students, ranging from 5.45% (Dong et al., 2013) to 36.3% (Ilyas et al., 2020).

5.2 Association of dietary intake and bowel movement frequency

In this study, only 65.5% of the participants achieved the acceptable range of energy intake for younger adults, 80 to 120% of total energy intake. However, a cross-sectional study by Mazlyn et al. (2013) reported that more than half of Malaysian undergraduate students did not achieve the energy intake recommendation by RNI 2017. They also found that just 12.2% of Malaysian adults aged 18 to 60 years old achieved the RNI for total energy consumption. A study by Yusop et al. (2021) also reported that only 8.9% of females and 10.3% of males from undergraduate achieved the recommended energy intake. Following a meal, the gastrocolic response is a physiological reflex that regulates the motility of the lower gastrointestinal tract. The colon's motility will increase in reaction to the stomach stretching caused by food ingestion. The gastrocolic reflex allows more food consumption by regulating peristalsis and transport of ingested food distally towards the rectum. Therefore, colon motility will decrease due to reduced food intake (Malone & Thavamani, 2020).

The mean daily dietary fibre consumption among the participants in this study was 7.10 ± 6.40 g/day, and nearly all (89.8%) consumed less than 20.0 g/day of dietary fibre. The findings were similar to prior studies investigating the Malaysians' fibre intake. In a previous study, adults aged 22 to 60 in Malaysia consumed lower dietary fibre (10.0 to 15.6 g) than the recommendation (Wai Ng et al., 2016). The study conducted by Yusop et al. (2021) also found that the mean dietary fibre intake among the UPM undergraduate students was 5.6 ± 3.5 g/day, and none met the minimum daily requirements of dietary fibre intake (20 g/day). This study showed a significant association ($p=0.015$) between dietary fibre intake and bowel movement frequency. Alternatively, lower dietary fibre intake contributed to infrequent bowel movements. Khatri et al. (2011) also found a negative correlation between dietary fibre consumption and constipation among adolescents, adults, and the elderly in Malaysia. In other words, the more dietary fibre consumed, the less likely to become constipated. Dietary fibre is composed of non-digestible carbohydrates and is well-known as the main component for influencing bowel movements. The microbiota in the colon converts specific fibres (the fermentable portion) into short-chain fatty acids (SCFAs), which help colonic epithelial cells function correctly. In addition, some fibres can function as prebiotics, promoting the growth of beneficial bacteria in the gut and decreasing bowel transit time. Therefore, higher dietary fibre intake can minimise the risk of constipation by increasing faecal bulk, defecation frequency, and stool consistency and reducing faecal material transit time through the large intestines.

The recommendation of fluid intake according to Malaysian Dietary Guidelines 2020 for males and females aged 19 to 29 years is 1500 – 2000 ml/day (6 to 8 glasses/day). In this study, most participants (55.6%) met the recommendation for water intake. This finding was similar to a study by Khatri et al. (2011), which reported a negative correlation between total fluid intake and constipation. In other words, the more water intake, the less likely to become constipated. This is because appropriate fluid intake can help the dietary fibre to increase stool weight and soften stools.

5.3 Association of dietary intake and bowel movement frequency

According to the IPAQ score for physical activity level, physically active is classified when the MET-min/week score is more than 1500 MET-min/week. This study found that most participants (49.6%) practice an inactive lifestyle while only 6.6% are physically active. This finding is similar to the study by Yusop et al. (2021), where 60.7% of undergraduate students practice low to moderate physical activity. Chronic constipation has been proven to be considerably reduced by regular physical activity (Chang et al., 2010). According to a systematic review by Pare et al. (2001), gastrointestinal disorders can be avoided by engaging in frequent low-intensity physical activity. In other words, the higher the physical activity level, the higher the number of bowel movements per week. This previous finding is similar to this study, where there is a significant association between physical activity and bowel movement frequency ($p=0.00$).

6.0 Conclusion & Recommendations

In conclusion, the present study showed the prevalence of constipation and adequacy of nutrient intake among undergraduate students. The findings highlight that nutrient intake and physical activity are associated with bowel movement frequency during restricted movement orders due to the COVID-19 pandemic.

The cross-sectional method conducted in this study is a strength as it allows to reach more participants. However, it could not demonstrate the cause and effect of the studied variable. Furthermore, if the data collection was conducted via face-to-face interviews, the anthropometric data can be measured directly rather than self-reported by the participants. In addition, more surveys could be conducted involving multiple higher learning institutions and multiracial participants.

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Paper Contribution to Related Field of Study

This study provides additional data on the prevalence of constipation and nutritional status among university students. It could help health-related agencies, government ministries, and other stakeholders to develop educational, promotion, prevention, and treatment programs to improve human behaviour towards lifestyle.

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