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Dietary intake, diet quality and nutritional status of homeless children: A cross-sectional study

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ABSTRACT

Introduction: The increasing number of homeless children is concerning. This study aimed to assess the dietary intake, diet quality, and nutritional status of homeless children in Klang Valley, as well as the relationship between diet quality and nutritional status. **Methods:** Approximately 120 homeless children aged 7 to 12 years from four locations in Klang Valley were enrolled. Their dietary intake and nutritional status were assessed using a two-day 24-hour dietary recall and body mass index-for-age, respectively. The Healthy Eating Index (HEI) was used to examine diet quality. **Results:** Prevalence of normal weight respondents was 58.3% (mean±*SD*: -0.79±1.80), with 25.0% classified as moderately and severely thin. Mean energy intake was significantly lower than recommended nutrient intakes (RNI) (p<0.050), while protein intake was higher (p<0.050). Calcium and zinc intakes were also significantly lower (p<0.001). Boys aged 7-9 years had significantly higher iron intake (median=11.6, IQR=8.7 mg, p=0.003), whereas girls aged 10-12 years had significantly lower intakes of iron (mean±*SD*=11.4±5.1, 11.1±4.7) and vitamin A (median=416.6, IQR=450.4 µgRE, p<0.001 for both). Mean HEI score was 51.30±6.78, indicating a need for diet quality improvement. No significant association between diet quality and nutritional status was observed (p=0.380). **Conclusion:** This study provided insights into dietary intake, diet quality, and nutritional status of homeless children. Further research is vital to shape evidence-based nutrition interventions.

Keywords: dietary intake, diet quality, homeless children, Malaysia, nutritional status

INTRODUCTION

Malnutrition remains a significant issue among children in developing countries, including Malaysia. It is a risk factor for chronic diseases in adulthood (Grey *et al.,* 2021). Thus, assessing children's dietary intake and diet quality is vital for policy transition. Diet quality indicators

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are associated with chronic diseases and impact health and nutritional status (Kennedy *et al.,* 1995); they are useful to identify nutritional risks and offer interventions for improving nutrient intakes and nutritional status.

Proper nutrition is crucial for children's growth, physical, and psychological development (Meli *et al.,* 2023). However, diet quality research among Malaysian children, particularly the homeless, is limited (Ihab *et al.,* 2012; Ali *et al.,* 2020). Studies in Southeast Asia highlighted similar gaps where vulnerable populations, including homeless children, are underrepresented (Jasni *et al.,* 2022). Previous studies showed homeless children to be at higher risks for malnutrition and related health problems (Haskett, Armstrong & Tisdale, 2016). Comprehensive dietary assessments among this group are sparse, largely due to challenges in data collection from this transient demographic (Lee & Siew, 2023). Issues include mistrust, logistical difficulties, and lack of consistent contact information or fixed addresses. This lack of research prevents effective interventions to address the nutritional vulnerability of homeless children, who face greater rates of developmental delays and behavioural health problems due to starvation and insufficient food intake (Haskett *et al.*, 2016).

The number of homeless children in Malaysia, especially in metropolitan areas like Klang Valley, is increasing. In Kuala Lumpur, a 2017 count identified 15 children among 1,037 homeless individuals, about 1.4% of the homeless population (Dietrich, 2018). Kuala Lumpur City Council data from 2016 noted the presence of children among the estimated 1,500 to 2,000 homeless individuals (Li, 2018). This increase highlights a pressing issue, extending to adjoining cities and towns in Selangor (Irsyad, 2016). In response, the Malaysian government launched initiatives such as temporary shelters, welfare schools, and humanitarian groups. However, undernutrition remains prevalent among homeless children (Rahman & Hakim, 2016). A prior study found that 21% of disadvantaged, homeless children and adolescents in a Kuala Lumpur welfare home were underweight (Chee, Yap & Siti Sabariah, 2008). This study aimed to fill these gaps by providing insights into the dietary components of homeless children, examining the relationship between diet quality and nutritional outcomes. This study is aligned with the Nutrition Research Priorities (NRP) in the 12th Malaysia Plan (2021-2025), addressing the marginalised group of homeless children and contributing to the critical research needs in the top priority area of NRP's maternal, infant, and young child nutrition.

MATERIALS AND METHODS

Study population and design

This cross-sectional study was conducted between July and August 2018 in Klang Valley, Malaysia. Sample size calculation using the Cochrane formula with a 35% prevalence rate for poor diet quality from Ihab (2012), 92% confidence level with ± 8% precision, and $Z^{2}\frac{\alpha}{2}$ = 1.75 resulted in 109 participants. A total of 120 participants were recruited to account for 10% attrition. To address the mobility and distribution of the homeless population, we used both simple random sampling and cluster sampling methods. We first randomly selected 4 out of 14 centre points and enrolled 120 homeless children aged 7 to 12 years from these locations as shown in Figure 1. Eligible participants were registered with an organisation and resided in a fixed building, excluding those bedridden, physically disabled, or mentally impaired. Verbal and written consent were obtained from parents

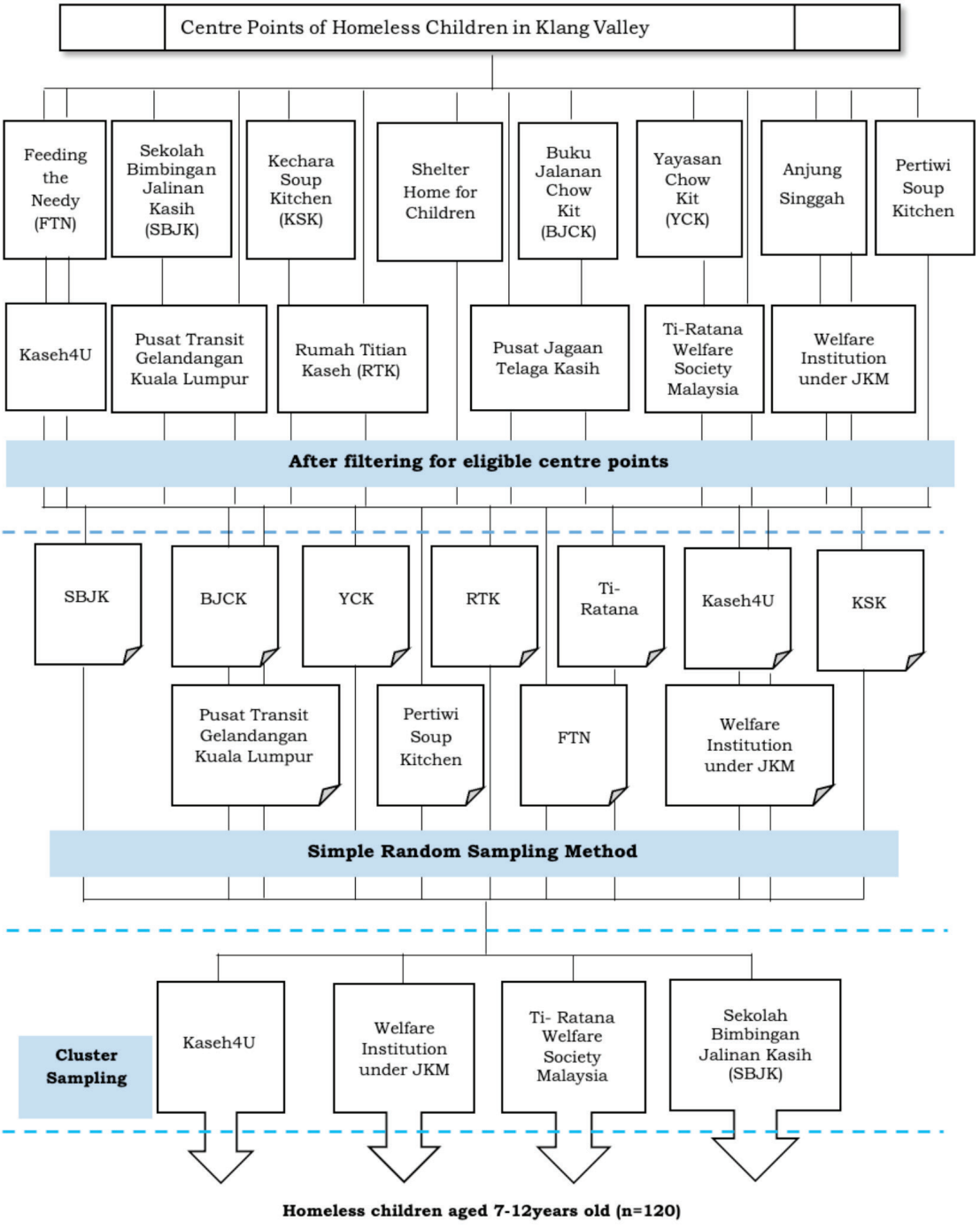

Figure 1. Sampling framework of the study

or guardians. The study was approved by Universiti Malaysia Terengganu's Human Ethics Committee (UMT/JKEPM/2018/25) and permissions were granted by relevant authorities, i.e. Ministry of Education [reference number KPM.600-3/2/3-eras(985)], Education Department of the Federal Territory of Kuala Lumpur (reference number JPNWP.900-6/1/7), and Social Welfare Department (reference number JKMM100/12/5/2:2018/286).

Research instruments

An interviewer-administered survey questionnaire was employed and the questions were answered by the participating children with the assistance of their parents or guardians. The questionnaire was divided into three sections: (i) socio-demographic, economic, and health profiles; (ii) assessments of dietary intake and diet quality; and (iii) assessment of nutritional status via anthropometric measurements.

Socio-demographic, economic, and health profiles

Date of birth, age, gender, citizenship, number of siblings, parents' employment statuses, monthly household income, financial support and food assistance statuses, length of homelessness, perception of current living, daily meal eating frequency, and sources of food intake were included in this part.

Dietary intake

A two-day 24-hour dietary recall adapted from the Malaysian Adult Nutrition Survey 2014 (IPH, 2014) was used to estimate respondents' dietary intakes. The children were asked to recall all foods and beverages consumed in the preceding 24 hours for one weekend and one weekday, respectively. The Malaysian Food Album (MOH, 2011) was used to assist respondents in recalling the names and the amount of foods and drinks they have consumed. The food album contained photographs of foods and drinks, as well as household measurements such as cups and tablespoons. The two-day recall method was chosen to capture potential variations in dietary patterns, thereby improving the accuracy of the dietary assessment (Thompson & Subar, 2001). The 24-hour recall was used to calculate total energy consumption, as well as intakes of macronutrients and selected micronutrients such as calcium, iron, zinc, and vitamin A. These micronutrients were selected based on their known deficiencies in other studies done on homeless populations (Chee *et al.,* 2008; Rahman & Hakim, 2016). The Nutritionist Pro™ Diet Analysis software version 5.3.0 (Axxya Systems LLC, Redmond, Washington, USA) was used to calculate total energy and nutrient consumption. Respondents' nutrient intakes were calculated based on food databases such as the Malaysian Food Composition Database (https://myfcd.moh.gov.my/) and the Malaysian Food Album (MOH, 2011). Food nutrition labelling was also referred. The daily energy, macronutrient, and micronutrient intakes of respondents were calculated and compared to the Recommended Nutrient Intakes (RNI) (NCCFN, 2017).

Healthy Eating Index score

The Healthy Eating Index (HEI) was adapted using the Malaysian Dietary Guidelines for Children and Adolescents (NCCFN, 2014) and included ten components: grains, vegetables, fruits, dairy, meat, total fat, saturated fat, cholesterol, sodium, and variety (Kennedy *et al.,* 1995). Adequacy components (1-5) were scored based on actual vs. recommended servings, while

Table 1. Socio-demographic, economic, and health characteristics of respondents (*n*=120)

Variables	*n (%)*	*Mean±SD / Median (IQR)*
Gender		
Male	55 (45.8)	
Female	65 (54.2)	
Age (in years)		9 (3.0)
7–9	62 (51.7)	
10–12	58 (48.3)	
Citizenship		
Malaysian	77 (64.2)	
Non-Malaysian	18 (15.0)	
Stateless	25 (20.8)	
Number of siblings		
<2	13 (10.8)	
2–5	83 (69.2)	
>5	24 (20.0)	
Father's employment status †		
Yes	56 (86.2)	
No	9 (13.8)	
Mothers's employment status ††		
Yes	41 (56.2)	
No	32 (43.8)	
Monthly household income (MYR)		
<500	13 (10.8)	
501–1000	47 (39.2)	
1001–1500	21 (17.5)	
>1500	39 (32.5)	
Have started menstrual cycle (An additional question for female respondents) †		
Yes	8 (12.3)	
No	57 (87.7)	
Financial support receiver		
Yes	71 (59.2)	
No	49 (40.8)	
Food aid receiver		
Yes	117 (97.5)	
No	3 (2.5)	
Current home		
Purpose built flat	33 (27.5)	
Emergency shelter	36 (30.0)	
Abandoned building	0 (0.0)	
Dwelling with business premises	0 (0.0)	
Vehicle	0 (0.0)	
Shop house	34 (28.3)	
Others	17 (14.2)	

Table 1. Socio-demographic, economic, and health characteristics of respondents (*n*=120) *(continued)*

Variables	*n (%)*	*Mean±SD / Median (IQR)*
Duration of being homeless		
<1 year	4 (3.3)	
1–5 years	53 (44.2)	
6–10 years	55 (45.8)	
>10 years	8 (6.7)	
Current life satisfaction		
Extremely dissatisfied	1 (0.8)	
Dissatisfied	27 (22.5)	
Neutral	19 (15.8)	
Satisfied	70 (58.3)	
Extremely satisfied	3 (2.5)	
Daily meal eating frequency		
1–2 times	5 (4.2)	
3–4 times	94 (78.3)	
>4 times	21 (17.5)	
Usual food sources[§]		
Cook at home	91 (26.2)	
Food stalls or hawker centres	45 (13.0)	
Schools	117 (33.7)	
Day care centres	19 (5.5)	
Friends or relatives	4 (1.2)	
Restaurants/Cafeterias/Fast food restaurants	16 (4.6)	
Soup kitchen or other NGOs	55 (15.9)	
BMI-for-age		-0.79±1.80
Severely thinness (-3SD)	13 (10.8)	-3.86±1.00
Moderately thinness (-3 to -2SD)	17 (14.2)	-2.53±0.22
Normal (-2 to 1SD)	70 (58.3)	-0.58±0.82
Overweight (1 to 2SD)	11 (9.2)	1.55±0.26
Obesity (2SD)	9 (7.5)	2.34±0.28

MYR: Malaysian Ringgit; BMI: Body mass index; NGO: Non-government organisations: IQR: Interquartile range; SD: Standard deviation

[†]A total of 65 respondents answered the question

[††]A total of 73 respondents answered the question

[§]A total of 347 responses received from all 120 respondents, with some of them expressing more than one response

higher intakes of components (6-9) led to lower scores. Dietary variety was assessed by the number of different food items consumed, with scores ranging from 0 to 10. A total HEI score of 80+ was good, 51-80 needed improvement, and <51 was poor.

Anthropometric measurements

The children's body height and weight were measured to the nearest 0.1 cm and 0.1 kg, respectively, using a portable stadiometer (SECA 225, Hamburg, Germany) and an electronic weighing scale (Tanita Bioelectrical Impedance

Analysis BC-541, Japan). Respondents were measured while dressed casually and without shoes. Measurements were taken twice by a trained researcher and the average value was taken as final. Data were analysed using the World Health Organization (WHO) Anthro software (version 3.2.2, 2011: Geneva: WHO) via calculation of the children's body mass index (BMI)-for-age in z-score. The WHO growth chart cut-off points were used to interpret BMI-for-age (WHO, 2007).

Data analysis

IBM SPSS Statistics for Windows version 27.0 (IBM Corporation, Armonk, New York, USA) was used for data analysis, including normality tests. One-sample *t*-test or Wilcoxon signed-rank test was performed to evaluate if total energy, macronutrient, and micronutrient intakes differed statistically from the RNI. Pearson's correlation test was used to analyse the relationship between total HEI scores and BMI, significant at $p<0.05$ and $p<0.01$.

RESULTS

Socio-demographic characteristics

Table 1 showed that 54.2% of the 120 respondents were females and 45.8% males. Most (51.7%) were aged 7-9 years. The majority were Malaysians (64.2%), while 15% were from neighbouring countries and 20.8% were stateless. About 50.0% had a household income below MYR1000 and one-third lived in emergency shelters, mostly for 1-2 years. Half of the respondents were of normal weight; 25.0% were thin and 16.7% were overweight or obese.

Total energy, macronutrient, and selected micronutrient intakes

As shown in Table 2, the average energy intake of respondents was significantly lower than the recommended levels ($p<0.050$), except for boys aged 7-9 years (median=1212kcal, IQR=697 kcal, $p=0.080$). Boys aged 10-12 years consumed 1301±477 kcal ($p=0.002$), while girls aged 7-9 and 10-12 years consumed 1077±342 kcal ($p<0.001$) and 1324 (282) kcal ($p=0.002$), respectively. Protein intake was higher than required, while carbohydrates intake was not significantly different. Intakes of calcium, zinc, and iron (for non-menstruating and menstruating females) were considerably lower than recommendations ($p<0.050$). Vitamin A intake was significantly lower in girls aged 10-12 years ($p<0.001$).

Healthy Eating Index score

Table 3 showed a mean HEI score of 51.30±6.78, indicating poor diet quality among homeless children. Table 4 revealed that 55% of respondents needed to improve their diet quality, while the rest had poor diet quality. High saturated fat intake, linked to higher protein sources like red meat and poultry skin, was noted. The median score for food variety was low at 2.00 (3.00). HEI components needing improvement included vegetables, fruits, milk and dairy products, and dietary diversity. Median scores for grains (7.27), vegetables (2.32), fruits (0.35), and milk/dairy (1.04) were below dietary guidelines recommendations.

Relationship between diet quality and nutritional status among homeless children

Pearson's correlation analysis showed no significant ($p=0.380$) relationship between diet quality and nutritional status among homeless children (Table 4). Additionally, this meant that the BMI of homeless children was not an accurate reflection of the quality of their nutrition.

Table 2. Distribution of total energy, macronutrient, and selected micronutrient intakes of respondents

Nutrients	*Boys (n=55)*			*Girls (n=65)*		
	RNI	*Average Intake*	*p-value*	*RNI*	*Average Intake*	*p-value*
Energy (kcal)						
7-9 years	1530	1212 (697)††	0.080	1410	1077±342[a]	<0.001*
10-12 years	1690	1301±477†	0.002*	1500	1324 (282)††	0.002*
Carbohydrates (%)						
7-9 years	55	56.1±9.1†	0.479	55	53.6 (8.3)††	0.177
10-12 years	55	55.5±6.2†	0.703	55	57.5±8.1†	0.093
Fat (%)						
7-9 years	30	26.9±5.7†	0.002*	30	28.9±5.9†	0.274
10-12 years	30	28.1±5.7†	0.154	30	25.9±5.9†	0.001*
Protein (%)						
7-9 years	15	17.0 (4.6)††	0.010*	15	17.1±4.7†	0.013*
10-12 years	15	15.6 (2.5)††	0.295	15	16.6±3.5†	0.016*
Calcium (mg)						
7-9 years	1000	257.8±131.3†	<0.001*	1000	222.9 (160.5)††	<0.001*
10-12 years	1300	239.1±84.9†	<0.001*	1300	238.0 (239.1)††	<0.001*
Zinc (mg)						
7-9 years	5.7	4.7±1.9†	0.004*	5.6	2.7 (1.6)††	<0.001*
10-12 years	7.0	3.3±1.3†	<0.001*	6.3	3.6 (2.3)††	<0.001*
Iron (mg)						
7-9 years	9	11.6 (8.7)††	0.003*	9	9.9 (6.5)††	0.174
10-12 years	15	12.6 (8.8)††	0.218	14 (nm)	11.4±5.1†	0.022*
				33 (m)	11.1±4.7†	<0.001*
Vitamin A (µgRE)						
7-9 years	500	536.0±285.9†	0.462	500	437.6±229.9†	0.123
10-12 years	600	601.7±342.3†	0.983	600	416.6 (450.4)††	<0.001*

Data are presented in mean±*SD* or median(IQR)
Kcal: calorie; mg: milligram; µgRE: µg all-trans retinol; nm: non-menstruating, m: menstruating
†One sample *t*-test was used; ††Wilcoxon Signed-Rank test was used
*significantly different at $p<0.05$

DISCUSSION

This study examined the dietary intake, diet quality, and nutritional status of homeless children in Malaysia. Despite 70.3% of parents having jobs, many were classified as poor, relying on financial (59.2%) and food aids (97.5%) to access three to four meals daily (78.3%). Although earlier research found high energy intakes among homeless groups (Koh *et al.,* 2012), Malaysian studies showed that low-income households often consumed less energy (Mohd Shariff *et al.,* 2015; Poh *et al.,* 2013), possibly due to economic constraints (Rahman & Hakim, 2016). Protein-energy malnutrition (PEM) remains a concern (Ubesie & Ibeziakor, 2012), but Malaysian children met the RNI for protein, likely due to welfare provisions (Pelham-Burn *et al.,* 2014). Calcium intake was adequate for homeless children, aligning with Western studies on nutrition (Seale, Fallaize & Lovegrove, 2016), but low calcium intake in Malaysian children is a broader issue (Poh *et al.,* 2013). Despite

Table 3. Average score for Healthy Eating Index (HEI) components and total scores (*n*=120)

HEI Components	*Possible range of score*	*HEI scoring criteria*		*Average score*
		Requirement for minimum score of 0	*Requirement for maximum score of 10*	
Grains	0 – 10	0	4 – 5 servings	7.27 (4.21)
Vegetables	0 – 10	0	2.5 –3 servings	2.32 (3.39)
Fruits	0 – 10	0	2 servings	0.35 (1.63)
Milk & dairy products	0 – 10	0	2 servings	1.04 (2.66)
Meat	0 – 10	0	0.75 – 1 serving	10.00 (0.00)
Total fat	0 – 10	≥ 45% energy	≤ 30% energy	10.00 (0.65)
Saturated fat	0 – 10	≥ 15% energy	≤ 10% energy	0.00 (0.00)
Cholesterol	0 – 10	≥ 600 mg	≤ 300 mg	10.00 (1.04)
Sodium	0 – 10	≥ 2400 mg	≤ 1200 mg	9.25 (5.03)
Variety	0 – 10	≤ 3 different food items	≥ 8 different food items	2.00 (3.00)
Total HEI Score	0-100	-	-	51.30±6.78

HEI: Healthy Eating Index

Table 4. Relationship between diet quality and nutritional status (BMI-for-age) (*n*=120)

Variable	*Frequency*	*Mean±SD*	*Pearson's correlation*	
	n (%)		*r value*	*p-value*
HEI scores (diet quality)	-	51.30±6.78	0.081	0.380
BMI-for-age (nutritional status)	-	-0.79±1.80		
Healthy Eating Index (HEI) classification of the respondents				
Poor (<51)	54 (45.0)	-	-	-
Need improvement (51 – 80)	66 (55.0)	-	-	-
Good (>80)	0 (0.0)	-	-	-

BMI: Body mass index, SD: Standard deviation
*Significant at $p<0.05$

adequate vitamin A intake, zinc and iron deficiencies were prevalent, similar to findings in Western populations (Naszydłowska *et al.,* 2021). Diet quality is a concern, with low consumption of grains, vegetables, fruits, and dairy, influenced by household income (Kasprzak *et al.,* 2021; Chong *et al.,* 2017). Energy-dense, cost-effective foods often replace fruits and vegetables (Drewnowski & Specter, 2004).

Over half of the respondents had a normal BMI. Despite financial and food aids, 25% were undernourished compared to 16.7% overweight or obese, reflecting a pressing issue of undernourishment (Rahman & Hakim, 2016). BMI measures overall weight, not diet quality; while HEI, focusing on diet quality, complements BMI as it does not capture nutritional balance (Chua *et al.,* 2018; Zheng, Wang & Wu, 2023). As such, high macronutrient intake can lead to high BMI without necessarily reflecting micronutrient adequacy.

This study calls for increased awareness and intervention to improve dietary quality among homeless children in Klang Valley. Efforts to improve diet quality should include affordable produce initiatives, dairy product donations, and diverse community kitchen menus. This study also underscores the importance of community involvement and strategic collaborations to enhance dietary patterns and meet nutritional benchmarks. Collaboration among stakeholders and additional support from government and non-governmental organisations can enhance health outcomes. Limitations include the cross-sectional design and potential self-report biases, suggesting the need for longitudinal studies and objective nutritional assessments in future research.

CONCLUSION

This study revealed significant dietary and nutritional challenges among homeless children in Malaysia. Despite support from welfare organisations, deficiencies in calcium, zinc, and iron persist. Addressing these issues is crucial for improving health outcomes and quality of life. Future research should build on the current findings to address these gaps.

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Authors' contributions

Yong KW, conceived the idea, designed the study, analysed and interpreted the data, conducted research, provided research materials, collected and organised the data, wrote the initial draft of the article; Ali A, conceived the idea, designed the study, analysed and interpreted the data, reviewed, edited and finalised the final draft; Mohd Yosuf H and Yusof A, provided statistical assistance; Tan MMC, reviewed, edited, and finalised the final draft. All authors critically reviewed and approved the final draft, and are responsible for the content and similarity index of the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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