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RELATIONSHIP BETWEEN BREAKFAST AND FAST- FOOD CONSUMPTION ON BODY MASS INDEX AMONG SECONDARY SCHOOL STUDENTS IN PENANG

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Abstract:

Overweight and obesity among adolescents have become an increasing public health concern globally, including in Malaysia, where unhealthy dietary behaviors may contribute to abnormal body mass index (BMI). Although previous studies have investigated dietary habits and obesity separately, evidence on the combined association between breakfast consumption, fast-food intake and BMI among Malaysian adolescents, particularly in northern Malaysian, remain limited. Therefore, this study aimed to examine the relationship between breakfast consumption, fast-food intake, and BMI among secondary school students in Penang, Malaysia. A cross-sectional study was conducted at Sekolah Menengah Kebangsaan Dato' Haji Ahmad Said involving 202 adolescents aged 13 to 16 years selected using convenience sampling. Data were collected through a structured questionnaire assessing dietary behaviours, particularly breakfast consumption and fast-food preference, along with anthropometric measurements to determine BMI. Data analysis was

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performed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarise participant characteristics and chi-square tests were performed to examine the associations between dietary behaviors and BMI. The findings indicated that the largest proportion of respondents were underweight (42.1%), followed by normal weight (26.2%), obese class I (18.3%), obese class II (7.4%), and overweight (5.9%) respectively. A statistically significant association was observed between BMI and breakfast consumption ($p = 0.030$), indicating the breakfast-skipping behavior was associated with higher BMI categories. A significant association was also found between BMI and fast-food preference ($p = 0.029$), indicating that higher BMI categories were associated with greater fast-food consumption. These findings provide local evidence on dietary behaviors associated with BMI among Malaysian adolescents and support the development of school-based nutrition interventions that promote regular breakfast consumption and healthier food choices.

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Keyword:

Adolescents, Body Mass Index, Breakfast Consumption, Dietary Behavior, Fast-Food Intake



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Introduction

Overweight and obesity present significant global public health challenges, with documented increases in prevalence across all age groups, including adolescents, over the past four decades (Bharuddin & Fazlen, 2020). In Malaysia, the prevalence of overweight adolescents significantly increased from 9.5% to 19.6% between 1997 and 2007, with a consistent yearly 1% rise in the number of overweight students, leading to potential obesity-related health complications (Vaidehi, Shashikala & Kandiah, 2020). Given the prevalence of overweight and obesity among adolescents in Malaysia has nearly doubled in less than a decade, there is an urgent need to implement targeted interventions to retard this upward trend (Naina-Mohamed et al., 2022).

Efforts to address unhealthy eating behaviors among adolescents also align with United Nations Sustainable Development Goals (SDGs), which are SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being). SDG 2 aims to diminish all forms of malnutrition, whereas SDG 3 encourages healthy lifestyles together with the prevention of non-communicable diseases through comprehensive public health interventions. So, with regard to these factors, the main components of dietary behaviors that are directly linked with overall BMI and nutritional status are breakfast consumption and fast-food intake (Mohammadi et al., 2020).

“Breakfast like a king” is a famous quote among Malaysian population to emphasize the most important meal of the day that perhaps provides complete nutritional meals to start a day that, in return, provides enough nutrients for growth and development of nutrient-demanding adolescents. Even so, a high prevalence among Malaysian adolescents is reported, with up to 70% skipping breakfast at least once a week. This unhealthy dietary behavior can lead to higher BMI among their age group (Lai et al., 2022; Mohammadi et al., 2020; Mustafa et al., 2019). Furthermore, the frequent and excessive consumption of fast food that is classified as higher calorie but low nutritional value further adversely affects diet quality, which later leads to higher body weight and chronic disease among secondary school students (Man et al., 2021). Nevertheless, skipping breakfast and consuming fast-food are modifiable risk factors contributing to abnormal BMI and they represent key targets for intervention in curbing obesity.

Despite a growing body of evidence linking BMI to eating behaviors, research findings remain inconsistent and inconclusive, particularly in the Malaysian multi-ethnic and multicultural nation, due to variation in dietary practices, socioeconomic and cultural influences. Furthermore, limited evidence is available from Malaysian secondary school students, particularly those residing in northern Malaysia, where dietary patterns may differ from other regions. Local data are therefore essential to better understand this rising issue. Therefore, this study aimed to examine the relationship between breakfast consumption, fast-food preference and BMI among secondary school students in Penang, Malaysia.

Literature Review

Adolescence and Obesity

Adolescence represents a critical developmental period during which dietary patterns and lifestyle choices are established, significantly influencing long-term health outcomes (Al-Haroni, Farid, & Azanan, 2025). This period is characterized by substantial physiological and psychological changes, making adolescents particularly vulnerable to the double burden of malnutrition, encompassing both undernutrition and the rising prevalence of overweight and obesity (Lai et al., 2024). In Malaysia, this trend is particularly concerning, with studies reporting a significant increase in the prevalence of obesity among adolescents, making it the second highest in Southeast Asia (Mohammadi et al., 2019). The situation is further exacerbated by the shift in diet towards an energy-dense food formulation popularized by Western countries, which are high in fat and sugar, combined with low daily physical activity levels (Mohamad et al., 2021; Mohammadi et al., 2019).

The National Health and Morbidity Survey 2015 highlighted that 14.4% of Malaysian adolescents aged 10–14 years and 9.6% of those aged 15–19 years were obese (Ishak et al., 2020), while late-adolescence BMI in Malaysia showed a noteworthy rise of over 3 kg/m² in both genders between 1985 and 2019 (Lai et al., 2024). Despite the documented high nutritional requirements for this age group, global dietary trends among adolescents frequently involve energy-dense, ultra-processed foods, often high in salt, refined sugar, and unhealthy fats, coupled with breakfast skipping and frequent fast-food consumption, while intake of fruits and vegetables remains moderate to low (Demmler et al., 2023). This pattern of unhealthy food consumption in adolescence is associated with increased rates of overweight and obesity, impacting both immediate and long-term health, and contributing to a higher risk of non-communicable diseases later in life (Zahrah, Fanani & Ardyanto, 2023).

Breakfast Consumption and Fast-food Intake

Breakfast is widely recognised as one of the most important daily meals because it provides essential nutrients required for normal physical growth, cognitive performance, and academic achievement among adolescents (Hällström et al., 2012). Several studies have demonstrated that regular breakfast consumption is associated with healthier dietary patterns and more favourable BMI outcomes, whereas breakfast skipping has been linked to overweight and obesity (Mohammadi et al., 2020; Lai et al., 2022). Nevertheless, some researchers have reported inconsistent findings, suggesting that breakfast skipping alone may not directly influence BMI after accounting for total daily energy intake and other lifestyle factors (Bonnet et al., 2020). These inconsistent findings indicate that the relationship between breakfast consumption and BMI remains inconclusive and warrants further investigation.

Even more concerning is that fast food consumption has become a habit and a routine among teenagers. Moreover, fast food is readily available, inexpensive, and convenient to eat. While fast food, which is high in sodium, fat, refined carbohydrates, and added sugar, may be filling, it has relatively very low nutritional value. (Bauer et al., 2008; Reichelt, 2016; Man et al., 2021). Plenty of studies have reported that uncontrollable fast-food intake is associated with increased obesity risk among adolescents. Nevertheless, numerous factors influence dietary habits, including family background, environment, economic status, and cultural and beliefs, which further lead to variations in findings across different populations (Moreno et al., 2010). Therefore, examining these dietary behaviors within the Malaysian context remains important.

Asian Body Mass Index (BMI) Classification

Body Mass Index (BMI) is an index used to determine normal anthropometric body size and is utilized worldwide in clinical settings and research fields. It was first introduced in 1832 by a Belgian statistician (Pray & Riskin, 2023); however, due to geographical and physiological differences, the World Health Organization (WHO) introduced a BMI classification specific to Asian populations that differs from that for Caucasians (Table 1). Adapting these BMI classification variations takes into account differences in body composition and disease risk thresholds specific to Asian populations (Mahmudiono et al., 2022). Such classification distinctions are crucial for accurately assessing and drawing conclusions regarding the growing adolescent population in Asia, specifically Malaysia. (Lai et al., 2024).

Table 1: Asian BMI Classification

BMI (kg/m²)	Classification
<18.5	Underweight
18.5-22.9	Normal
23.0-24.9	Overweight
25.0-29.9	Obese Class I
>30.0	Obese Class II

Methodology

Study Design

This study was conducted at government secondary school which is Sekolah Menengah Kebangsaan (SMK) Dato' Haji Ahmad Said, Penang, Malaysia, with a total of 202 participants aged 13-16 years recruited via convenience sampling and included in this study. A cross-sectional research design was used to examine the relationship between breakfast consumption, fast-food intake and BMI among secondary school adolescents. All selected participants enrolled in this study had obtained written consent from parents or guardians and teachers. Their participation was voluntary. Participants with incomplete questionnaire responses and incomplete anthropometric data were excluded.

In terms of data collection, the questionnaires were structured and designed to gather information on dietary practices, specifically on breakfast and fast-food consumption, with a section on anthropometric measurement to determine BMI (Said et al., 2025). Data on body weight and height were self-reported by the students. Due to limited time allocation, the class teacher also assisted in terms of anthropometric data to ensure accurate recording. BMI is calculated by dividing weight in kilograms by height in meters squared. Participants were classified as underweight ($<18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}22.9 \text{ kg/m}^2$), overweight ($23.0\text{--}24.9 \text{ kg/m}^2$), obese class I ($25.0\text{--}29.9 \text{ kg/m}^2$), and obese class II ($\geq 30.0 \text{ kg/m}^2$) according to the World Health Organization (WHO) Asian BMI classification.

Data Analysis

All the collected data were keyed in and analyzed using SPSS statistical tool (IBM Corp., Armonk, NY, USA) for Windows. Participants' demographic data and BMI classifications were presented in frequencies and percentages, whereas the Chi-square test was run to investigate the association between breakfast and fast-food consumption with BMI. The test was considered statistically significant if the p-value was less than 0.05.

Results

Descriptive Analysis

Overall, 202 adolescents included in this study comprised of 139 females (68.8%) and 63 males (31.2%). As presented in Table 2, the largest distribution of BMI categories is underweight, with 85 participants (42.1%), followed by normal weight ($n=53$, 26.2%). The overweight category has the lowest proportion, with 12 participants (5.9%). The obese class I and II accounted for 18.3% ($n = 37$) and 7.4% ($n = 15$), respectively.

Table 2: Distribution of BMI Categories (N=202)

BMI Category	Frequency (n)	Percentage (%)
Underweight	85	42.1
Normal	53	26.2
Overweight	12	5.9
Obese Class I	37	18.3
Obese Class II	15	7.4

Relationship between Breakfast Consumption and BMI

A statistically significant association was identified between breakfast consumption and BMI category ($p = 0.030$), with a Cramer's V of 0.230, indicating a small-to-moderate association. Among participants who reported skipping breakfast ($n = 124$), the highest proportion was observed in the underweight group with 43 individuals (34.6%), followed by the normal BMI group with 35 individuals (28.2%). Additionally, 28 participants (22.6%) in the obese class I category and 12 individuals (9.7%) in the obese class II group also did not consume breakfast, respectively.

Similarly, among participants who reported having breakfast ($n = 78$), the majority were underweight (53.8%, $n = 42$), followed by those with normal BMI (23.1%, $n = 18$). Smaller proportions were observed among overweight (7.7%, $n = 6$), obese class I (11.5%, $n = 9$), and obese class II participants (3.8%, $n = 3$), respectively. The findings indicate that breakfast consumption patterns vary according to BMI category, but the difference is particularly evident between obese adolescents who skip breakfast than those who do not. Overall, the significant chi-square result indicates that breakfast consumption behavior is associated with BMI status among the adolescents in this study.

Table 3: Relationship between Breakfast Consumption and BMI

Variable	Skipped breakfast ($n=124$)(%)	Having breakfast ($n=78$)(%)	Chi-square statistic (df)	p -value
BMI Categories				
Underweight	43 (34.6)	42 (53.8)	10.701 (4)	0.030
Normal	35 (28.2)	18 (23.1)		
Overweight	6 (4.8)	6 (7.7)		
Obese Class I	28 (22.6)	9 (11.5)		
Obese Class II	12 (9.7)	3 (3.8)		

Relationship between BMI and Fast-food Consumption

The chi-square analysis also demonstrated a statistically significant association between BMI category and fast-food consumption ($p = 0.029$). The Cramer's V value of 0.206 indicated a small association between the variables. As presented in Table 4, the vast majority of the participants were observed in the underweight group, accounting for 85 participants (42.5%), followed by those with normal BMI with 53 participants (26.5%). Participants classified within the obese class I category comprised of 36 individuals (18.0%), while those in the obese class II category accounted for 14 participants (7.0%). A smaller proportion was observed among participants in the overweight group, with 12 individuals (6.0%).

In contrast, only two participants reported that they did not prefer fast food, with one individual (50%) belonging to the obese class I category and obese class II (50%). No participants from the underweight, normal, or overweight categories reported not consuming fast food. These findings indicate that fast-food consumption is prevalent across all BMI categories among the adolescents, with a statistically significant association observed between BMI status and fast-food consumption in this study.

Table 4: Relationship between BMI and Fast-Food Consumption

Variable	Do not prefer fast-food (n=2)(%)	Prefer fast-food (n=200)(%)	Chi-square statistic (df)	p-value
BMI Categories				
Underweight	0 (0)	85 (42.5)	17.135 (8)	0.029
Normal	0 (0)	53 (26.5)		
Overweight	0 (0)	12 (6.0)		
Obese class I	1 (50)	36 (18.0)		
Obese class II	1 (50)	14 (7.0)		

Discussion

The present study examined the association between breakfast consumption, fast-food preference, and BMI among secondary school students in Penang, Malaysia. One notable finding was the high prevalence of underweight adolescents (42.1%), which exceeded the proportions of overweight (5.9%) and obesity (25.7%). This pattern differs from many national and international studies that have reported increasing rates of adolescent overweight and obesity (Al-Hazzaa, Alhakami & Alotaibi, 2025; Bhandari et al., 2025). Several factors may explain this observation. Adolescents experience rapid physical growth and increased nutritional requirements, and inadequate dietary intake or irregular eating habits may contribute to lower body weight (Albayrak & Özbek, 2025). In addition, the high propensity for high-calorie, low-nutrient-value fast food leads to significant nutritional depletion and imbalance, further deteriorating physical and health conditions (Abduelkarem et al., 2020). Moreover, BMI classification may also have introduced reporting bias in this study, as it is self-reported and guided by teachers. Therefore, the higher prevalence of underweight should be interpreted with caution, requires further investigation, and should probably be measured directly using the required or standard measurement tools during data collection.

A significant association was identified between breakfast consumption and BMI ($p = 0.030$), although the effect size was small to moderate (Cramer's $V = 0.230$). Adolescents who skipped breakfast were more frequently represented in the obese BMI categories than those who reported consuming breakfast. This finding is consistent with previous studies demonstrating that breakfast skipping is associated with higher BMI and increased obesity risk among adolescents (El-Shaheed et al., 2019; Halaši et al., 2021; Narciso et al., 2019). One possible explanation is that skipping breakfast may increase hunger later in the day, leading to overeating, greater consumption of energy-dense foods, and poorer overall dietary quality (Verduci et al., 2022). Nevertheless, breakfast consumption should not be viewed as the sole determinant of BMI because body weight is influenced by multiple interacting factors, including physical activity, total energy intake, sleep patterns, socioeconomic status, and family eating behaviours (Haerens et al., 2010). This is supported by studies reporting that some adolescents compensate for skipped breakfasts through increased food intake later in the day, thereby reducing the immediate impact of breakfast omission on BMI (Yasinta, Sudargo & Ratrikaningtyas, 2024).

Next, BMI shows a significant association with a preference for fast food with a p-value of 0.029, although the effect size indicated by Cramer's V of 0.206 is relatively small. Nevertheless, these findings must be interpreted with caution as the vast majority of participants (99.0%) reported a preference for fast food, resulting in an unbalanced distribution

of responses. The present study only reports the participants' preference for fast food rather than measuring the frequency and quantity of consumption, which differs from most of previous studies that consistently conclude that regular fast-food consumption can lead to higher BMI resulting from larger amounts of fat, sugar and sodium content (Jain et al., 2023; Khalid, 2021; Sultana et al., 2022). Consequently, although the findings of this study show a significant relationship between BMI and fast-food preference, this study cannot definitively confirm whether regular fast-food intake directly contributes to the difference in body weight among participants.

All in all, dietary habits, specifically breakfast and fast-food consumption, are associated with BMI among adolescents in Penang, Malaysia. Yet, their relatively small effect sizes show that these dietary behaviors account for only a portion of the variation in BMI, thereby emphasizing that adolescent nutritional status is broad and influenced by a range of interconnected factors. Future studies should be improved by obtaining accurate weight and height measurements using standard tools and employing more comprehensive diet recalls that capture details such as frequency, portion sizes, and snack intake alongside physical activity. Evidence and conclusions drawn from such studies will provide a more comprehensive and convincing understanding regarding the factors influencing BMI among adolescents and can assist in formulating more effective school-based nutrition education programs and public health strategies. These efforts can, in turn, support SDG 3 (Good Health and Well-being) by promoting healthy lifestyle practices among adolescents.

Conclusion

In conclusion, this study sheds light on the important association between breakfast habits, fast-food preferences, and BMI among secondary school students in Penang, Malaysia. It is clear that skipping breakfast is more prevalent among those who are dealing with obesity, and there is a noteworthy association between a preference for fast food and BMI, even if the effects are relatively small. These insights underline the need for proactive efforts to foster healthy eating habits during these formative years.

Promoting regular breakfast consumption and making healthier food choices should be key components of school-based nutrition programs and family discussions. Public health initiatives can play a vital role in guiding adolescents toward better nutritional practices.

Looking ahead, it will be essential for future research to include precise measurements and to explore other factors that contribute to BMI, such as socioeconomic status, physical activity, dietary habits, and cultural influences. This broader approach will help deepen our understanding of the factors that affect adolescent weight and aid in creating effective, evidence-based strategies to support healthy growth and well-being in young people.

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