Int J Adv Life Sci Res. Volume 8(4) 232-241
https://doi.org/10.31632/ijalsr.2025.v08i04.017

International Journal of Advancement in Life Sciences Research

Online ISSN: 2581-4877

Journal homepage http://ijalsr.org

Original Article

Quantitative Assessment of School Food Environment and Dietary Practices of Malaysian Adolescents

Digsha Augundhooa[1], Siti Madihah Muhammad Royani[1], Baskaran Gunasekaran[2], Lailatul Muniroh[3] and Vaidehi Ulaganathan[1*]

[1]Department of Food Science and Nutrition, Faculty of Applied Sciences, UCSI University, 56000 Wilayah Persekutuan, Kuala Lumpur, Malaysia
[2]Department of Biotechnology, Faculty of Applied Sciences, UCSI University, 56000 Wilayah Persekutuan, Kuala Lumpur, Malaysia
[3]Department of Nutrition, Faculty of Public Health, Universitas Airlangga, 60115 Surabaya, Indonesia

**Corresponding Author's Email: vaidehi@ucsiuniversity.edu.my*

Abstract

Background: The food environment plays a significant role in shaping dietary practices, contributing to the rise of an obesogenic generation. Existing research has primarily focused on population-wide initiatives, creating a research gap concerning adolescents. Distinct environmental factors influence their dietary habits, with the school food environment being a major contributor, as students spend a considerable amount of time in schools. This study aims to determine the relationship between public secondary school students' perceptions of their school food environment and their dietary practices. **Methods:** This study involved a sample size of 118 students attending public secondary schools in Malaysia. Data were collected via online platforms using a validated and pre-tested school food environment questionnaire and were analysed using IBM SPSS 26. **Results:** The students exhibited a moderate level of perception (mean = 0.50 ± 0.02) and practice (mean = 2.73 ± 0.04) regarding the school food environment. Significant differences were observed between students' perceptions of the school food environment and variables such as ethnic groups (Malay, Chinese, and Indian) (p = 0.001), father's educational status (p = 0.019), mother's educational background (p = 0.038), and father's employment status (p = 0.014). A significant, positive, and moderate relationship was found between students' perception and practice of a healthy diet in the school environment (r = 0.246, p = 0.007). After adjusting for confounding variables, the relationship between students' perception and practice of a healthy diet in the school environment remained significant (r = 0.246, p *<0.05*). **Conclusion:** Developing a healthy school food environment is essential for enhancing students' perceptions and improving their dietary practices within the school canteen.

Keywords: *Health Education; Obesity; Practice; School Food Environment*

Introduction

Obesity has transcended the perception of being solely a behavioural outcome linked to an individual's willpower and is now recognised as a "multifactorial disease." In 2019, the prevalence of overweight and obesity for those aged between 5 and 17 years old was 15.0% and 14.8%, respectively (National Institutes of Health, 2019). While genetic predispositions and individual factors contributed to obesity, they did not fully explain the rapid growth of the obesity epidemic, particularly among adolescents. Environmental perspectives have therefore attempted to identify the reasons behind the dramatic increase in obesity rates, although previous findings remain scattered and inconclusive.

Received on :4th December 2024; Revised version received on :3rd September 2025; Accepted: 15th September 2025

A substantial body of research has explored the impacts of the food environment on dietary behaviours and health outcomes across various settings (Hermans *et al*., 2020; Li *et al*., 2022). Numerous studies have demonstrated that interventions and modifications in the food environment can lead to changes in dietary behaviours among adults in community and workplace settings (Downs & Demmler, 2020; Schliemann & Woodside, 2019; Sogari *et al*., 2018). In contrast, fewer studies have provided evidence on how adolescents' dietary behaviours are influenced by their perceptions of the food environment, despite adolescence being a critical transitional period from childhood to adulthood (Devine *et al*., 2023; Iyassu *et al*., 2024; Mastorci *et al*., 2024). A positive relationship between the school food environment and obesity has been observed among multi-ethnic adolescent samples from different regions in Malaysia (Ghaffar *et al*., 2019). An unhealthy school food environment influences adolescents' dietary habits, as at least two main meals, such as breakfast and lunch, are consumed within this setting. Consequently, approximately 40% of their daily dietary intake occurs within the school environment (Sildén, 2018). However, food choices in schools are restricted by the availability of school canteens or vending machines, which typically offer various food items. For instance, the food items and beverages available are often energy-dense, low in nutritional value, and high in fats, sugars, and calories. The preference for these unhealthy options is frequently driven by accessibility, affordability, and availability, which in turn influences long-term dietary behaviours and poses significant health risks (Even *et al*., 2025).

The perception of healthy eating among adolescents is often misunderstood. They tend to perceive fried foods, such as fried rice, fried chicken, and other energy-dense foods, as healthy and frequently associate nutritious food with poor taste (Masthalina *et al*., 2024). While they may demonstrate an understanding of the concept of healthy eating and food choices, their dietary practices at school reveal a preference for foods high in saturated fats and cholesterol, such as deep-fried drumsticks and hamburgers, consumed both during main meals and snack periods (Malczyk *et al*., 2025; Tripicchio *et al*., 2023). These choices reflect conflicting priorities, with taste and convenience taking precedence over nutritional value. Therefore, addressing these misconceptions is crucial for developing effective interventions to promote healthier dietary practices among students within the school setting.

Additionally, poor nutritional status and a low-quality diet have been significantly associated with less effective food handler services in schools, including inadequate knowledge, skills, monitoring, and follow-up (Soon *et al*., 2020). For example, the methods and techniques used in food preparation contribute to this issue. Consequently, the poor quality of the diet within the school food environment remains a barrier to promoting healthier food choices within the school premises. Evidence also suggests that Malaysian adolescents are particularly susceptible to adopting unhealthy dietary practices and consuming low-quality diets, characterised by limited intake of fruits and vegetables, fibre, and essential micronutrients (Millar *et al*., 2025). The increased consumption of calorie-dense food items further heightens the risk of overweight, obesity, and chronic diseases. Therefore, the present study aims to explore how the school food environment influences adolescents' dietary practices and to understand how adolescents perceive their school food environment.

Material and Methods

This study was a descriptive cross-sectional examination involving Form 1, 2, and 4 public secondary school adolescents in Malaysia. The Institutional Ethics Committee at UCSI University approved the current study (approval: UCSI/IEC-2021-FAS-028) and permission was also obtained from the Ministry of Education (OE KPM600-3/2/3-eras (9389)).

A sample of 118 adolescents was recruited using the Daniel (1999) formula, excluding those with national examinations, international adolescents, reading disabilities, or special care needs for data reliability. All the eligible adolescents provided written consent for review and signature before starting the survey. A total of 40 public secondary schools in Malaysia participated in this study.

Survey materials were distributed via email, facilitated by designated teachers from various public secondary schools in Malaysia. The questionnaire was also shared with different tuition centres across

multiple states for circulation to eligible adolescents. The school food environment questionnaire was distributed exclusively to the parents of consenting adolescents, who could participate via a QR code attached to a poster or a link sent to the designated teachers. Adolescents were required to meet the inclusion criteria to participate in this study.

The self-administered questionnaire was available in both English and Malay and underwent a content validity assessment by ten experts. A pre-test was conducted with ten adolescents using Questionnaire 1, followed by validation testing to ensure a Cronbach's alpha greater than 0.7 and a *p*-value of < 0.05. Cronbach's alpha for the perception of the school food environment was 0.899, and for dietary practices, it was 0.873. Corrections and edits for potential amendments were made, and a subsequent test was conducted using Questionnaire 2, which was retested after two weeks. The expected outcome from the test and retest was anticipated to be similar. Therefore, the school food environment questionnaire used in this study was both validated and pre-tested.

Statistical analysis was conducted using IBM SPSS version 26. Descriptive data were presented as mean ± SD or frequency and percentage. Independent t-tests and One-Way ANOVA were used to compare means, while bivariate correlation analysis was employed to test the relationship between perception and dietary practices. Confounding variables were controlled for in the partial correlation analysis.

Results

Perception of school food environment and dietary practices in school canteens

Overall, the adolescents moderately perceive a healthy school food environment with a mean score of 0.50 ± 0.02. The mean score for the adolescents' dietary practices in the school canteen was 2.73 ± 0.04, indicating a moderate level of healthy dietary practices in the school food environment. There was a significant difference in the adolescents' perceptions of the school food environment across ethnicities (F = 6.932, *p* = 0.001). Significant differences were also observed between respondents' perceptions of the school food environment and parents' education (father: F = 3.442, *p* = 0.019; mother: F = 2.900, *p* = 0.038). A significant difference in adolescents' perceptions was identified across fathers' employment (F = 2.546, *p* = 0.014). However, there was no significant difference between the adolescents' dietary practice and socio-demographic background (Table 1).

Table 1: *Perception Aad Practice Towards School Food Environment Across the Socio-Demographic of Adolescents*

Variables	**n (%)**	**Adolescents' Perception**			**Adolescents' Practice**		
		Mean ± SD	**F**	***p*-value**	**Mean ± SD**	**F**	***p*-value**
All		0.50 ± 0.02			2.73 ± 0.04		
Gender							
Male	45(62.2)	0.52 ± 0.17	0.534[a]	0.466	2.78 ± 0.51	1.153[a]	0.285
Female	74(37.8)	0.49 ± 0.18			2.69 ± 0.38		
Age (years)							
13	24(20.2)	0.47 ± 0.19	1.254	0.289	2.73 ± 0.43	0.607	0.547
14	27(22.7)	0.47 ± 0.16			2.65 ± 0.49		
16	68(57.1)	0.52 ± 0.18			2.76 ± 0.41		
Ethnic Groups							
Malay	29(24.4)	0.42 ± 0.14	6.932	0.001*	2.69 ± 0.44	2.604	0.078
Chinese	67(56.3)	0.51 ± 0.18			2.68 ± 0.41		
Indian	29(24.4)	0.59 ± 0.18			2.91 ± 0.45		
Father's Education Status							
No Formal School	4(3.4)	0.62 ± 0.22	3.442	0.019*	2.86 ± 0.53	2.542	0.060
Primary School	5(4.2)	0.57 ± 0.14			3.10 ± 0.49		
Secondary School	63(52.9)	0.53 ± 0.19			2.77 ± 0.39		
Tertiary	47(39.5)	0.44 ± 0.14			2.62 ± 0.45		
Mother's Education Status							
No Formal School	4(3.4)	0.71 ± 0.07	2.900	0.038*	2.95 ± 0.57	2.258	0.085
Primary School	5(4.2)	0.57 ± 0.22			3.16 ± 0.57		

Secondary School	64(53.8)	0.51 ± 0.18			2.71 ± 0.40		
Tertiary	46(38.7)	0.47 ± 0.16			2.69 ± 0.44		
Father's Employment							
Managers	14(11.8)	0.42 ± 0.16	2.546	0.014*	2.63 ± 0.38	1.271	0.266
Professionals	14(11.8)	0.43 ± 0.10			2.64 ± 0.29		
Technician & Associate Professionals	22(18.5)	0.55 ± 0.15			2.73 ± 0.50		
Clerical support workers	3(2.5)	0.74 ± 0.04			2.95 ± 0.66		
Service & sales workers	26(21.8)	0.46 ± 0.19			2.70 ± 0.37		
Machine operator & assembler	4(3.4)	0.58 ± 0.26			2.82 ± 0.45		
Elementary occupations	19(16.0)	0.54 ± 0.18			2.64 ± 0.50		
Not working or retired	14(11.8)	0.57 ± 0.20			3.03 ± 0.41		
Mother's Employment							
Managers	2(1.7)	0.54 ± 0.00	1.195	0.309	2.43 ± 1.01	0.838	0.571
Professionals	10(8.4)	0.39 ± 0.16			2.52 ± 0.35		
Technician & Associate Professionals	3(2)	0.46 ± 0.08			2.79 ± 0.47		
Clerical support workers	19(16.0)	0.53 ± 0.19			2.71 ± 0.43		
Service & sales workers	15(12.6)	0.44 ± 0.16			2.77 ± 0.35		
Machine operator & assembler	2(1.7)	0.38 ± 0.11			2.79 ± 0.61		
Elementary occupations	6(5.0)	0.45 ± 0.23			2.51 ± 0.33		
Not working/ retired or housewives	61(51.3)	0.53 ± 0.18			2.79 ± 0.45		
Household Income							
B40	70(58.8)	0.52 ± 0.19	0.792	0.455	0.44 ± 0.05	0.083	0.921
M40	40(33.6)	0.48 ± 0.18			0.40 ± 0.06		
T20	9(7.6)	0.48 ± 0.09			0.50 ± 0.17		
Household members							
3	11(9.2)	0.43 ± 0.12	1.356	0.254	2.60 ± 0.56	1.407	0.236
4	29(24.4)	0.52 ± 0.16			2.71 ± 0.34		
5	41(34.5)	0.53 ± 0.19			2.66 ± 0.48		
6	26(21.8)	0.45 ± 0.17			2.83 ± 0.36		
>6	12(10.1)	0.53 ± 0.23			2.90 ± 0.43		

Note: [a] independent t -test

Relationship between perception and dietary practice in the school food environment

A significant and positive relationship was found between the perception and practice of healthy food in the school canteen (r = 0.246, p = 0.007). Partial correlation analysis revealed a significant and positive relationship between adolescents' perception and dietary practices after controlling for ethnicity and the father's employment background ($r_{partial}$ = 0.195, p = 0.036). The relationship between perception and dietary practices remained significant even after controlled for ethnicity ($r_{partial}$ = 0.209, p = 0.024), father's employment ($r_{partial}$ = 0.223, p = 0.015), and parents' education (father: $r_{partial}$ = 0.199, p = 0.032) and (mother: $r_{partial}$ = 0.213, p = 0.021) independently; but not in combination ($r_{partial}$ = 0.174, p = 0.064) (Table 2).

Table 2: *Pearson and Partial Correlation Between Adolescents' Perception and Practice for the School Food Environment, and Adjusted for Confounding Variables*

Adolescents' Perception	**Adolescents' Practice**	
	Bivariate Correlation (r)	***p*-value**
	0.246	0.007*
Confounding Variables	Partial Correlation (r)	
Ethnicity, Father's Education, Mother's Education, Father's Employment Status	0.174	0.064
Ethnicity and Father's Employment Status	0.195	0.036*
Ethnicity	0.209	0.024*
Father's Education	0.199	0.032*
Mother's Education	0.213	0.021*
Father's Employment Status	0.223	0.015*

Discussion

Assessing the perception and practice of a healthy diet among adolescents was not new (Awaluddin *et al*., 2019; Lepley *et al*., 2022). However, this study uniquely explores the relationship between these aspects, specifically within the context of school food environments. Understanding this relationship is crucial for shaping school food environments to enhance adolescents' dietary practices and further promote healthier eating among adolescents. An increased availability of prohibited food items, such as processed meat products, energy-dense foods with high amounts of salt, sugar, and fats, and bakery products like creamy and velvety rolls, biscuits, and bread, was offered in the school canteens. These restrictions significantly increased the purchase frequencies of unhealthy food items and decreased the intake of fruits and vegetables among adolescents, significantly reducing healthy dietary practices in the school food environment (Ardzejewska *et al*., 2013; Nathan *et al*., 2016). Hence, the feedback and comments from students and school representatives were considered, and the school canteen can use the results to improve its menu further and adhere to healthy canteen guidelines (Teo *et al*., 2021). However, many school canteens remain profit-orientated, whereby their prime focus is to generate higher profits, hence they increase the sale of tastier food even though these food items are unhealthy and reduce the sale of healthier food, for which the profits are usually significantly less (Rosin *et al*., 2024).

A moderate level of students' perception typically indicates that they possess some awareness, attitude, or belief about healthy or unhealthy food in the school canteen; however, they may not fully understand the complexities of these concepts. In some cases, students may recognise that canteen food influences their health but may not fully grasp the nutritional implications. This condition also reflects their awareness of commonly recognised unhealthy options, such as fried food or sugary drinks, though their understanding of hidden risks, such as excess salt in processed foods, remains limited. Furthermore, this suggests a mixed attitude among students, with some prioritising taste, cost, and convenience over healthy eating (Rezali *et al*., 2015). Previous studies have demonstrated that adolescents perceive an increase in the availability of healthy food items and choices as significantly enhancing their consumption of nutritious foods. For instance, they recognise that if fruits and vegetables are more accessible within their school food environment through initiatives like vending machines they are more likely to consume them (Oliveira *et al*., 2024). Adolescents are also concerned about their body image and express intentions to grow taller and thinner. Moreover, they perceive that food costs should be revised to make healthy food choices more affordable at school. Providing varied food coupons could alleviate the financial burden associated with purchasing nutritious food items (Mohammadi *et al*., 2020). According to a study, adolescents perceive that healthy eating at school is influenced by factors such as limited access, affordability, personal preferences, and the availability of food options in the school canteen (Mohammadi *et al*., 2020). Food preferences, satisfaction, and sensory qualities such as texture, taste, smell, and appearance also influence adolescents' perceptions of a healthy diet (Rodríguez-Barniol *et al*., 2024). The implementation of nutrition education and specific culinary training has been shown to further encourage the consumption of healthy food items (Roy *et al*., 2024). Another study conducted in Norway among secondary adolescents observed that most

students preferred to bring their lunch from home and expressed dissatisfaction with the types of food and beverages sold in the school canteen (Chortatos *et al*., 2018). For example, adolescents tend to choose fried rice, perceiving it as healthy due to the presence of vegetables and chicken, without considering the preparation methods used by the canteen operators. Adolescents perceive healthy and unhealthy eating based on a variety of food items, consistency, texture, taste, and specific foods or food brands (Leme *et al*., 2021). However, in schools, when adolescents perceive that the availability of energy-dense foods exceeds that of nutritious or healthy food options, it acts as a barrier to practicing healthy eating (Mukoma *et al*., 2023). Enhancing the affordability and appeal of healthy foods in schools could positively influence adolescents' perceptions, willingness, and potential to maintain good dietary practices within the school setting (Ares *et al*., 2024). This approach aims to improve the acceptance of healthy food items, fostering positive dietary practices among adolescents despite their ethnic and socioeconomic differences (Varela *et al*., 2024). These findings underscore the importance of addressing and understanding adolescents' perceptions to develop effective interventions that promote healthier dietary practices in schools.

A moderate level of students' practice or inconsistent actual behaviour may be characterised by occasional healthy food choices, such as fruits or water, but they still often buy fried foods, sweets, or sugary drinks. Although the school canteen offers several healthy options, students widely prefer unhealthy items, often with inconsistent portion control and balance (Ardzejewska *et al*., 2013). The adolescents perceived a lack of knowledge and awareness of healthy and unhealthy food options, which significantly acts as a barrier for them to practice healthy eating, and they were unaware of the benefits or harmfulness associated with these options (Ishak *et al*., 2020). From their perspective, unhealthy food options in the school canteen were considered more fulfilling and helped decrease their hunger during school hours (Mohammadi *et al*., 2020). A study done in Klaten and West Lombok, Indonesia, supported that the main factors for the adolescents' food choices at school were based on the taste, healthfulness, and affordability of the food items available in the school canteen (Rachmadewi *et al*., 2021).

The current study found no significant difference in the perception and practice of adolescents between the gender and age groups. However, this study's findings differed from a previous study, which had indicated that female adolescents exhibited higher concerns and self-efficacy in practising healthy eating, often avoiding or using the school canteen less than the male adolescents (Efthymiou *et al*., 2021), implying that gender-based differences in dietary attitudes may be narrowing over time. There is a significant difference in adolescents' perceptions across ethnicities, which underscores the necessity of acknowledging cultural nuances in the development of effective strategies to improve the school food environment for the overall well-being of all adolescents. The ethnic variations in the dietary habits of the Malaysian adolescents in Kuala Lumpur indicated that Malay adolescents lean towards energy-dense foods like fried chicken and rice, while Indian adolescents preferred dishes like dhal with mixed vegetables and legumes, which are healthier (Ishak *et al*., 2020).

There was a significant difference in students' perceptions of healthy food choices in the school canteen based on their parents' socio-economic backgrounds, specifically education and employment. The results revealed a distribution pattern where students from lower socio-economic backgrounds tended to have more positive perceptions compared to those from higher socio-economic backgrounds. This finding contrasts with the common hypothesis that a higher socio-economic background is consistently associated with better health perceptions (Eng *et al*., 2022; Khaw *et al*., 2022). Educational levels, which reflect one's knowledge, consistently demonstrate that well-informed parental understanding of nutrition positively influences adolescents' perceptions, thereby improving the quality of their food choices both at home and within the school setting (Mohammadi *et al*., 2020). Parents' basic education on food security and balanced diets positively influences adolescents' dietary practices, although some parents may lack awareness of the consequences of unhealthy eating (Khaw *et al*., 2022). This highlights the significant role that the school canteen plays in shaping the health perceptions of students from lower socio-economic backgrounds. For students from lower socio-economic backgrounds, school canteen food may be valued more as it represents a reliable or primary source of a healthy meal. In contrast,

students from higher socio-economic backgrounds are likely to have greater food choices at home and better access to food from external vendors, which can make them more critical of the food options available in the canteen. A study shows that, during adolescence, parental control and supervision over dietary patterns and food choices decline, and peer pressure begins to have a significant impact on eating behaviours, influencing eating patterns through secondary socialisation and adaptation (Muniroh *et al*., 2025). However, the current findings indicate that parents from higher socio-economic backgrounds may have a greater ability to influence their children to be more discerning, leading to stricter judgments about what is considered “healthy.” In contrast, families from lower socio-economic backgrounds may instil a more positive perception of any balanced or regulated food option compared to competitive food sold outside schools. Additionally, for families from lower socio-economic backgrounds, school canteen food is often more affordable and healthier than external food options (Devine *et al*., 2023; Mohammadi *et al*., 2021). While some parents completely trust schools to manage their children's dietary intake, others, depending on their financial capacity, prefer to prepare meals at home while concurrently educating their children about the impact of unhealthy food on their overall well-being (Vaughan *et al*., 2024). Initiatives such as special meal plans or combo meals at affordable rates for healthy food could promote a positive change in dietary practices and improve the quality of students' diets at school (Silva, 2025). Indeed, with the implementation of the healthy school canteen guidelines from the Ministry of Health, the food served in school canteens is subject to regulation. However, due to a lack of enforcement, some school canteens have not fully implemented these guidelines. Empowering parents with the authority to engage in school canteen activities can significantly enhance the establishment and implementation of goals and policies centred on promoting healthy eating habits. By involving parents in the formulation and assessment of healthy eating policies, schools can ensure that diverse perspectives are considered, leading to more comprehensive and effective guidelines. Moreover, granting parents a role in influencing health and well-being further strengthens the collaborative approach between schools and families, fostering a holistic environment that prioritises the overall health and nutritional needs of adolescents (Mohammadi *et al*., 2020).

Current findings indicate a positive correlation between students' perceptions and practices regarding healthy school canteen food. This suggests that students who view healthy canteen food as both nutritious and appealing are more inclined to engage in healthier eating behaviours within the school setting. This supports the hypothesis that perception influences behaviour and aligns with models such as the Health Belief Model and Social Cognitive Theory, which suggest that health-related behaviours are significantly influenced by perception and self-efficacy (Devine *et al*., 2023; Mohammadi *et al*., 2021). Therefore, there is a need to strengthen positive perceptions, especially by improving food appeal or enhancing nutritional promotion, education, or campaigns to translate this into healthier dietary practices in the school food environment. The integration of Malaysian dietary guidelines, as well as the Healthy School canteen guideline, in the syllabus can enhance knowledge and guide adolescents towards healthier choices. The promotion of healthy eating and nutrition education enables children to improve their diets, acquire and develop healthy eating habits, and extend them to their peers and further to their families and communities (Haines *et al*., 2019). The correlation observed remained significant even after controlling for parents’ socio-economic background, suggesting that, besides being influenced by their family, factors within the school food environment, including peer encouragement and the level of autonomy in making dietary choices, play an important role in shaping adolescents’ dietary behaviours (Mohabati *et al*., 2024).

The findings of this study may serve as a reference for future studies in Malaysia and could be valuable for developing specific school canteen intervention programmes, including improved guidelines and standards. These insights contribute to the broader conversation on promoting healthier eating habits among adolescents, with implications for both research and practical interventions. Despite the adequacy and accuracy of the collected and analysed data, notable limitations exist in this study. The absence of a passive or placebo control group for reference may lead to overestimation or underestimation of the findings. A self-administered questionnaire introduces bias and potential inaccuracy, especially for socioeconomic variables. The online survey method lacks face-to-face clarifications, potentially influencing specificity. Reliance on online distribution may introduce biases,

potentially affecting the study's validity and intent.

Conclusion

In conclusion, the majority of the Malaysian adolescents demonstrated a moderate perception of their school food environment, influenced by limited availability, accessibility, personal preferences, and affordability of healthful options. Initiatives involving adolescents in canteen activities and educational programmes can address these challenges. Notably, a positive relationship exists between perception and dietary practice, emphasising the need for school food environment-based educational programmes to encourage healthier food choices. Overall, fostering a conducive school food environment through targeted interventions can positively influence adolescents' dietary practices and well-being. Integrating both descriptive and quantitative audits of the food environment, along with longitudinal dietary behaviour data, has the potential to enhance our understanding of the determinants influencing the dietary behaviours of adolescents.

Conflict of Interest

The authors declare that they have no competing interests.

Acknowledgment

This study was funded by the UCSI Research Excellence & Innovative Grant under the SHINe-module project (School: Healthy & Improved Nutritional Environment e-module) [REIG-FAS-2020-008F] and [REIG-FAS-2022/040].

References

Ardzejewska, K., Tadros, R., & Baxter, D. (2013). A descriptive study on the barriers and facilitators to implementation of the NSW (Australia) Healthy School Canteen Strategy. *Health Education Journal*, *72*(2), 136-145. https://doi.org/10.1177/0017896912437288

Ares, G., De Rosso, S., Mueller, C., Philippe, K., Pickard, A., Nicklaus, S., ... & Varela, P. (2024). Development of food literacy in children and adolescents: implications for the design of strategies to promote healthier and more sustainable diets. *Nutrition Reviews*, *82*(4), 536-552. https://doi.org/10.1093/nutrit/nuad072

Awaluddin, S. M., Ibrahim Wong, N., Rodzlan Hasani, W. S., Omar, M. A., Mohd Yusoff, M. F., Nik Abd Rashid, N. R., & Aris, T. (2019). Methodology and representativeness of the Adolescent Health Survey 2017 in Malaysia. *Asia Pacific Journal of Public Health*, *31*(8_suppl), 8S-17S. https://doi.org/10.1177/1010539519854884

Chortatos, A., Terragni, L., Henjum, S., Gjertsen, M., Torheim, L. E., & Gebremariam, M. K. (2018). Consumption habits of school canteen and non-canteen users among Norwegian young adolescents: a mixed method analysis. *BMC Pediatrics*, *18*(1), 328. https://doi.org/10.1186/s12887-018-1299-0

Devine, L. D., Hill, A. J., & Gallagher, A. M. (2023). Improving adolescents' dietary behaviours in the school-setting: challenges and opportunities. *Proceedings of the Nutrition Society*, *82*(2), 172-185. https://doi.org/10.1017/S0029665123002197

Downs, S., & Demmler, K. M. (2020). Food environment interventions targeting children and adolescents: a scoping review. *Global Food Security*, *27*, 100403. https://doi.org/10.1016/j.gfs.2020.100403

Efthymiou, V., Charmandari, E., Vlachakis, D., Tsitsika, A., Pałasz, A., Chrousos, G., & Bacopoulou, F. (2021). Adolescent self-efficacy for diet and exercise following a school-based multicomponent lifestyle intervention. *Nutrients*, *14*(1), 97. https://doi.org/10.3390/nu14010097

Eng, C. W., Lim, S. C., Ngongo, C., Sham, Z. H., Kataria, I., Chandran, A., & Mustapha, F. I. (2022). Dietary practices, food purchasing, and perceptions about healthy food availability and affordability: a cross-sectional study of low-income Malaysian adults. *BMC Public Health*, *22*, 192. https://doi.org/10.1186/s12889-022-12598-y

Even, B., Truong, T. T. T., Thai, H. T. M., Pham, H. T. M., Nguyen, D. T., Bui, A. T. V., & Béné, C. (2025). Unpacking food environment policy landscapes for healthier diets in “emerging” countries: the case of Viet Nam. *Frontiers in Public Health*, *13*, 1548956. https://doi.org/10.3389/fpubh.2025.1548956

Ghaffar, S. A., Talib, R. A., Karim, N. A. (2019). Food choices and diet quality in the school food environment: a qualitative insight from the perspective of adolescents. *Malaysian Journal of Medicine and Health Sciences*, *15*(SP1), 16-24. https://medic.upm.edu.my/upload/dokumen/2019041008170103_MJMHS_Vol_15_SP1.pdf

Haines, J., Haycraft, E., Lytle, L., Nicklaus, S., Kok, F. J., Merdji, M., ... & Hughes, S. O. (2019). Nurturing children's healthy eating: position statement. *Appetite*, *137*, 124-133. https://doi.org/10.1016/j.appet.2019.02.007

Hermans, R. C., Smit, K., van den Broek, N., Evenhuis, I. J., & Veldhuis, L. (2020). Adolescents' food purchasing patterns in the school food environment: Examining the role of perceived relationship support and maternal monitoring. *Nutrients*, *12*(3), 733. https://doi.org/10.3390/nu12030733

Ishak, S. I. Z. S., Chin, Y. S., Taib, M. N. M., & Shariff, Z. M. (2020). Malaysian adolescents' perceptions of healthy eating: a qualitative study. *Public Health Nutrition*, *23*(8), 1440-1449. https://doi.org/10.1017/S1368980019003677

Iyassu, A., Laillou, A., Tilahun, K., Workneh, F., Mogues, S., Chitekwe, S., & Baye, K. (2024). The influence of adolescents' nutrition knowledge and school food environment on adolescents' dietary behaviors in urban Ethiopia: A qualitative study. *Maternal & Child Nutrition*, *20*, e13527. https://doi.org/10.1111/mcn.13527

Khaw, W. F., Nasaruddin, N. H., Alias, N., Chan, Y. M., Tan, L., Cheong, S. M., ... & Yong, H. Y. (2022). Socio-demographic factors and healthy lifestyle behaviours among Malaysian adults: National Health and Morbidity Survey 2019. *Scientific Reports*, *12*(1), 16569. https://doi.org/10.1038/s41598-022-20511-1

Leme, A. C. B., Fisberg, R. M., Baranowski, T., Nicklas, T., Callender, C. S., Kasam, A., ... & Thompson, D. (2021). Perceptions about health, nutrition knowledge, and myplate food categorization among US adolescents: a qualitative study. *Journal of Nutrition Education and Behavior*, *53*(2), 110-119. https://doi.org/10.1016/j.jneb.2020.11.008

Lepley, T., Schwager, Z., & Khalid, Z. (2022). Identification and management of night eating syndrome in the adolescent and young adult population. *The primary care companion for CNS disorders*, *24*(1), 21r03062. https://doi.org/10.4088/PCC.21r03062

Li, X., Braakhuis, A., Li, Z., & Roy, R. (2022). How does the university food environment impact student dietary behaviors? A systematic review. *Frontiers in Nutrition, 9,* 840818. https://doi.org/10.3389/fnut.2022.840818

Malczyk, E., Walkiewicz, K. W., Muc-Wierzgoń, M., & Dzięgielewska-Gęsiak, S. (2025). Estimation of intake of fat, saturated fatty acids, and trans fatty acids from sweet and salty snacks among children and adolescents. *Nutrients*, *17*(9), 1572. https://doi.org/10.3390/nu17091572

Masthalina, H., Purba, M., & Pangaribuan, L. (2024). Fast food consumption patterns nutritional status and anemia among female. *Jurnal Penelitian Pendidikan IPA*, *10*(7), 3656-3663. https://doi.org/10.29303/jppipa.v10i7.8030

Mastorci, F., Lazzeri, M. F. L., Vassalle, C., & Pingitore, A. (2024). The transition from childhood to adolescence: Between health and vulnerability. *Children*, *11*(8), 989. https://doi.org/10.3390/children11080989

Millar, H., Tzivakis, D., Rangan, A., & Roy, R. (2025). Dietary transitions and sustainability among asian international tertiary education students in western countries: A scoping review. *Sustainability*, *17*(6), 2505. https://doi.org/10.3390/su17062505

Mohabati, S., Mirahmadizadeh, A., Hassanzadeh-Rostami, Z., Bellissimo, N., & Faghih, S. (2024). The relationship between weight status and food environments, peer influence and dietary intake among high-school students: a case-control study. *Nutrition & Food Science*, *54*(2), 391-402. https://doi.org/10.1108/NFS-03-2023-0049

Mohammadi, S., Su, T. T., Jalaludin, M. Y., Dahlui, M., Azmi Mohamed, M. N., Papadaki, A., ... & Majid, H. A. (2020). School-based intervention to improve healthy eating practices among Malaysian adolescents: a feasibility study protocol. *Frontiers in Public Health, 8,* 549637. https://doi.org/10.3389/fpubh.2020.549637

Mohammadi, S., Su, T. T., Papadaki, A., Jalaludin, M. Y., Dahlui, M., Mohamed, M. N. A., ... & Majid, H. A. (2021). Perceptions of eating practices and physical activity among Malaysian adolescents in secondary schools: a qualitative study with multi-stakeholders. *Public Health Nutrition*, *24*(8), 2273-2285. https://doi.org/10.1017/S1368980020002293

Mukoma, G., Bosire, E. N., Klingberg, S., & Norris, S. A. (2023). Healthy eating and physical activity: analysing Soweto's young adults' perspectives with an intersectionality lens. *PLOS Global Public Health*, *3*(7), e0001429. https://doi.org/10.1371/journal.pgph.0001429

Muniroh, L., Puspikawati, S. I., Indriani, D., Abihail, C. T., Astuti, R. D. P., Ulaganathan, V., & Socadevia, A. (2025). Exploring cultural influences on eating habits and lifestyles among tengger tribe adolescents: a qualitative approach. *Amerta Nutrition*, *9*(3). 389-396. https://doi.org/10.20473/amnt.v9i3.2025.389-396

Nathan, N., Yoong, S. L., Sutherland, R., Reilly, K., Delaney, T., Janssen, L., Robertson, K., Reynolds, R., Chai, L. K., & Lecathelinais, C. (2016). Effectiveness of a multicomponent intervention to enhance implementation of a healthy canteen policy in Australian primary schools: a randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, *13*, 106. https://doi.org/10.1186/s12966-016-0431-5

National Institutes of Health (2019). *NCDs: Non-communicable diseases—Risk factors and other health factors. National Health and Morbidity Survey 2019.* National Institutes of Health. https://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2019/Report_NHMS2019-NCD_v2.pdf

Oliveira, L., BinMowyna, M. N., Alasqah, I., Zandonadi, R. P., Teixeira-Lemos, E., Chaves, C., ... & Raposo, A.

(2024). A Pilot Study on Dietary Choices at Universities: Vending Machines, Canteens, and Lunch from Home. *Nutrients*, *16*(11), 1722. https://doi.org/10.3390/nu16111722

Rachmadewi, A., Soekarjo, D., Maehara, M., Alwi, B., Mulati, E., & Rah, J. H. (2021). School canteens in selected areas in Indonesia: a situation analysis. *Food and Nutrition Bulletin*, *42*(2), 225-246. https://doi.org/10.1177/03795721211008021

Rezali, F. W., Chin, Y. S., Shariff, Z. M., Yusof, B. N. M., Sanker, K., & Woon, F. C. (2015). Evaluation of diet quality and its associated factors among adolescents in Kuala Lumpur, Malaysia. *Nutrition Research and Practice*, *9*(5), 511-516. https://doi.org/10.4162/nrp.2015.9.5.511

Rodríguez-Barniol, M., Pujol-Busquets, G., & Bach-Faig, A. (2024). Screen time use and ultra-processed food consumption in adolescents: A focus group qualitative study. *Journal of the Academy of Nutrition and Dietetics*, *124*(10), 1336-1346. https://doi.org/10.1016/j.jand.2024.04.015

Rosin, M., Ni Mhurchu, C., & Mackay, S. (2024). Implementing healthy food policies in health sector settings: New Zealand stakeholder perspectives. *BMC Nutrition*, *10*(1), 119. https://doi.org/10.1186/s40795-024-00924-z

Roy, R., Alsaie, A., Malloy, J., & Kemper, J. A. (2024). Sustainable culinary skills: fostering vegetable-centric cooking practices among young adults for health and environmental benefits—a qualitative study. *Sustainability*, *16*(2), 928. https://doi.org/10.3390/su16020928

Schliemann, D., & Woodside, J. V. (2019). The effectiveness of dietary workplace interventions: a systematic review of systematic reviews. *Public Health Nutrition*, *22*(5), 942-955. https://doi.org/10.1017/S1368980018003750

Sildén, K. E. (2018). Impact of competitive foods in public schools on child nutrition: effects on adolescent obesity in the United States an integrative systematic literature review. *Global Health Action*, *11*(1), 1477492. https://doi.org/10.1080/16549716.2018.1477492

Silva, P. (2025). Enhancing adolescent food literacy through mediterranean diet principles: From evidence to practice. *Nutrients*, *17*(8), 1371. https://doi.org/10.3390/nu17081371

Sogari, G., Velez-Argumedo, C., Gómez, M. I., & Mora, C. (2018). College students and eating habits: A study using an ecological model for healthy behavior. *Nutrients*, *10*(12), 1823. https://doi.org/10.3390/nu10121823

Soon, J. M., Wahab, I. R. A., Hamdan, R. H., & Jamaludin, M. H. (2020). Structural equation modelling of food safety knowledge, attitude and practices among consumers in Malaysia. *PloS One*, *15*(7), e0235870. https://doi.org/10.1371/journal.pone.0235870

Teo, C. H., Chin, Y. S., Lim, P. Y., Masrom, S. A. H., & Shariff, Z. M. (2021). Impacts of a school-based intervention that incorporates nutrition education and a supportive healthy school canteen environment among primary school children in Malaysia. *Nutrients*, *13*(5), 1712. https://doi.org/10.3390/nu13051712

Tripicchio, G. L., Bailey, R. L., Davey, A., Croce, C. M., & Fisher, J. O. (2023). Snack frequency, size, and energy density are associated with diet quality among US adolescents. *Public Health Nutrition*, *26*(11), 2374-2382. https://doi.org/10.1017/S1368980023001635

Varela, P., De Rosso, S., Moura, A. F., Galler, M., Philippe, K., Pickard, A., ... & van Kleef, E. (2024). Bringing down barriers to children's healthy eating: a critical review of opportunities, within a complex food system. *Nutrition Research Reviews*, *37*(2), 331-351. https://doi.org/10.1017/S0954422423000203

Vaughan, E., Spyreli, E., McKinley, M., Hennessy, M., Woodside, J., & Kelly, C. (2024). Exploring the world of food with families: perspectives of low-income families on factors influencing their food choices. *Public Health Nutrition*, *27*(1), e53. https://doi.org/10.1017/S136898002400020X