Ensuring Food Safety in the Education Sector: An Analysis of School Canteen Food Handling Practices for Students' Well-being

***Purpose**: The study notes an emerging phenomenon affecting students' health due to their dietary intake and food choices. The study examines the impact of canteen food on the daily lives, activities, health, and academic performance of students. **Methodology**: The study employed a mixed-methodological approach, collected data from students in Malaysia, and analyzed it using SmartPLS 4 and NVivo 15, yielding mixed findings. **Findings**: The key contributing factors identified by this study are student awareness, attitude, food perception, and the nutritional value of food in relation to food consumption in the canteen. **Originality**: The study is one of the rare studies that notes down the student' attitude and intention at the school level about their consumption of canteen food. The study implications are essential for policymakers and school management to improve students' academic performance.*

Keywords: *students, canteen food, consumption, academic performance, Malaysia*

Introduction

How can we expect students to thrive academically when the fuel we give them is subpar? Says Celebrity chef Jamie Oliver (Medrano, 2024).

Undoubtedly, either a nation is turning towards a better society, or a crowd with a specific mindset decides how their education, knowledge, and drive for skill acquisition are shaped. Regardless of how industries and social stakeholders contribute, the education department always serves as a stepping stone to a brighter future (Ikeda, 2024). The education sector thrives only once its core product, which is that students embark on a successful future. Studies reveal that students are suffering, and their performance is declining, with many underlying factors contributing to this decline. Pearson reports revealed that 1.65 million primary and secondary students feel unprepared to continue with their education or progress to the next level (Pearson, 2025). Manno, (2025) says that the student performance is declining, and their education disengagement is increasing. This is far beyond pandemic and Daly, (2024) claims this era as the midst of education depression. Nietzel, (2024) further warns that the student enrolment for higher education is also decreasing, calling it a demographic cliff. The report of Baerren, (2025) finds food insecurity as the root cause of falling graduate rates, attendance, lower academic performance, and their behaviour. The lower nutritional value, inaccessibility to good food, or unavailability of universal meal plans leads to chronic health issues alongside their poor academic performance (Orta-Aleman *et al.*, 2024). The study of Lee, (2019) argues that it is not only the accessibility of good food but also the dietary habits of students, student attitude, their perception of nutrition, and food portion that are critical.

Food insecurity, hygiene issues, compromised portions, and a mixture of unhealthy ingredients are practices that are not demographically specific, as the world battles with this issue. However, the situation intensifies when it comes to schools, where students are not mature enough and parents are unable to monitor their dietary consumption. A study conducted with school students found that 46% of the food was found to be unhealthy, 32% was of intermediate quality, and only 22% was healthy food (Gell *et al.*, 2023). Further, Alsiwat et al., (2025) expressed a concern that the Ministry of Education should have strict checks on food quality in school canteens. The study of Shi et al., (2024) highlighted that students should be aware enough to differentiate between healthy and unhealthy food, their food preferences, and nutritional values. The Ministry of Education requires specific protocols to regulate the food served in canteens. The implications of these particular protocols are complex, rather than just announcing them in countries where infrastructure is not supportive, procedures are not automatic, and the number of schools and students is outpacing specifically, the Asian countries. The study of Rachmadewi et al., (2021) revealed the triple burden of malnutrition in canteen food, and sedentary lifestyle and poor dietary habits are major causes of it in one of the Southeast Asian countries.

When it comes to nutrition, food hygiene, and student awareness, many countries have expressed concern and dissatisfaction over canteen food. However, few countries witnessed shocking events, such as recently in Malaysia, more than one thousand individuals got food poisoning, and more than 100 pupils were hospitalized after having food from their school canteen (Loh, 2024). Another shocking event has been witnessed, as students discovered contaminated food, including worms and partially blackened boiled eggs, provided by the school (Tantivangphaisal, 2023). Therefore, the Malaysian Health Ministry invited schools to participate in healthy food programs (Pallianysamy *et al.*, 2025). Many studies recommend that students be aware of food nutrition and educated about what is best for their health, as these foods help them improve their academic performance. The study of Pallianysamy et al., (2025) food safety awareness is mentioned as an essential aspect for students. The study of Abreu et al., (2025) highlighted a gap to further investigate the nutritional contribution of canteen food to student health. Furthermore, Murphy et al., (2024) urges the need to understand healthy dietary choices in canteen food in schools. The study of Foo & Tan, (2021) also highlighted an assessment of school canteen food quality. Based on the provided arguments, the study aims to further explore the nutritional preferences and perceptions of students in Malaysia, as well as their awareness of canteen food and recommendations for improving it, and its impact on their daily routines, lives, and health.

Literature Review

Food: A fuel for Generations

With the advent of technology, sophisticated practices, enforcement of legal implications, and societal awareness, food hygiene, safety, a sustained supply chain, and easy access to healthy, nutritious food remained a problem. The study Subedi et al., (2025) revealed that food safety is turning into a pandemic as unsafe food caused 600 million cases of disease and 420,000 deaths worldwide. It is further responsible for 30% of deaths among children under five. The study McKay et al., (2025) highlights that one of the most vulnerable groups is students. Foodborne illnesses and deficiencies in necessary nutrients not only impact their health but also their academic performance. The ripple effect of unsafe food extends beyond its impact on academic performance, disrupting the country's economic fabric, as the education sector is one of the most crucial pillars of any nation's infrastructure. The study of Mayer and Harrison, (2012) urges the universities to educate students to learn about food safety and be careful in their dietary selections.

Students can be negatively impacted by the food served in their canteen, which is often high in sugar, calories, and heavily processed, leading to poor eating habits. These poor diets lead to obesity, dental caries, and other metabolic disorders that impact concentration, energy, and cognition, compromising academic achievement. A high content of ultra-processed, sugar-rich foods in school canteens undermines nutritional quality and encourages students toward unhealthy eating habits, resulting in reduced alertness and learning ability. Interventions aimed at improving canteen menus are crucial for safeguarding the physical health and academic performance of students (Abreu *et al.*, 2025).
The food from the canteen has a significant impact on the performance and cognitive development of students, which in turn affects their academic level. The study of An et al., (2025) argues that green, fresh, balanced nutritional food can assist in enhancing cognitive function and promoting well-being. The study Mauramo et al., (2025) further adds that the supply of fresh food not only attracts the eaters but also saves them the hassle of working hours and does not adversely impact their finances. The study of Sakai et al., (2022) observed that most students have unhealthy dietary habits, with excessive drinking of sweetened beverages and instant noodles, and a low consumption of fruits, vegetables, animal protein, and milk. The low nutrient content in canteen menus and the possible nutrient inadequacy of students impact their routines, health, and performance. The study argues that campaigns to combat obesity and promote nutrition education should be implemented to improve students' dietary habits. The canteen food should be further investigated to ensure that students receive the appropriate food, and meanwhile, students should be educated about their nutritional requirements.

Qualitative Methodology

The study employs an exploratory sequential design to investigate the factors influencing the perception of canteen food and its impact on students. To achieve this, the study initiated the first phase, which involved conducting interviews and collecting and analyzing qualitative data, aiming to produce an in-depth understanding of the phenomenon. This phase of qualitative research seeks to identify the major themes, constructs, or variables that will be carried forward into the second phase. Subsequently, a quantitative phase is implemented to extend the qualitative results by using a questionnaire, drawing on knowledge derived from the emergent findings. This two-step process enables theory development first, which is later validated through statistical analysis.

To gather interviews from the students, the study contacted the students in schools in Malaysia. The study attempted to contact 25 students for an interview. However, the saturation point of interviews was reached at 14 interviews. The interviews, on average, took 25 minutes, and students' personal information was not obtained to ensure the anonymity of the data. To ensure the robustness of the study, the students were informed that their participation in the interviews was voluntary, and they had the right to withdraw without any explanation. They were assured that their interview would only be used for research purposes. After the interview process, the interviews are transcribed and recorded in a Word file and analyzed with NVivo 15. The study interviewed 14 students and asked about their perceptions of food hygiene level and their perceptions of canteen food, and the students are mentioned as respondents and referred as (R). The respondents were asked the student about what kind of food they get from canteens, and they mentioned noodles (R3, R8, R9), rice (R4, R9, R11), soups (R1, R5, R8, R13), vegetables (R1, R2) and chicken (R6, R14). Once asked about their preference about canteen food home cooked food. R5, R11, and R12 mentioned bringing food from home but still buying snacks from the canteen. However, most of the students said that they get a variety of food and various options to eat at the canteen, so their preference is always canteen food (R2, R4, R9, R14). While answering the question of their opinion about canteen food safety and quality, R5, R6, and R10 said that quality is not at optimum level; however, when it comes to taste, students rarely care about quality. Some of the students said that canteens couldn't meet extreme hygiene standards because they need to sell food at a cheaper price, and finding quality ingredients at a cheaper price is challenging. (R7, R12). While discussing their uneasiness of food or any feeling of uncomfortable, the student mentioned that they are used to canteen food, but sometimes they get food poisoning, and they are not sure of its causes (R12, R14). However, R2, R5, and R6 mentioned that canteen food is not as healthy as we assume, and we must be careful how much portion we consume and what combination of food we choose. While answering the question about the impact of canteen food on their skills and mental health, the students did not have a clear answer and said they were unsure about it. R7, R8, and R10 highlighted the presentation style of canteen food and explained that

they usually get it in plastic plates or in a paper that they discard after consuming the food. The juices and liquids they normally get come in plastic cups and plastic bags. Answering the question about any potential impacts their parents mentioned, R5 and R12 mentioned that they do not stress much about it and are satisfied that we do not go hungry. However, R2, R6, and R14 mentioned that their parents advised them to buy whatever they felt was fresh and to avoid baked products. Further, R2, R9, R12, and R14 mentioned that they eat along with their friends and keep trying different foods due to them. Students mentioned that they understand the food from canteens is not hygienic, but they are still comfortable with it as they do not find great alternatives (R6, R8, R9). Further, R4, R13, and R15 mentioned that canteen food sellers do not practice hygiene standards and usually do not wear hats or gloves. Somehow, they maintain standards by using forks or knives, but we are unsure whether they follow these practices while preparing food (R1, R4, R10). The students also mentioned that they usually do not witness food sellers in proper chef attire; they seem to wear nice clothes but have food stains on them (R5, R12, R13). About the raw material, cooking oil, and ingredients, students perceive that they might not be of the highest standard. Still, surely it is not the lowest standard as well, and the food looks acceptable, tastes acceptable, and has acceptable spice combinations (R4, R7, R11, R14). While discussing the cleanliness of the canteen kitchen, students mentioned that the area is not very clean as food raw materials or packages are always there (R2, R5, R9). Once the students asked about safe food options, they agreed that having noodles and vegetables is one of the great options, and chickens are not raised on great feed, so it is better to avoid chicken (R6, R8, R9, R14). Further, R1, R4, R5, R11, R13, and R14 mentioned that they regularly buy food from the canteen and do not see any significant bad effects on their health. R5, R9, and R10 mentioned buying fresh vegetables to improve food services, and R11 and R14 agreed that the unsold food should be discarded and that there should be fresh food for them every day. R1, R3, and R8 mentioned that chefs should not use any material or ingredient near its expiry date. R4, R9, and R12 mentioned that the drinks should not have extra sugars, and the food should not be deep-fried. R5 and R7 mentioned that school management should regularly check the canteen kitchens to ensure their standards. Table 1 depicts the key themes of the study. Further, the frequent themes are provided in Figure 1.

Table 1. *Key Themes of Study*

Themes	Codes	Supporting Evidiences
Types of Food at Canteen	Food Variety, Food Options	Students mentioned a range of food such as noodles (R3, R8, R9), rice (R4, R9, R11), soups (R1, R5, R8, R13), vegetables (R1, R2), and chicken (R6, R14).
Preference: Canteen vs Home-Cooked	Home-Cooked Food, Canteen Food Preference	R5, R11, and R12 bring food from home but buy snacks, while R2, R4, R9, and R14 prefer canteen food for its variety.
Food Safety & Quality	Quality of Food, Food Safety Concerns	R5, R6, and R10 report food quality not at optimum levels. R7, R12 mention food hygiene issues due to pricing constraints.

Health and Food Concerns	Food Poisoning, Health Concerns	R12, R14 mention food poisoning incidents without clear causes. R2, R5, and R6 caution about the healthiness of canteen food, emphasizing careful portion and food combination choices.
Impact on Skills & Mental Health	Uncertainty about Impact, Lack of Clarity	Students express uncertainty about how canteen food impacts their skills and mental health.
Presentation & Waste	Food Presentation, Food Waste	R7, R8, and R10 mention food is served on plastic plates or paper that they discard. Juices and liquids are in plastic cups or bags.
Parental Guidance	Parental Advice, Parental Concerns	R5 and R12's parents do not stress much about food, while R2, R6, and R14's parents advise choosing fresh food and avoiding baked products.
Social Influence on Food Choices	Peer Influence, Eating with Friends	R2, R9, R12, and R14 mention eating with friends and trying different foods because of peer influence.
Hygiene of Canteen Staff	Hygiene Standards, Food Sellers' Hygiene	R4, R13, R15 report that food sellers do not wear hats or gloves, and R1, R4, R10 are unsure if hygiene standards are followed during food prep.
Cleanliness of Kitchen	Kitchen Cleanliness, Raw Materials	R2, R5, R9 mention the canteen kitchen is not very clean, with food materials or packaging often left out.
Quality of Ingredients	Ingredient Standards, Cooking Materials	R4, R7, R11, R14 believe ingredients might not be top-tier but are acceptable, and food tastes acceptable.
Safe Food Options	Healthy Food, Safe Food Choices	R6, R8, R9, and R14 agree that noodles and vegetables are safer choices. They avoid chicken due to concerns over feed quality.
Freshness of Food	Fresh Food, Discarding Unsold Food	R11, R14 stress the need to discard unsold food daily to ensure fresh food is available.
Food Preparation Standards	Expiry Date, Ingredient Handling	R1, R3, and R8 emphasize that chefs should avoid using ingredients near their expiry date.
Food Types & Health	Deep-Fried Food, Sugar Content in Drinks	R4, R9, and R12 note drinks should not contain excess sugar, and R4, R9 advocate against deep-fried food.
Canteen Oversight & Monitoring	Canteen Inspections, Management Oversight	R5 and R7 suggest regular checks by school management to maintain standards in the kitchen.

Figure 1. *Illustrates the most frequent words derived from the themes*

Literature Review

Student Awareness

Student awareness is one of the most significant factors that determines the impact of canteen food on their health. Students' understanding of the school canteen food is crucial for improving the quality of the diet they consume and maintaining their health. Canteen food plays a crucial role in the daily food choices of students, influenced by factors such as easy access, peer behavior that urges them to get food from the school canteen, and nutritional knowledge (Ovca *et al.*, 2014). Therefore, educating students about the nutritional value, hygiene status, and health effects of food services at the canteen is not only necessary for them but also increases the value of canteen food, facilitated by parents' trust. Awareness of the advantages of balanced nutrition and the negative impacts of consuming too many processed and high-sugar food options leads students to make better food choices, which in turn results in improved health, lower levels of obesity, and enhanced cognitive function that assist them in improving their academic performance (Feijoo and Moreira, 2020).

Through students' awareness-raising initiatives, they can also influence the school to collaborate with food vendors that provide healthy food, ensuring the provision of nutritious, hygienically prepared meals with optimal portions and reduced fat and sugar content. In this regard, schools can take various measures, such as displaying health posters, conducting quality checks, hosting educational workshops to raise awareness among students, or incorporating nutrition information, promoting healthy food choices, managing food waste, and integrating green practices into the school curriculum (Nanayakkara *et al.*,

2017). These strategies not only increase knowledge but also help foster lifelong healthy eating habits, significantly improving student health and academic performance. Parents' involvement and support are crucial for continuing awareness beyond the school environment. Therefore, the study proposed the following hypothesis.

H1: The student awareness significantly impacts their canteen food consumption.

Student Preferences

The students' consumption of food in a canteen is paving the way for their healthier lives or compromised performance, based on their preferences for canteen food in schools. Therefore, students need to shape their preferences (Conti *et al.*, 2018). Food cravings among students are typically for food that is tasty, fancy, well-presented, convenient, and inexpensive, often high in calories and low in nutritional value, such as fried foods, sweetened drinks, and salty and sweet snacks. Numerous empirical studies have noted this trend, associated with adverse health outcomes such as obesity, metabolic syndrome, and shortfalls in essential nutrients, declining academic performance, and a lack of motivation for active life (Roy *et al.*, 2019).

Foodborne illness or health problems can impact their cognitive skills, such as memory, attention, and information processing, which are essential contributor to their academic success. Furthermore, hunger can lead to a lack of energy, increased absences, and decreased focus in the classroom, all of which may impact student achievement. Conversely, students who show a preference for nutrient-balanced meals containing fruits, vegetables, whole grains, reduced sugar, healthy fats, and lean protein tend to experience improved physical health and enhanced cognitive function (Offei–Ansah, 2012). The student’s preference shapes their canteen food purchase behavior and their consumption pattern, as canteens usually offer balanced food too, but somehow, student preference also impacts their food menu choices. Therefore, the study proposed the following hypothesis.

H2: Student preferences significantly influence the canteen food consumption.

Student Attitude

The student’s attitude is critical in shaping canteen food consumption habits in schools. Favourable canteen attitudes, associated with perceived quality, taste, hygiene, variety, and value for money, lead to greater utilization and consumption of available items by students. However, students can adopt unfavourable attitudes due to doubts regarding nutritional value, food safety, or poor service. They may go to the extreme of avoiding canteen food, opting instead to buy food outside the school or bring it from home. Therefore, canteens should be careful in their servings (Aziz and Dahan, 2013). The literature also

suggests that students' awareness of healthy eating and diet influences their behaviours and attitudes towards canteen food consumption. For instance, many school canteens offer a variety of options, including vegetables, green foods, fried snacks, and meat products, allowing students to make their own choices (Mensink *et al.*, 2012). However, peer influence and the school's social climate alter students' attitudes and influence the food choices they make in the school canteen. Understanding students' attitudes toward canteen food is vital for school administrators and food service program planners in enhancing dietary intake and promoting healthy eating habits among students while they are at school (Murphy *et al.*, 2024). This student awareness can influence canteen food handlers to make menu modifications and promotional efforts that align with students' expectations and preferences, ultimately improving students' academic performance. Therefore, the study proposed the following hypothesis.

H3: Student attitude has a significant influence on canteen food consumption.

Student observation of the service provider

Student observation of service providers in canteens plays a crucial role in the overall dining experience, influencing their satisfaction, trust, and intention to repurchase from the canteens in their schools (Collins *et al.*, 2019). The perception of students regarding the professionalism, level of hygiene maintenance, and efficiency of the canteen staff influences their attitudes and encourages them to continue consuming canteen food. Furthermore, students also perceive how they are being treated, including the manner of canteen staff, such as friendliness, attentiveness, and responsiveness, which shape their perception and impression and influence their comfort level and decision to consume food from the canteen (Czarniecka-Skubina *et al.*, 2020).

Students' perceptions of canteen attendants' dress and hygiene also greatly influence their perceptions of the cleanliness and service quality of meals. A uniform is one way to represent professionalism and cleanliness to students in the school canteens. They view the canteen as a trustworthy and clean place to obtain their meals if those providing the food wear clean, well-presented uniforms, present food in clean dishes, and keep their canteen dust-free (Ji and Ko, 2021).

Other Hygienic habits, such as the usage of gloves, hairnets, and frequent hand washing by canteen staff, are crucial in shared dining environments where health risks can be magnified (Koch *et al.*, 2021). Maintaining strict uniform policies and ensuring high hygiene standards among canteen workers is essential to uphold a good image and encourage students to consume canteen food. Therefore, the study proposed the following hypothesis.

H4: Student observation of the service provider has a significant influence on canteen food consumption.

Food perception of Students

Students' perception of canteen food, in terms of portion size and presentation, has a significant impact on their consumption intentions, which in turn affects their level of satisfaction. Portion size is one of the appealing components for students as young adults, as they consider it a good value for money. The size of the food served should be enough to satisfy students' hunger levels and nutritional requirements at that time (Guha, 2026; Pires *et al.*, 2022). For instance, if students perceive food portion sizes as too small, they may not feel satisfied, remain hungry, and subsequently bring food from home or eat at an alternative location outside of school, thereby reducing their consumption of canteen food. Portion size and the visual appearance of canteen food are essential in making it appealing to students and encouraging them to keep consuming from school canteens (Lorenz *et al.*, 2017). Studies have highlighted that well-organized food is more visually appealing, which in turn makes it more inviting and attractive to consume. Furthermore, the palatability of foods is a crucial factor that can influence students to choose healthier options from the meal line, which increases the consumption of well-balanced meals (Vermote *et al.*, 2018). Having a better understanding of these perceptions enables canteen management to tailor meal options to better meet students' expectations, encourage healthier eating habits, and minimize food waste, ultimately contributing to improved nutritional status and a higher sense of overall well-being for students, which positively impacts their daily life activities and academic performance. Therefore, the study proposed the following hypothesis.

H5: Student food perception has a significant influence on canteen food consumption.

Nutrition Value of Food

Well-balanced nutrition is one of the most significant factors of food. The students' perception of the nutritional value of canteen food and its role in determining consumption and dietary behavior is an essential factor in canteen food consumption, as students are getting more health-conscious. Students who perceive that canteen food is healthy, balanced, and good for their health are more likely to purchase it and are also encouraged by their parents. However, many studies have mentioned that canteen food is often perceived as unhealthy, containing excessive fat or sugar, or lacking essential nutrients (Forrestal *et al.*, 2021; Raviv and Aflalo, 2022). This consumption pattern and buying attitude have several determinants, including access to nutritional information, menu labeling, and inclusion of fruits, vegetables, and whole grains (Li *et al.*, 2022). These perceptions affect not only students' consumption patterns but also the overall effectiveness of school food policies aimed at promoting healthy eating. Therefore, the study argues the following hypothesis.

H6: Nutritional value of food significantly influences canteen food consumption.

Quantitative Methodology

The study distributed 400 questionnaires and received 304 usable questionnaires, which were further processed with the partial least squares structural equation modelling software SmartPLS 4. Out of 400 questionnaires, a few were incorrectly filled out as they followed a sequence and ticked a specific option only. Few questionnaires were half-filled, and a few had ticked two responses to particular questions. To avoid bias issues, the study has eliminated such a questionnaire and does not consider it to proceed with further analysis. The data was obtained from school students in Malaysia and their perceptions about canteen food. The study followed a purposive sampling technique, and the anonymity of respondents was assured (Raza *et al.*, 2024). The data was collected offline from the students, and only school students were considered for survey purposes. To ensure targeted respondents fill the questionnaire, the survey had the filtered questions such as they were asked that are they school students or not. The respondents who disagreed with this filtered question were not considered. For the survey questions, the anonymity of respondents is crucial, and therefore, the survey questions did not include any questions to collect the respondents' personal information.

The respondents mentioned that data is obtained only for academic purposes, and their personal information is not obtained, required, or recorded. They were allowed to withdraw their participation at any time as it was voluntary. The study followed the seven-point Likert scale. The rationale behind using the seven-point Likert scale is its rigor, as the study of Johns, (2010) argues that data accuracy is affected once the Likert scale is chosen below five points or higher than seven points. Before the main data collection, the study initiated a pilot test. The study obtained 25 responses, and Cronbach's alpha value met the threshold (Hair *et al.*, 2020). The pilot testing for this study was conducted by obtaining responses from the students, and the core purpose was to understand whether the specific population fully understood the survey questions. After the pilot testing, the study proceeded with the main data collection. The scope of the study was limited to students in Malaysian schools, and their perception of canteen food was observed.

Results and Analysis

The partial least squares structural equation modelling is utilized for this study as Hair et al., (2019) it is considered good for dealing with complex models. After the pilot testing and ensuring common method bias, the study has assessed the measurement model, structural model, and PLS prediction.

Common method bias

Common method bias strikes a study once the data is collected through a single questionnaire for a complex model. Therefore, it is important to overcome this issue before proceeding further. As per the study of Kock, (2015) if the

variance inflation factor (VIF) is below 3.3, then there is no issue of common method bias. The study ensured the value of VIF below 3.3 as presented in the following table.

Measurement Model

The study's measurement model investigated the composite reliability values, average variance extracted, and data loadings to ensure they met the threshold. Items with loadings below 0.5 can be deleted, but this decision is entirely based on the research context and the researchers' choice. However, it is recommended that the items with lower loadings be deleted if the deletion significantly improves the average variance extracted. The study of Hair et al., (2007) highlights that the values of average variance extracted should be higher than 0.5, and Cronbach's alpha and composite reliability should be more than 0.7. However, Maruf et al., (2021) argues that if composite reliability is adequate, the average variance extracted can be accepted at 0.4 as well. Table 2 depicts the loadings, average variance extracted, Cronbach's alpha, composite reliability, and variance inflation factor.

Table 2. *Measurement Assesments*

		Loadings	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted	VIF
Student Awareness about Canteen Food			0.911	0.913	0.738	
	Awareness 1	0.868				2.603
	Awareness 2	0.879				3.031
	Awareness 3	0.856				2.895
	Awareness 4	0.859				2.862
	Awareness 5	0.832				2.562
Student Preferences			0.898	0.901	0.709	
	Preferences 1	0.843				2.424
	Preferences 2	0.852				2.568
	Preferences 3	0.822				2.178
	Preferences 4	0.83				2.216
	Preferences 5	0.863				2.623
Student Attitude			0.86	0.869	0.602	
	Attitude 1	0.872				3.103
	Attitude 2	0.831				2.48
	Attitude 3	0.851				2.554
	Attitude 4	0.709				1.457
	Attitude 5	0.82				2.393

	Attitude 6	0.513				1.177
Student Observation of Service Provider			0.827	0.856	0.462	
	Observation 1	0.627				2.474
	Observation 2	0.628				2.524
	Observation 3	0.693				1.66
	Observation 4	0.606				2.146
	Observation 5	0.787				1.781
	Observation 6	0.634				2.244
	Observation 7	0.762				1.729
Food Perception			0.909	0.914	0.733	
	Perception 1	0.862				2.553
	Perception 2	0.804				1.96
	Perception 3	0.879				2.837
	Perception 4	0.84				2.515
	Perception 5	0.893				3.094
Nutrition Value of Food			0.821	0.858	0.596	
	N Value 1	0.819				1.872
	N Value 2	0.855				2.253
	N Value 3	0.465				1.17
	N Value 4	0.829				2.066
	N Value 5	0.82				2.026
Canteen Food Consumption by Students			0.891	0.907	0.484	
	Consumption 1	0.68				2.118
	Consumption 2	0.74				2.167
	Consumption 3	0.628				1.861
	Consumption 4	0.518				1.776
	Consumption 5	0.783				2.943
	Consumption 6	0.806				2.919
	Consumption 7	0.809				2.828
	Consumption 8	0.693				2.159
	Consumption 9	0.536				1.714
	Consumption 10	0.68				2.144
	Consumption 11	0.706				2.262

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The analysis was further carried out to assess heterotrait-monotrait ratio (HTMT). The conservative benchmark of HTMT is that values should not exceed 0.9 (Sarstedt *et al.*, 2019). However, the study of Roemer et al., (2021) mentioned that HTMT is context-based and should not follow a conservative benchmark, and it is good to have values close to one. The HTMT values of this study are provided in Table 3.

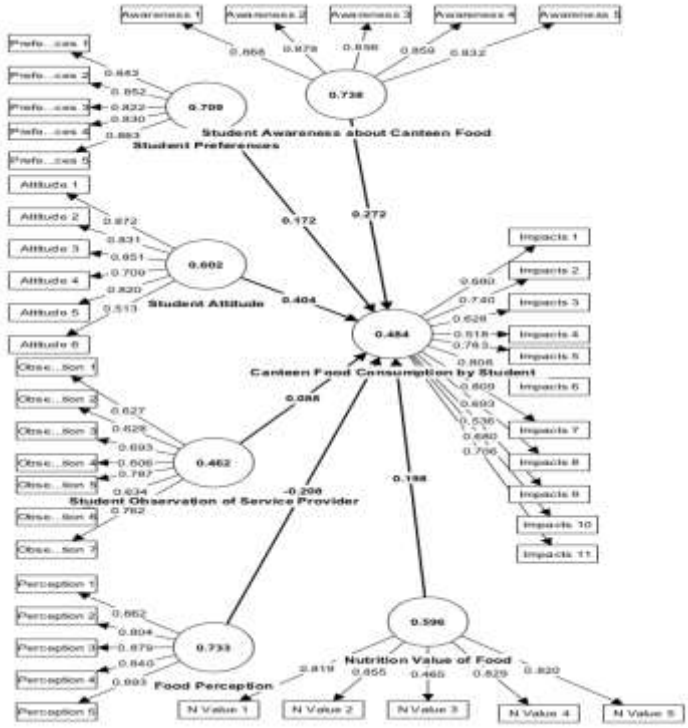
Table 3. *HTMT*

	Canteen Food Consumption by Students	Food Perception	Nutrition Value of Food	Student Attitude	Student Awareness about Canteen Food	Student Observation of Service Provider	Student Preferences
Canteen Food Consumption by Students							
Food Perception	0.633						
Nutrition Value of Food	0.584	0.531					
Student Attitude	0.849	0.853	0.535				
Student Awareness about Canteen Food	0.781	0.84	0.445	0.922			
Student Observation of Service Provider	0.641	0.79	0.528	0.735	0.789		
Student Preferences	0.774	0.832	0.497	0.903	0.901	0.786	

After assessing the HTMT values, the study further investigated the R square value of 0.664. The effect size of food perception is 0.039, nutrition value of food is 0.086, student attitude is 0.125, student awareness about canteen food is 0.051, student observation of service provider is 0.008, and student preference is 0.022 on canteen food impacts on students.

The next phase of the study is to evaluate the predictive relevance of the model. Trough PLS predicts the feature of SmartPLS, the obtained value of Q^2 is 0.639. Values of Q^2 as higher from zero indicate strong predictive relevance of the model. The measurement model is provided in Figure 2.

Figure 2. *Measurement Model of Study*



Structural Model Assessment

After ensuring the measurement model assessment and PLS Predict, the next phase is to test the study's proposed hypotheses, which are as follows. This study obtained mixed results, which are mentioned in Table 3. The study found that H1, H2, H3, H5, and H6 were significant, and H4 was found to be insignificant due to contextual reasons. The details are provided in Table 4.

Table 4. *Hypotheses Testing*

		Original sample	Sample mean	Standard deviation	T statistics	P values
H1	Student awareness about canteen food -> Canteen food consumption by students	0.272	0.27	0.084	3.253	0.001
H2	Student preferences -> Canteen food consumption by students	0.172	0.173	0.08	2.152	0.031
H3	Student attitude -> Canteen food consumption by students	0.404	0.405	0.077	5.224	0
H4	Student observation of service provider -> Canteen food consumption by students	0.088	0.09	0.062	1.424	0.155
H5	Food perception -> Canteen food consumption by students	-0.208	-0.208	0.072	2.891	0.004
H6	Nutrition value of food -> Canteen food consumption by students	0.198	0.199	0.046	4.311	0

Discussion of the Study

School canteens play a crucial role in shaping students' eating habits and overall health. Literature suggests that, despite many school management teams working hard to make the food served in their cafeterias healthier, they often still offer high-fat, high-sugar options that aren't beneficial for students. As students in schools are still young and may not be able to prioritize healthier food, they are becoming obese and suffering from poor nutrition (Decataldo and Fiore, 2018).

In this study, H1 examined student awareness and canteen food consumption, yielding significant results that align with the existing literature (Deksne *et al.*, 2025). As the awareness of students helps them to go for healthier options. The H2 indicated that students' preferences for canteen food consumption were significant, supporting the proposition that students can choose green vegetables even among less and more unhygienic options, and still prefer those with the least impact on their health (Roy *et al.*, 2019). H3 mentioned the relationship between student attitudes towards canteen food consumption, which is also significant, and suggests that students can encourage canteen food handlers to adopt hygienic practices and follow standard health rules to ensure that their food has a positive impact on their health and improves academic performance (Görür and Topalcengiz, 2021). H4 highlights the student's observation of the service provider and their canteen food consumption, and the reasons for such insignificance can be traced in context. The plausible explanation for this is that the students may not observe the service provider as they are not old enough to understand canteen food machinery, and it may not influence their consumption pattern. H5 highlights the food perception that was found to be significant, indicating that if a student perceives the food portion to be sufficient, palatability, presentation, and service are also satisfied, which can improve student consumption of canteen food (Japur and Diez-Garcia, 2010). The H6 highlighted the nutritional value of food and its impacts on consumption, which were found to be significant. It suggests that the nutritional value of food is ultimately beneficial for healthy eaters. If the proportion of nutrients is balanced, it may not only encourage students but also their parents to opt for canteen food, with the belief that it not only satisfies their hunger but also improves their daily lives and academic performance (Watson *et al.*, 2009).

Implications of the Study

From a theoretical perspective, the study contributes to exploring the relationship between the consumption of canteen food and students' health, as well as the effects of students' understanding, preferences, beliefs, and nutritional value on their consumption. Ecological theories can be combined with behavioral aspects to provide a theoretical model. Numerous factors, including individual, interpersonal, and environmental influences, affect students' food choices in school canteens. Personal factors, including taste preferences, consumption habits, and nutritional knowledge, significantly

influence dietary patterns (Abreu *et al.*, 2025). Social factors encompass peer pressure and family attitudes toward students' food choices in the school canteen. Environmental factors include the food available, its presentation, and price, as well as canteen policy. Unfortunately, when it comes to the taste and convenience of food, nutritional value can sometimes be overlooked by students.

The practical aspect of the study that canteen food affects student health could be addressed by implementing specific measures to improve the canteen offerings and the choices students make. School-based programs have the capacity to increase the availability of fruits, vegetables, and low-energy-dense foods in canteens, resulting in lower-energy-dense snacks that are crucial in improving dietary intake and reducing the consumption of unhealthy, energy-dense, nutrient-poor foods (Mohammadi *et al.*, 2020). Educating canteen operators through training in healthy cooking methods and menu planning, as well as subsidizing healthy foods, has a positive effect on the preference for healthy food. It is also essential in increasing student awareness, liking, perception, and knowledge of the nutritional value of food. Nutrition education as part of canteen offerings enables students to make informed food choices, thereby matching their preferences with healthy options (Mensink *et al.*, 2012). Furthermore, obstacles such as cost, taste preferences, and a lack of knowledge about healthy foods can be addressed by engaging school communities, students, canteen staff, teachers, and parents in creating a healthy food environment.

Limitations of the Study

Apart from exploring several avenues in food literature and education, the study provides further avenues for future researchers to explore. The study is limited to students, and additional studies could examine the viewpoints of canteen staff and school management. The study investigated the mixed methodological aspect, and future studies can further validate it in other contexts. The study examined the students' preferences, attitudes, and perceptions, and future studies can further explore the pressures from their peers and parents on their food selection choices. It is worth considering the secondary perspective of data and the inclusion of mediation and moderation in this study.

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