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Awareness of healthy plate and knowledge of healthy eating and their associated factors among adolescents in Kuala Lumpur

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ABSTRACT

Introduction: The Ministry of Health has promoted the Malaysian Healthy Plate initiative to combat obesity, yet its impact on adolescents remains limited. This study aimed to assess adolescents' awareness of the Malaysian Healthy Plate and healthy eating knowledge, as well as their relationships with weight status, physical activity, parental support, peer influence, and social media. **Methods:** A cross-sectional study was conducted among 13–16-year-old students in Cheras, Kuala Lumpur, using self-administered questionnaires including sociodemographic profile, awareness of the Malaysian Healthy Plate, healthy eating knowledge, parental support, peer influence, and social media impact. **Results:** Out of 306 students, 87.6% were aware of the Malaysian Healthy Plate. Using the mean score of 6.81±1.56 out of 10 as the cut-off, nearly two-thirds of the students (63.4%) had good healthy eating knowledge. Two questions that they failed were plate size and water intake. Multiple linear regression showed that higher parental support (β=0.23, 95% *CI*:0.06–0.41, p<0.01) and female gender (β=0.40, 95% *CI*:0.05–0.74, p=0.02) were significantly associated with better healthy eating knowledge. **Conclusion:** Supportive parents improve adolescents' healthy eating knowledge and targeted guidance is needed to ensure the adoption of healthier practices. Future efforts must emphasise proper food portions and the importance of plain water intake with every healthy plate.

Keywords: healthy eating knowledge, healthy plate, parents, peers

INTRODUCTION

The prevalence of overweight and obesity among Malaysian adolescents is a pressing concern, with 16.2% overweight and 14.3% obese as of 2022 (IPH, 2022). Alarmingly, this trend has doubled over the past 26 years, increasing by 0.6% annually. This issue increases the risk of early-onset non-communicable diseases (NCDs), like type 2 diabetes and cardiovascular disease (Chua *et al.*, 2024).

A key strategy to combat obesity is by promoting healthy eating habits through the consumption of a balanced diet that ensures sufficient nutrient intake (IPH, 2020). To practise healthy eating, adolescents must first develop awareness and an accurate understanding of healthy eating principles, including components of a balanced meal and their impact on health. Visual guides like the Malaysian *Suku-Suku-Separuh* (Quarter-Quarter-

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Half) illustrate appropriate portion sizes (NCCFN, 2021). Despite these efforts, the messages appear not to reach all age groups. In Malaysia, only 20.4% of adults were aware of the healthy plate concept in 2019, with 15.9% awareness among 18- and 19-year-olds (IPH, 2020). While similar global data exist, to the best of our knowledge, there is limited information for Malaysian adolescents.

From childhood to adolescence, food literacy evolves as adolescents acquire the skills and knowledge needed to make informed food choices. Healthy eating knowledge emerges later in adolescence after children form their eating habits through sensory experiences and family influences. This knowledge falls under the functional food-related competency where adolescents acquire, comprehend, and apply knowledge on a variety of food and nutrition-related topics (Ares *et al.*, 2024). It is shaped by various factors, including attitudes, practices, sociodemographic characteristics, and food availability, all of which play a crucial role in influencing diet-related behaviours (Ishak *et al.*, 2020). Global studies have revealed varying levels of healthy eating knowledge. In China, 30.99% of adolescents demonstrated good healthy eating knowledge (Wang *et al.*, 2022) compared to 14% in the United Arab Emirates, where none exhibited good knowledge (Al-Yateem & Rossiter, 2017). A study in Sabah found no significant difference in healthy eating knowledge between urban and rural adolescents, with an average score of 18.59 out of 24, reflecting relatively good knowledge (Jeinie *et al.,* 2021). A qualitative study showed that Malaysian adolescents associated healthy eating with balance and moderation (Ishak *et al.*, 2020).

Sociodemographic factors significantly influence healthy eating knowledge, with better scores observed among females (Jeinie *et al.*, 2021), those with a higher socioeconomic status, and those having parents with higher education levels (Delbosq *et al.*, 2022). However, research on parental support, peer influence, and social media remains limited. Parents shape healthy food availability and model adolescents' eating habits (Ishak *et al.*, 2020; Serasinghe *et al.*, 2023). Social media has emerged as a major source of nutrition information, with adolescents preferring registered dietitians over influencers for evidence-based nutrition guidance (Kreft *et al.*, 2023). Peers can also positively reinforce healthy eating behaviours when engaged effectively (Rageliene & Gronhoj, 2020).

Therefore, this study aimed to evaluate the awareness of the healthy plate and knowledge of healthy eating among Malaysian adolescents. Furthermore, it aimed to ascertain the associations between the level of healthy eating knowledge among adolescents and sociodemographic factors, weight status, parental support, peer influence, and social media impact.

METHODOLOGY

Study design

This cross-sectional study was conducted from August to October 2024, involving students from three secondary schools in Cheras. The inclusion criteria were students aged 13 to 16 years old, able to understand the Malay language, and living at home with their parents. The exclusion criteria were absence on the day of data collection, having an active psychiatric illness, including eating disorders or medical conditions that necessitate a special diet, and no parental consent. The minimum calculated sample size was 340 using a single proportion formula (Kish, 1965), with the expected proportion of students with good knowledge at 74% (Hassan, 2015), a level of confidence of 95%, a precision rate of 5%, and a drop-out rate of 15%.

Data collection

Following ethical approval from the Universiti Kebangsaan Malaysia (UKM) Research and Ethics Committee (JEP-2023-930) and the Ministry of Education, the field researcher met with school principals and counsellors to explain the study objectives and procedures. Due to logistic reasons, this study used a convenience sampling method. Depending on the school principals' readiness and students' availability during the data collection period, three secondary schools in Cheras, Kuala Lumpur were selected. The school principals and counsellors selected the classes based on the study criteria. With the assistance of the school counsellors, information sheets and parental consent forms were distributed to all students in the selected classes. On the day of data collection, only students with parental consent gathered in the school hall. They were asked to complete a self-administered questionnaire, which included self-reported height and weight. All completed questionnaires were collected on the same day. Refreshments were provided after the session.

Study instruments

The self-administered questionnaires comprised six sections in the Malay language:

1. Basic information: This section covered the student's profile (age, gender, ethnicity, height, weight, and weekly physical activity) and family's profile (parental marital status, parental level of education, and monthly family income).
2. Awareness of the Malaysian Healthy Plate: This was assessed using a single question, "Are you aware of the Malaysian Healthy Plate?", with 'Yes' and 'No' responses. Participants answering 'Yes' were categorised as having awareness.
3. Knowledge of healthy eating: There were ten questions on food groups, portions, preparation, water intake, and meal timing, with 'correct', 'wrong', and 'do not know' responses. This set was developed based on the National Health and Morbidity Survey 2019 and the Malaysian Dietary Guidelines 2020 (IPH, 2020; NCCFN, 2021). Content validity was performed by two family physicians and a dietitian, requiring minimal grammatical corrections. The questionnaire was tested on 30 adolescents for psychometric testing. The items showed good variation in item difficulty (0.18 to 0.84) and acceptable discriminatory index (>0.21), except for Q5 (0.09) (Lama *et al.*, 2023). All items were retained for variation. The wide range of difficulty levels suggests that the questionnaire provides both easy and challenging items, which is fair for potential respondents in the community. As most items achieved an acceptable discriminant index of >0.21, they were able to differentiate respondents with higher and lower levels of knowledge. Q5 was retained, as it asked about the components of a healthy plate, where the correct answer is the Malaysian Healthy Plate should only be accompanied by a glass of plain water, not other beverages. The questionnaire effectively addressed specific aspects of dietary knowledge, particularly the Malaysian Healthy Plate concept, with an acceptable Cronbach's alpha value of 0.56. Based on Taber (2018), values of 0.45 to 0.98 are regarded as acceptable. In addition, as this questionnaire assesses different aspects of healthy eating knowledge, items may not inherently be correlated, and thus the lower Cronbach's alpha value. Each correct response earned 1 point, while a wrong or 'do not know' response had 0 points. The total score ranged from 0 to 10; students were classified into good and poor knowledge based on the mean of the total score.

4. The Adolescent Food Parenting Questionnaire–Adolescent version (AFPQ-A): This 16-item questionnaire assessed parental support for adolescents' healthy eating, using a five-point Likert scale of "disagree" (1) to "agree" (5). Higher mean scores indicated greater parental support. The internal consistency, Cronbach's alpha coefficients, ranged from 0.74 to 0.85 (Koning *et al.*, 2021). The questionnaire covered five domains:
   a. Autonomy support (four items): facilitation of independence through responsive feeding and praise, associated with healthy eating.
   b. Healthy structure (two items): promotion of food availability and accessibility, associated with healthy eating.
   c. Coercive control (four items): pressure, restriction and emotional feeding, associated with unhealthy eating.
   d. Modelling (two items): demonstration of healthy food choices in front of children, associated with healthier eating. These items were reverse-scored.
   e. Snack structure (five items): non-coercive rules for snack routines and portions, associated with healthier eating. These items were reverse-scored.
5. Support for Healthy Lifestyle Questionnaire (SHeL): This 12-item questionnaire assessed adolescents' perceptions of peer influence and undermining behaviours regarding healthy eating, using a five-point Likert scale of "never" (1) to "always" (5). Higher mean scores indicated stronger peer support. The internal consistency, Cronbach's alpha coefficients, ranged from 0.82 to 0.92 (Biggs *et al.*, 2019). This questionnaire covered two domains:
   a. Peer Healthy Eating Support (seven items) was associated with healthy eating behaviours such as eating habits, fruit and vegetable intake, and intuitive eating.
   b. Peer undermining (four items) was associated with less intuitive eating and greater sedentary activity.
6. Scale of Effects of Social Media on Eating Behaviour Questionnaire (SESMEB): This 18-item questionnaire assessed the impact of social media on adolescents' dietary behaviours, using a five-point Likert scale of "never" (1) to "always" (5). Higher mean scores indicated greater social media impact. The internal consistency, Cronbach's alpha coefficient, was 0.93 (Keser *et al.*, 2020).

All questions underwent a standard forward-backward translation into the Malay language by four individuals who were proficient in Malay and English. Thirty adolescents aged 13 to 17 years were assigned to assess face validity, comprehension, and internal reliability. They reported no difficulty in understanding the questionnaire, with internal consistencies of Cronbach's alpha coefficients ranging from 0.82 to 0.93.

Ethical consideration

The study was approved by the UKM Research and Ethics Committee (JEP-2023-930), the Ministry of Education, the Wilayah Persekutuan Kuala Lumpur Education Department, and principals of the selected schools. All participating students provided parental consent. Permission to use the Adolescent Food Parenting Questionnaire, Support for Healthy Lifestyle Questionnaire, and Scale of Effects of Social Media on Eating Behaviour Questionnaire was obtained from the original authors.

Statistical analysis

Data were analysed using IBM SPSS Statistics for Windows version 30.0 (IBM Corp., Armonk, NY, USA). Descriptive

Table 1. Sociodemographic profiles, weight status, and physical activity of students (*N*=306)

Variables	*Mean±SD*	*n (%)*
Age (years)	15.0±0.9	
Age group (years)		
13		32 (10.5)
14		25 (8.2)
15		159 (51.9)
16		90 (29.4)
Gender		
Female		154 (50.3)
Male		152 (49.7)
Ethnicity		
Malay		216 (70.6)
Chinese		81(26.5)
Indian		5 (1.6)
Others		4 (1.3)
Weight status		
-2*SD* to 1*SD* Normal		200 (65.4)
<-3*SD* Severe thinness		13 (4.2)
<-2*SD* Thinness		27 (8.8)
>1*SD* Overweight		41(13.4)
>2*SD* Obesity		25 (8.2)
Physical activity		
Never		10 (3.3)
Occasional (1-2 times/week)		177 (57.8)
Regular (3-4 times/week)		88 (28.8)
Often (5-6 times/week)		20 (6.5)
Very often (≥7 times/week)		11 (3.6)
Parent's marital status		
Married		255 (83.3)
Divorced/Single parent		51 (16.7)
Father's education level		
Primary school		8 (2.6)
Secondary school		166 (54.3)
Mother's education level		
Primary school		5 (1.6)
Secondary school		148 (48.4)
Higher education		153 (50)
Family income		
Low (<RM5250)		145 (47.4)
Middle (RM5250-RM11819)		140 (45.8)
High (>RM11820)		18 (5.9)

analysis was performed using frequencies and percentages for categorical data and mean for normally distributed numerical data. Simple linear regression was used to examine the relationships between healthy eating knowledge and students' socio-demography, parental support, peer influence, and social media impact. Subsequently, variables with $p<0.25$ were subjected to multiple linear regression analysis, adjusting for potential confounders. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 342 students participated in the study; however, 36 responses were

Table 2. Descriptive analysis of health eating knowledge items

Healthy eating knowledge domain	*Frequency (%)*	
	Yes	*No*
Q1. Fill a quarter plate of rice/ noodles/ bread/ cereals/ cereal or grain products/ tubers/ other carbohydrate sources.	230 (75.2)	76 (24.8)
Q2. Fill a quarter plate of fish/ chicken/ beef/ legumes/ other protein sources.	254 (83.6)	50 (16.4)
Q3. Half of the plate with vegetables and fruits.	258 (84.3)	48 (15.7)
Q4. The size of the Malaysian Healthy Plate is the same for adolescents and adults.	88 (28.8)	218 (71.2)
Q5. Malaysian Healthy Plate can be completed with plain water or any type of drink.	193 (63.1)	103 (36.9)
Q6. The best methods for food preparation include steaming, baking, boiling, and grilling.	185 (60.7)	120 (39.3)
Q7. Consume 3 healthy and balanced main meals every day.	262 (85.6)	44 (14.4)
Q8. Avoid taking any snacks between main meals.	219 (71.6)	87 (28.4)
Q9. Malaysian Healthy Plate assists you in consuming the crucial food components that are needed every day.	262 (85.6)	44 (14.4)
Q10. Drink 8 glasses of plain water in a day.	271 (88.6)	35 (11.4)

excluded due to incomplete answers, making the response rate 89.5%. Table 1 summarises the profiles of the 306 students subjected to the analysis. The mean age was 15.0±0.9 years, with almost equal proportions of males and females. Most students were Malays (70.6%) and stayed with married parents (83.3%). About half of their parents had tertiary education (fathers: 43.1% and mothers: 50.0%) and were from families with a total monthly income of ≤ RM5250 (47.4%).

Weight status was defined using body mass index-z score (WHO, 2007), with 65.4% of students having normal weight, 13.4% overweight, and 8.2% obese. Only about 38.9% practised regular physical activity more than twice weekly.

Awareness of healthy plate and knowledge of healthy eating

The majority of students (*n*=268, 87.6%) were aware of the Malaysian Healthy Plate. From the ten questions on knowledge, the mean total score was 6.81±1.56. In a more detailed assessment of the ten questions (Table 2), the majority (60.7% to 88.6%) were correct on food groups, portions, preparation, meal timing, and water intake, except for two questions. Only 28.8% of students knew that their plate size is similar to adults, and 36.9% knew that a healthy plate is to be completed with plain water.

Parental support, peer influence, and social media impact on healthy eating

Table 3 summarises the students' scores for the Adolescent Food Parenting Questionnaire (AFPQ-A), the Support for Healthy Lifestyle Questionnaire (SHeL), and the Scale of Effects of Social Media on Eating Behaviour Questionnaire (SESMEB). The mean parental support score was 3.36±0.39. Among the sub-domains, healthy structure (3.87±0.81) and modelling (3.87±0.84) scored highest, indicating strong parental support in maintaining structured and positive dietary habits. Using the mean as a cut-off, 85.6% (*n*=262) had good parental support (mean scores ≥3) and 14.4%

(*n*=44) had poor support (mean scores <3). The mean peer influence score was 3.34±0.50, with 78.4% (*n*=240) having a high peer influence (mean scores ≥3) and 21.6% (*n*=66) having a low influence (mean scores <3). The mean social media impact score was 2.61±0.69, with 26.8% (*n*=82) having a high social media impact (mean scores ≥3) and 73.2% (*n*=224) having a low impact.

Table 3. Questionnaires mean of domains and categories

Variables	*Mean±SD*
Parental support	
Autonomy support	3.83±0.75
Healthy structure	3.87±0.81
Coercive control	2.96±0.78
Snack structure	2.77±0.75
Modelling	3.87±0.84
Mean score	3.36±0.39
Peer influence	
Peer healthy eating	3.40±0.78
Peer undermining	3.25±0.66
Mean score	3.34±0.50
Social media impact	2.61±0.69

Factors associated with knowledge of healthy eating

Table 4 shows the results of the regression analyses. In simple linear regression, gender, parental support, and peer influence were significantly associated with healthy eating knowledge. Higher knowledge scores were associated with female students (β=0.41, 95% *CI*:0.07–0.76, p=0.02), having higher parental support (β=0.26, 95% *CI*:0.08–0.43, p<0.01), and higher peer influence (β=0.21, 95% *CI*:0.04–0.39, p=0.02).

Variables with p<0.25 were subjected to multiple linear regression analysis using the backward method. The analysis met assumptions for linearity, normality of residuals, and homoscedasticity with variance inflation factor (VIF) values ranging from 1.01 to 2.88. The model explained 5.6% of the variance in healthy eating knowledge. Female gender (β=0.40, 95% *CI*:0.05–0.74, p=0.02) and higher parental support (β=0.23, 95% *CI*:0.06–0.41, p<0.01) continued to be associated with higher knowledge scores. No significant associations were observed for age, weight status, physical activity, parental education, family income, peer influence, or social media impact.

DISCUSSION

The Malaysian Healthy Plate (*Suku-Suku-Separuh)* was first introduced in 2016 and was actively promoted by the Ministry of Health Malaysia. It is motivating to find that the campaign has reached young people, where 87.6% of students were aware of the Malaysian Healthy Plate, a much higher rate than the 20.4% awareness among adults in 2019 (IPH, 2020). Additionally, the students showed high healthy eating knowledge, with nearly two-thirds scoring 7 and above, surpassing findings from other studies, which ranged between 14% and 54.6% (Al-Yateem & Rossiter, 2017; Wang *et al.*, 2022). These results highlight the beneficial impact of national nutrition campaigns, including school-based interventions like the Healthy Meal Programme (HiTS) (MOH 2019). This aligns with Malaysia's National Plan of Action for Nutrition III 2016-2025, which aims to promote healthy eating and monitor school food environments (NCCFN, 2016). This positive impact was also indirectly reflected in weight distribution, with 65.4% maintaining a normal weight, with only 13.4% overweight and 8.2% obese, compared to prevalences in the recent National Adolescent Health Survey in 2022 of 61.2%, 16.4%, and 14.3%, respectively (IPH, 2022).

Most students accurately identified the food groups, portion sizes, preparation methods, meal timing, and water intake, except for plate size and the need for plain water as part of a healthy plate. For improvement, adolescents should use the same standard 10-inch

Table 4. Simple and multiple linear regression analyses of factors associated with healthy eating knowledge

Variables	*Simple linear regression*		*Multiple linear regression*	
	β (95% CI)	*p-value*	*β (95% CI)*	*p-value*
Gender				
Female [Male]	0.41 (0.07, 0.76)	0.02*	0.40 (0.05, 0.74)	0.02*
Ethnicity				
Others [Malay]	-0.01 (-0.40, 0.38)	0.96	-0.32 (-0.76, 0.13)	0.17
Age (years)				
14 [13]	0.07 (-0.75, 0.88)	0.88	0.07 (-0.73, 0.88)	0.86
15 [13]	0.56 (-0.03, 1.16)	0.06	0.50 (-0.08, 1.08)	0.09
16 [13]	0.46 (-0.17, 1.09)	0.15	0.49 (-0.13, 1.10)	0.12
Weight status				
Thin [Normal]	-0.42 (-0.95, 0.12)	0.12	-0.35 (-0.88, 0.18)	0.20
Overweight & obese [Normal]	-0.36 (-0.79, 0.07)	0.10	-0.25 (-0.70, 0.20)	0.28
Physical activity				
> 2 times/week [≤ 2 times/week]	-0.10 (-0.46, 0.26)	0.60	-0.12 (-0.42, 0.39)	0.95
Parents' marital status				
Divorced/Single parent [Married]	-0.10 (-0.57, 0.37)	0.68	-0.15 (-0.66, 0.35)	0.55
Father's education level				
Tertiary [Secondary/Lower]	-0.17 (-0.52, 0.19)	0.35	-0.38 (-0.82, 0.68)	0.10
Mother's education level				
Tertiary [Secondary/Lower]	0.05 (-0.31, 0.40)	0.80	0.16 (-0.28, 0.59)	0.48
Family income				
> RM5250 [≤RM5250]	0.15 (-0.21, 0.49)	0.42	0.19 (-0.22, 0.59)	0.36
Parental support	0.26 (0.08, 0.43)	<0.01**	0.23 (0.06, 0.41)	<0.01**
Peer influence	0.21 (0.04, 0.39)	0.02*	0.11 (-0.09, 0.31)	0.29
Social media impact	0.01 (-0.17, 0.18)	0.93	-0.03 (-0.21, 0.15)	0.75

*p<0.05; **p<0.01

plate as adults to ensure sufficient nutrient intake as required by their bodies. Another point for improvement is daily water intake. Although most students knew that eight glasses of plain water daily are recommended, many failed to recognise that a healthy plate needs to be accompanied by plain water and not any type of beverage (NCCFN, 2021). This must be corrected, as excessive consumption of sugar-sweetened beverages such as fruit juices and carbonated beverages is associated with significant sugar spikes that are detrimental to health, resulting in metabolic complications (Calcaterra *et al.,* 2023).

Two factors were significantly associated with high knowledge of healthy eating – female gender and parental support. Female students exhibited better nutrition knowledge than male students, consistent with previous studies (Jeinie *et al.*, 2021). This was most likely due to female students' greater interest in nutrition, motivation to change eating habits, and critical analysis of nutritional information while engaging in health-promoting activities (Bookari, 2023).

While knowledge develops during adolescence, parental influence significantly shapes eating habits during childhood (Ares *et al.*, 2023). Parents share information and discuss food and nutrition with their children, thereby influencing children's healthy eating knowledge (Zarnowiecki *et al.*, 2012).

Parental support encompasses three main domains, including structure, autonomy support, and coercive control. Structure includes creating healthy routines like ensuring food availability, accessibility, and preparation, modelling healthy consumption, and implementing snack-related rules. Autonomy support covers healthy eating education, child participation, encouragement, and reasoning. Restrictions, dietary pressure, threats, and the use of food to control negative emotions are examples of coercive control techniques (Vaugh *et al.*, 2016). In this study, autonomy support, healthy structure, and modelling were scored high by the students. Ensuring healthy food availability and accessibility, along with the freedom to choose such foods, will positively impact healthy food practices (Serasinghe *et al.*, 2023). Conversely, coercive control and strict snack structure scored low, indicating excessive parental restriction could negatively affect children's social and emotional acceptance of food (Norton *et al.*, 2023).

This study did not show any significant influence of peer support and social media impact with healthy eating knowledge. Although both may influence adolescents' eating practices outside the home, parents remain the most common and reliable source of healthy eating knowledge, and family is still the main driver of adolescents' eating practices (Fleming *et al.*, 2020). The lack of social media impact could be due to adolescents' usage patterns. Instead of engaging in diet-related content, most use social media for self-expression, entertainment, curiosity, and connection with others (Romero *et al.,* 2022). Although literature has shown that frequent use of social media for healthy lifestyle information improves health and food literacy, it didn't always translate into better health knowledge (Sercu, 2024). Additionally, much of the content may be centred on *"good food"* and *"healthy cooking"*, which overlooked other key knowledge domains assessed in our study. These findings suggest that social media promotes individual processing of health information, rather than interactive learning, and its role in building actual health knowledge is limited (Sercu, 2024).

In this study, age had no significant relationship with healthy eating knowledge, likely due to equal access to school-based nutrition intervention programmes like the Healthy Meal Programme (HiTS) (MOH, 2019). Similarly, physical activity was not linked to better knowledge, as adolescents engage in physical activity for body image rather than health awareness (Fleming *et al.,* 2020). Other non-significant factors were parental education and family income. While evidence has suggested that higher income and education are associated with better healthy eating knowledge (Delbosq *et al.*, 2022), this study highlighted other factors at play. Regardless of their parental socioeconomic and education status, information on healthy eating seems to have reached students through widespread media coverage and national health campaigns.

The absence of peer and social media influences highlights the continued primacy of family and school in shaping adolescents' dietary knowledge. Parental engagement through school-based education sessions and healthy eating campaigns can reinforce healthy eating practices. Schools remain the primary platform for healthy eating education, integrating practical activities like student-led health clubs, cooking classes, and plate demonstrations for all students. In addition, peer and social media channels should be strategically used to introduce youth-friendly digital campaigns and training in digital health literacy so that adolescents can better navigate online content and resist unhealthy marketing. Building partnerships between schools, parents, and media platforms can also create

a supportive ecosystem that sustains healthy eating knowledge and practices.

This study is one of the early efforts to examine adolescents' awareness of the Malaysian Healthy Plate concept, contributing valuable insights to the body of scientific knowledge. A key strength is the balanced gender distribution of participants, which strengthened the association between gender and healthy eating knowledge. However, this study had several limitations. Convenience sampling inadvertently introduced biases, as permission was dependent on the Ministry of Education, while student selection was determined by schools. Self-reported height and weight may have introduced recall bias. Finally, this study involved three schools in an urban area, which may not be fully representative of national schools.

CONCLUSION

This study demonstrated that many adolescents were aware of the Malaysian Healthy Plate and had good healthy eating knowledge. However, emphasis is needed on using the same plate size as adults and accompanying meals with plain water. Having high parental support and being female were significantly associated with higher levels of healthy eating knowledge. Parents play a crucial role in bridging knowledge gaps, particularly among male adolescents, by promoting healthy eating and teaching practical skills like meal planning, portion control, and making informed food choices. Targeted guidance is needed to ensure both genders have equal opportunities to make healthier food choices and practices.

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Authors' contributions

Loo SY, conceived and designed the study, conducted data collection, drafted the initial manuscript; Noor Azimah M, conceived and designed the study and edited the final version of the manuscript; Amir ZA, analysed the data. All authors approved the final version of the manuscript.

Conflict of interest

The authors declare no conflicts of interest.

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