Journal of Multidisciplinary Healthcare

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Relationship Between Family Factors, Food Consumption Behaviors, and Nutritional Status Among Muslim School-Age Students in Rural Southern Thailand

Kiatkamjorn Kusol, Pastraporn Kaewpawong

School of Nursing and the Excellence Center of Community Health Promotion, Walailak University, Nakhon Si Thammarat, Thailand

Correspondence: Pastraporn Kaewpawong, School of Nursing and the Excellence Center of Community Health Promotion, Walailak University, Nakhon Si Thammarat, Thailand, Email Pastraporn3@gmail.com

Purpose: The double burden of malnutrition, with both undernutrition and overweight threatening school-age children's development, presents a critical global public health challenge. This research aimed to study the relationships between family factors, food consumption behaviors, and nutritional status among Muslim school-age children in rural southern Thailand.

Samples and Methods: This study was cross-sectional descriptive research. The samples included 228 children aged 9–12 years in Thasala District, Nakhon Si Thammarat. Data were collected using demographic data, Nutritional status assessment, and food consumption behaviors assessment. Data were analyzed using descriptive, chi-square, and binary logistic regression statistics.

Results: Overall, 15.8% of the samples were classified as overweight and obese, and 18% were classified as stunted (<-1.5 SD). The samples had a normal weight-for-height (72.3%). The overall food consumption behaviors of the participants were moderate (Mean = 2.17, SD = 0.60). The number of siblings and food consumption behaviors had a significant relationship with nutritional status ($p < 0.05$). Confirmation with binary logistic regression results also revealed that the likelihood of appropriate nutritional status was 2.74 times higher in children with 3–4 siblings than those with 1–2 siblings (OR = 2.74; 95% CI: 1.494–5.047). Additionally, children with appropriate food consumption behaviors were 2.04 times more likely to have a proper nutritional status than those with inappropriate food consumption behaviors (OR = 2.04; 95% CI: 1.044–3.996).

Conclusion: The study found that most participants had moderately appropriate food consumption behaviors, with 15.8% showing issues like overweight and obesity. The number of siblings and food consumption behaviors significantly influenced nutritional status. Interventions should leverage Islamic religious settings and engage religious leaders to foster healthier lifestyles. Culturally and religiously sensitive nutritional education, blending scientific evidence with Islamic teachings, should be integrated into school curricula to cultivate healthy eating habits and mitigate long-term health risks.

Keywords: food consumption behaviors, nutritional status, school-age students

Introduction

School-age children are a crucial demographic group to study regarding nutrition due to their rapid growth and development.[1] Their nutritional status can significantly impact on their overall health, academic performance, and future well-being. This age range is a critical window for intervention, as dietary habits established during childhood often track into adulthood.[2] Focusing on this age group allows for early identification of nutritional issues and implementing strategies to promote healthy eating habits, which can have long-term benefits for individuals and public health.[1]

Nutritional status problems among school-age children have become a significant global public health issue, affecting both developed and developing countries. Many nations face serious dietary challenges, including malnutrition, overweight, and obesity. In Asia, over 390 million children and adolescents aged 5–19 years are reported to be overweight or obese. In Southeast Asia, the prevalence of overweight and obesity has reached alarming levels, with rates as high as

Received: 27 December 2024
Accepted: 12 March 2025
Published: 18 March 2025

30%.[3,4] The second Southeast Asian Nutrition Surveys (SEANUTS II), conducted between 2019 and 2021 among children aged 6 months to 12 years in Thailand, Indonesia, Malaysia, and Vietnam, revealed a growing trend of both overnutrition and malnutrition, particularly among children aged 7–12 years.[5,6]

In Thailand, this situation is particularly concerning. The country has set targets for reducing the prevalence of undernutrition and overnutrition in children to below 5% and 10%, respectively. However, data from 2020 to 2022 indicates that the rates of overweight and obesity among Thai children have risen to 12.5% and 13.3%, surpassing these targets. Similarly, the prevalence of stunting has increased from 6.0% to 9.5%, exceeding the target. Additionally, the proportion of children with standard height and weight has decreased from 64.3% to 57.2% during this period, further highlighting the growing nutritional concerns.[7]

Improper nutritional status in school-age children can lead to various health issues. Children who consume more calories than their bodies require are at risk of developing central obesity and metabolic disorders, such as hypertension and cardiovascular diseases.[8] Obese children are also prone to joint and bone-related problems due to excess pressure on their musculoskeletal systems.[9,10] In contrast, children suffering from malnutrition are more susceptible to frequent illnesses and stunted growth, which can hinder brain development, leading to poor concentration and decreased learning ability.[11,12] A well-balanced diet, comprising adequate portions from all five food groups- 1) Carbohydrates, which include rice, flour-based foods, snacks, and sugary beverages; 2) Proteins, comprising meat, eggs, and legumes; 3) Fats from both plant and animal sources; 4) Dietary fiber, derived from vegetables and fruits; and 5) Milk-is crucial for ensuring that children receive the nutrients necessary for optimal growth and development.[7] Poor dietary habits, such as consuming diets high in carbohydrates and fats and sugary snacks and drinks, are strongly associated with nutritional outcomes in school-age children. Recent studies indicate that diets high in starch and fat, coupled with sugary beverages, are linked to various nutritional problems, ranging from wasting and severe malnutrition to overweight and obesity.[13–16] The dietary habits of school-age children globally present a complex challenge: while many consume adequate food quantities, there's a prevailing tendency to prioritize taste over nutritional value, leading to the selection of energy-dense, nutrient-poor foods, irregular eating patterns, breakfast skipping, and frequent consumption of unhealthy snacks.[17–19] These nutritional issues are evident worldwide: Aboriginal schoolchildren in Malaysia exhibit low dietary diversity, students in India suffer from inadequate nutrient intake and anemia, Indonesian children experience micronutrient deficiencies, and North American children, particularly in the United States, consume excessive processed foods, sugar, and fast food, resulting in childhood obesity and other chronic diseases.[20–24] The overall dietary consumption of Canadian children aged **2–18** years is also suboptimal, with inadequate fruit and vegetable intake despite the **2019** Canada's Food Guide (CFG) recommendations.[25] These pervasive problems highlight the urgent need for interventions that promote healthy eating habits and enhance nutritional knowledge among school-age children to prevent long-term health complications.

In 2019, the southern region of Thailand ranked second in the country for childhood overnutrition, with Nakhon Si Thammarat being the fourth-highest province in the area.[26] Despite efforts to address these issues, the situation remains concerning. In 2023, the percentage of school-age children in the province with appropriate height-to-weight ratios decreased from 54.54% to 53.49% in 2024, falling below the target the Department of Health set.[27] Specifically, in Thasala District, only 54.9% of school-age children had a normal nutritional status, which is lower than the national standard. Meanwhile, the proportion of children who were obese, stunted, or underweight increased to 12.7%, 9%, and 5.9%, respectively.[28] The causes of malnutrition are multifaceted, with food consumption being one of the key modifiable factors. In the Muslim communities of Thasala District, the local food culture emphasizes high-fat, low-fiber foods. Popular dishes such as sticky rice with fried chicken, grilled chicken with coconut curry, chicken biryani, Massaman curry, and roti are often fatty but lack essential nutrients like fiber. Frequent consumption of these foods increases the risk of overnutrition and obesity, which can lead to other health issues such as cardiovascular diseases.[9,29] When school-age children are at home, they often eat the same meals as adults. Additionally, many school-age children choose food based on taste rather than nutritional value, skip breakfast, eat irregularly, and consume unhealthy snacks.[17] These behaviors result in excessive calorie intake and insufficient nutrient consumption, which may pose significant risks to the nutritional status of school-age children.

Family factors are an environmental element that influences nutritional status and can either promote or hinder a child's growth and development.[18,19] Previous studies in the southern provinces of Thailand and Eswatini have shown that the number of siblings plays a significant role in causing malnutrition among Muslim children.[30,31] Muslim families often have large family sizes, which affects the distribution of resources, including finances and food. Studies have found that children in families with many siblings are more likely to face growth challenges, such as stunting. Limited resources often lead to insufficient food intake or a lack of access to nutritious food. This situation negatively impacts children's physical and cognitive development, exacerbating malnutrition in the long term.

In the Muslim community in Thasala District, located along the coastline of Nakhon Si Thammarat Province, most residents work in the fishing industry, requiring them to spend several days at sea. As a result, primary caregivers are often grandparents or extended family members. Primary caregivers play a crucial role as they are the closest to the children, responsible for meal preparation and serving as role models for healthy eating habits. Previous studies have shown a statistically significant relationship between the role of primary caregivers and children's nutritional status.[13,32] From the literature review, no studies have examined the relationship between family factors, precisely the number of siblings and the role of primary caregivers, and the nutritional status of Muslim school-age children in Thasala District, Nakhon Si Thammarat Province. Most previous studies have focused on family factors such as income, parenting styles, and parental education.[33]

These findings highlight the significant influence of family factors and unhealthy eating behaviors on children's nutritional status. However, despite the prevalence of abnormal nutritional status among Muslim school-age children in Thasala District, Nakhon Si Thammarat Province, surpassing the standard target set by the Ministry of Public Health, there remains a gap in research. This gap lies in the inadequate exploration of the relationships between family factors, dietary habits, and the nutritional status of this specific demographic. Addressing this gap is crucial for promoting appropriate nutritional status and developing targeted strategies to mitigate abnormal nutritional status in Muslim school-age children. Furthermore, promoting healthy eating behaviors among Muslim school-age children is essential to ensure their growth into healthy and productive members of society, contributing to the nation's overall well-being.

Materials and Methods

Study Design and Sample

This cross-sectional descriptive study was conducted from August to October 2022 in Thasala District, Nakhon Si Thammarat, Thailand, a province in southern Thailand. The study population comprises Muslim school-age students in grades 4 to 6, aged 9 to 12 years, living and studying in the Thasala rural area. Muslim students were explicitly chosen because previous research indicated that some Muslims experience malnutrition, including both overnutrition and undernutrition. Additionally, field surveys conducted in this predominantly Muslim area revealed an increasing prevalence of obesity and stunted growth among children. The sample was systematically drawn from this population because cultural and religious beliefs strongly influence dietary habits and nutritional status.

The population of this study comprised 228 students enrolled in a school located in the Thasala rural area. The sample size was determined using G*power software and logistic regression with a one-tailed statistical significance test. A priori power analysis was conducted with a significance level = 0.01, effect size = 0.30, and a power of $1\text{-}\beta = 0.95$. The initially calculated sample was 198 school-age students; however, 15% of the minimum required samples were added to avoid potential sample loss. Thus, the total sample size was 228. Participants were selected using purposive sampling based on inclusion criteria. Inclusion criteria were school-age children, specifically those aged 9–12 years, enrolled in grades 4–6 in schools located in the Thasala district, able to read and write Thai, and of the Muslim faith. Children with chronic illnesses affecting nutritional status, such as thalassemia or cancer, were excluded.

Research Instrument

Research instruments were detailed as follows:

Part 1: Demographics data questionnaire and family factors, which included gender, educational level, age, primary caregivers, and the number of siblings. The questions were multiple-choice and open-ended.

Part 2: Nutritional status assessment. The researchers adopted the evaluation from the Department of Health, Bureau of Nutrition, Ministry of Public Health. Participants' nutritional status was assessed using weight-for-height, height-for-age, and weight-for-age.[34]

Part 3: Food consumption behavior assessment. The researchers adopted the evaluation from the Department of Health, Bureau of Nutrition, Ministry of Public Health. The questionnaire was an 18-item. The questionnaire consisted of eleven positive statements and seven negative statements. And yielded a total score of 54 points using a 3-point detailed rating.[35]

Always engage in that behavior, averaging 4 to 7 times or 4 to 7 days a week = 3

Rarely engage in that behavior, averaging 1 to 3 times or 1 to 3 days a week = 2

Never did it = 1

Best and Kahn's criteria were used to classify each food consumption behavior item into three categories: low-level food consumption behaviors (mean score range from 1.00 to 1.66), moderate-level food consumption behaviors (mean score range from 1.67 to 2.33), and good-level food consumption behaviors (mean score range from 2.34 to 3.00).[36]

Overall food consumption behaviors were interpreted based on Bloom's (1971) taxonomy into two categories, including appropriate food consumption behaviors (score ≥ 70%) and Inappropriate food consumption behaviors (score < 70%).[37] Meanwhile, the food consumption behavior assessment questionnaire was tested for reliability with 30 students with characteristics similar to the samples. The reliability coefficient, measured using Cronbach's Alpha, was 0.73.

Statistical Analysis

This study analyzed the statistics using SPSS software (Version 26) for Windows™ (IBM Corporation, New York, NY, USA). The statistics employed the following:

1. Descriptive statistics, including frequencies, percentages, means, and standard deviations (SD), were employed to analyze participants' demographic data, food consumption behaviors, and nutritional status.
2. The relationships between family factors, food consumption behaviors, and nutritional status were analyzed using chi-square and binary logistic regression statistics, determining statistical significance at 0.05.

Results

Samples' Demographics and Family Factors

The participants were females (59.2%) and aged between 11 and 12 (54.4%). It was in the fourth grade of primary school (43.9%). Moreover, the primary caregivers for most of the sample group were their parents (80.3%), and approximately two-thirds of them had 3–4 siblings (61.4%) (Table 1).

Table 1 Number and Percentage of the Samples' Demographic Data and Family Factors (n = 228)

Demographics Data	Number	%
Gender		
Male	93	40.8
Female	135	59.2

(*Continued*)

Table 1 (Continued).

Demographics Data	Number	%
Educational level		
Grade 4	100	43.9
Grade 5	65	28.5
Grade 6	63	27.6
Age		
9–10 years old	104	45.6
11–12 years old	124	54.4
Primary caregiver		
Father/mother	183	80.3
Grandparents/relatives	45	19.7
Number of siblings		
1–2	88	38.6
3–4	140	61.4

Nutritional Status Among Muslim School-Age Students

When considering height-for-age, it was found that most children fall within the standard height range (68.4%). In comparison, 13.6% were reasonably tall and tall, and 18.0% were classified as relatively stunted or severely stunted. For weight-for-age, most children also fall within the normal weight range (66.2%), while 13.2% were relatively underweight or severely underweight, and 20.6% were classified as relatively overweight or obese. Regarding weight-for-height, most children had a balanced body shape (72.3%), while 15.8% were categorized as overweight or obese, and 8.8% were classified as relatively wasted or severely wasted (Table 2).

Table 2 Number and Percentage of Nutritional Status Among Muslim School-Age Students (n = 228)

Nutritional Status	Number	%
Height-for-age (Mean = 139.2, S.D. = 10.1, Min-Max = 102–165 cm)		
Severely stunted (< −2 SD)	21	9.2
Stunted (< −1.5 SD to −2 SD)	20	8.8
Standard height (−1.5 SD to +1.5 SD)	156	68.4
Fairly tall (> +1.5 SD. to +2 SD)	9	3.9
Tall (> +2 SD)	22	9.7

(*Continued*)

https://doi.org/10.2147/JMDH.S514601

Table 2 (Continued).

Nutritional Status	Number	%
Weight-for-age (Mean = 36.1, SD = 12.3, Min-Max = 20–90 kg)		
Severely underweight (< −2 SD)	10	4.4
Underweight (< −1.5 SD to −2 SD)	20	8.8
Normal weight (−1.5 SD to +1.5 SD)	151	66.2
Mildly overweight (> +1.5 SD to +2 SD)	13	5.7
Excess weight (> +2 SD)	34	14.9
Weight-for-height		
Severely wasted (< −2 SD)	7	3.1
Wasted (< −1.5 SD to −2 SD)	13	5.7
Normal (−1.5 SD to +1.5 SD)	165	72.3
Possible risk of overweight (> +1.5 SD to +2 SD)	7	3.1
Overweight (> +2 SD to +3 SD)	26	11.4
Obese (> +3 SD)	10	4.4

Food Consumption Behaviors Among Muslim School-Age Students

After evaluating 18 food consumption behavior items, it was determined that the overall food consumption behavior of the participants was at a moderate level (Mean = 2.17, S.D. = 0.60). Most food consumption behaviors were at a moderate level. Notably, the items categorized as high-level food consumption behaviors were having breakfast containing grains, animal protein or grains, and daily milk (Mean = 2.38, S.D. = 0.51). On the other hand, low food consumption behaviors included eating iron-rich foods 1–2 days a week (Mean = 1.60, S.D. = 0.56), eating sweet snacks, ice cream, and chocolate (Mean = 1.46, S.D. = 0.51), and drinking carbonated beverages, iced cocoa, and iced tea (Mean = 1.55, S.D. = 0.59) (Table 3).

Table 3 Food Consumption Behaviors in Muslim School-Age Students (n = 228)

Food Consumption Behaviors	Mean	S.D.	Level
1. Having breakfast containing grains and animal protein or grains and milk	2.38	0.51	High
2. Having three main meals every day	2.33	0.53	Moderate
3. Having two snacks every day	2.32	0.57	Moderate
4. Eating eight spoonfuls of rice or starch a day	2.15	0.60	Moderate
5. Eat four servings of vegetables a day	2.21	0.58	Moderate
6. Eat three servings of fruits a day	2.32	0.54	Moderate
7. Eating six servings of meat a day	2.31	0.60	Moderate
8. Drink three boxes of plain milk a day (180 mL. per milk box)	2.23	0.57	Moderate

(*Continued*)

Table 3 (Continued).

Food Consumption Behaviors	Mean	S.D.	Level
9. Eat fish at least 3 days a week	2.37	0.61	Moderate
10. Eat 3 or 4 eggs a week	2.28	0.54	Moderate
11. Eating fatty meat, such as chicken or duck skin	2.23	0.65	Moderate
12. Eating bakery products like cakes, pies, and doughnuts	1.86	0.51	Moderate
13. Eating snacks	1.71	0.59	Moderate
14. Adding more condiments to cooked foods	1.86	0.59	Moderate
15. Adding more sugar to cooked foods	1.99	0.61	Moderate
16. Eat iron-rich foods 1–2 days a week	1.60	0.56	Low
17. Eating sweet snacks, ice cream, and chocolate	1.46	0.51	Low
18. Drink carbonated beverages, iced cocoa, and iced tea	1.55	0.59	Low
Overall	**2.17**	**0.60**	**Moderate**

Family Factors, Food Consumption Behaviors, and Nutritional Status

Muslim children with normal nutritional status mostly live with their grandparents/relatives (77.8%) and have three or more siblings. According to the classification of the five food groups based on the nutrition flag, it was observed that Muslim students with a normal nutritional status predominantly consumed protein-rich foods regularly (77%), followed by the consumption of fruits and vegetables (75.7%), and 71.4% reported drinking three boxes of milk per day (180 mL. per milk box) Among students categorized as under malnutrition, only 10% regularly consumed milk, while 8.1% consumed protein-rich foods and fruits and vegetables. In contrast, students identified as overnourished showed a regular intake of fats from plant and animal sources (26.9%), followed by carbohydrate-rich foods, including rice, flour-based products, snacks, and sugary beverages (19.5%) (Table 4).

Table 4 Family Factors, Food Consumption Behaviors, and Nutritional Status Among Muslim School-Age Students (n = 228)

Factors	Nutritional Status (Weight-for-Height)			
	Total n (%)	Undernutrition (< −1.5 SD) n (%)	Normal (−1.5 SD to +1.5 SD) n (%)	Overnutrition (> +1.5 SD) n (%)
Family Factors				
1) Primary caregivers				
Father/mother	183 (80.3)	15 (8.2)	130 (71.0)	38 (20.8)
Grandparents/relatives	45 (19.7)	5 (11.1)	35 (77.8)	5 (11.1)
2) Number of siblings				
1–2	88 (38.6)	9 (10.2)	52 (59.1)	27 (30.7)
3–4	140 (61.4)	11 (7.9)	113 (80.7)	16 (11.4)

(*Continued*)

https://doi.org/10.2147/JMDH.S514601

Table 4 (Continued).

Factors	Nutritional Status (Weight-for-Height)			
	Total n (%)	Undernutrition (< −1.5 SD) n (%)	Normal (−1.5 SD to +1.5 SD) n (%)	Overnutrition (> +1.5 SD) n (%)
Food consumption behaviors				
1) Carbohydrates, which include rice, flour-based foods, snacks, and sugary beverages				
Always engage in that behavior	87 (38.2)	8 (9.2)	62 (71.3)	17 (19.5)
Rarely engage in that behavior	127 (55.7)	10 (7.9)	94 (74.0)	23 (18.1)
Never did it	14 (6.1)	2 (14.3)	9 (64.3)	3 (21.4)
2) Proteins, comprising meat, fish and eggs				
Always engage in that behavior	87 (38.2)	7 (8.1)	67 (77.0)	13 (14.9)
Rarely engage in that behavior	125 (54.8)	11 (8.8)	88 (70.4)	26 (20.8)
Never did it	16 (7.0)	2 (12.5)	10 (62.5)	4 (25.0)
3) Fats from both plant and animal sources				
Always engage in that behavior	26 (11.4)	3 (11.5)	16 (61.6)	7 (26.9)
Rarely engage in that behavior	122 (53.5)	10 (8.2)	87 (71.3)	25 (20.5)
Never did it	80 (35.1)	7 (8.8)	62 (77.5)	11 (13.7)
4) Dietary fiber derived from vegetables and fruits				
Always engage in that behavior	74 (32.5)	6 (8.1)	56 (75.7)	12 (16.2)
Rarely engage in that behavior	139 (61.0)	11 (7.9)	99 (71.2)	29 (20.9)
Never	15 (6.5)	3 (20.0)	10 (66.7)	2 (13.3)
5) Milk: drinking three packs/boxes of plain milk a day				
Always engage in that behavior	70 (30.7)	7 (10.0)	50 (71.4)	13 (18.6)
Rarely engage in that behavior	141 (61.8)	13 (9.2)	101 (71.6)	27 (19.2)
Never did it	17 (7.5)	0 (0.0)	14 (82.4)	3 (17.6)

Relationships Between Family Factors, Food Consumption Behaviors, and Nutritional Status

The relationships between family factors, food consumption behaviors, and nutritional status among Muslim school-age students were analyzed using chi-square statistics. This study found that the number of siblings and food consumption behaviors were significantly related to nutritional status (χ^2 = 12.635, p = 0.000; χ^2 = 6.651, p = 0.010), respectively. (Table 5).

When analyzing by binary logistic regression, it was found that the number of siblings and food consumption behaviors were significantly related to nutritional status. To clarify, Muslim school-age children with 3–4 siblings were 2.7 times more likely to have a standard dietary status compared to those with 1–2 siblings. (OR = 2.746; 95% CI: 1.494–5.047). Additionally, Muslim school-age children with appropriate food consumption behaviors were 2.04 times as likely to have a standard nutritional status than those with Inappropriate food consumption behaviors (OR = 2.042; 95% CI: 1.044–3.996) (Table 6).

Table 5 Relationships Between Family Factors, Food Consumption Behaviors, and Nutritional Status (n = 228)

Factor	Total	Nutritional Status		χ2	*p-value*
		Under and Over n (%)	Standard n (%)		
Primary caregivers					
Grandparents/relatives	45 (19.7)	10 (22.2)	35 (77.8)	0.820	0.365
Father/mother	183 (80.3)	53 (29.0)	130 (71.0)		
Number of siblings					
1–2	88 (38.6)	36 (40.9)	52 (59.1)	12.635	0.000**
3–4	140 (61.4)	27 (19.3)	113 (80.7)		
Food consumption behaviors					
Inappropriate (18–37 score)	53 (23.2)	22 (41.5)	31 (58.5)	6.651	0.010*
Appropriate (38–54 score)	175 (76.8)	41 (23.4)	134 (76.6)		

Note: *$p < 0.05$, **$p < 0.001$.

Table 6 Binary Logistic Regression of the Relationships Between Family Factors, Food Consumption Behaviors, and Nutritional Status (n = 228)

Variable	Nutritional Status		B	S.E.	Wald	*df*	EXP(B)	95% CI		*p-value*
	Under and Over	Standard						Lower	Upper	
	n (%)	n (%)								
Number of siblings										
1–2 [ref.]	36 (40.9)	52 (59.1)						1		
3–4	27 (19.3)	113 (80.7)	1.010	311	10.576	1	2.746	1.494	5.047	001**
Food consumption behaviors										
Inappropriate [ref]	22 (41.5)	31 (58.5)						1		
Appropriate	41 (23.4)	134 (76.6)	714	342	4.349	1	2.042	1.044	3.996	037*

Notes: Cox and Snell R Square = 0.075, Nagelkerke R Square = 0.109, *p < 0.05, **p < 0.01, ref. = reference.

Discussion

This study found that 15.8% of Muslim school-age children were classified as overnourished. This result aligns with the Department of Health data, which reported that 15% of school-age children in the region experienced overnutrition.[7] Globally, these studies are also consistent with the World Health Organization's data, which estimates that 18% of children aged 5–19 years are overnourished, equating to over 340 million children worldwide.[3] The prevalence is lower than in neighboring countries such as Malaysia, as well as Brazil, Nigeria and Venezuela[38,39] The rate of childhood overweight is higher in those countries than in Thailand due to a combination of factors, including a nutritional transition towards increased consumption of processed foods, a lifestyle shift towards convenience leading to decreased physical activity, socioeconomic factors that limit access to healthy foods, and differing cultural values regarding perceptions of an ideal body weight. Furthermore, the study revealed that 8.8% of children in the sample were classified as short for their age, while 9.2% were stunted. The average height in this study was only 139.2 centimeters. Consistent with the 2022 survey by the Department of Health, it was found that 9.5% of Thai children aged 6–14 years were classified as stunted, which still exceeds the Department's target of no more than 5%.[40] This finding is concerning and reflects a broader trend of malnutrition in Thailand's southern provinces. The proportion of stunted children in the present study

mirrors similar trends observed in Pattani Province,[30] although lower than the rates seen in other low- and middle-income countries like Nepal, India, and Indonesia.[20–22] The prevalence of both overnutrition and stunting in the school-age population highlights the "double burden" of malnutrition, wherein children in the same communities face both undernutrition and obesity. This dual challenge has been attributed primarily to unhealthy eating habits, often influenced by easy access to low-nutrient, high-calorie foods near schools. These establishments typically sell sugary beverages and fried snacks at affordable prices, making it difficult for children to maintain balanced diets despite school policies promoting healthier eating.

Family factors related to nutritional status were identified in this study. The number of siblings was found to be associated with nutritional status. School-age children with 3–4 siblings had a 2.74 times higher likelihood of having a normal nutritional range than those with 1–2 siblings. This could be attributed to families with 3–4 siblings being more likely to organize meals for their children to eat together, which promoted healthy eating habits and discipline. A study in Brazil found that a more significant number of siblings is associated with a more diverse diet in late adolescence, which may predict better nutrient adequacy and health outcomes.[41] On the other hand, families with 1 or 2 siblings may be more inclined to provide larger quantities of food, potentially leading to excessive nutritional intake and subsequent overweight or obesity. This differs from previous studies, which found that the number of siblings in families of children with normal nutritional status and those who were overweight did not differ.[42] Since children's eating habits and nutrition are not determined solely by the number of siblings, other factors such as parental control over food, eating patterns, and family support also play an essential role. It is important to note that these results may vary depending on economic status, social factors, environment, and siblings' age compared to this study's findings.

In the current study, the type of primary caregiver was not associated with the nutritional status of these school-age children. This could be explained by the fact that these school-age children were nurtured similarly regardless of the type of primary caregiver, whether parents, grandparents, or other relatives. Moreover, school-age children spend 5 days a week in school, where they can eat and purchase food according to their preferences. This finding contradicted a previous study conducted in Nepal, which indicated that children living with non-parental caregivers were 3.71 times more likely to be malnourished compared to those living with both parents.[33] This discrepancy may be due to several factors: firstly, the cultural context in Thailand, where childcare by extended family members like grandparents is familiar, potentially leading to nutritional care comparable to that provided by parents. Secondly, the role of schools in providing meals and the influence of socioeconomic factors, such as family financial stability and governmental support, may outweigh the impact of the primary caregiver type. Additionally, variations in study limitations, including sample size and data collection methods, could contribute to the observed differences in results.

The study found a significant association between food consumption behaviors and nutritional status among school-age children. These children with appropriate food consumption behaviors were twice as likely to have a normal nutritional status than those with inappropriate food consumption behaviors. These findings are consistent with previous research demonstrating a strong relationship between school-aged children's dietary habits and nutritional status. Students who regularly ate breakfast consumed three main meals daily and included fruits, vegetables, meat, milk, and eggs in their diet were likelier to maintain a healthy nutritional status.[43] When examining the nutritional status of Muslim school-aged children, those who were overweight or obese were found to regularly consume energy-dense foods high in carbohydrates and sugars, such as sweets, sugary drinks, soft drinks, and fats from both plant and animal sources, while consuming fewer fruits and vegetables. This is consistent with studies on the dietary habits of obese children, which highlight a preference for snacks, processed foods, and sugary beverages that are easily accessible from nearby convenience stores. In contrast, Muslim children with severe stunting were found to consume less protein from sources such as meat, fish, eggs, and milk than recommended. The daily recommended protein intake for children aged 9–12 is approximately 43 grams (or six tablespoons), including one egg per day and 2–3 boxes of milk for adequate protein and calcium intake.[5] This aligns with research indicating that Muslim school-age children in Pattani also experienced stunting due to inadequate protein and calcium intake from foods such as meat, milk, and eggs.[24] In the Thai Healthy Children Program, students receive at least one glass of milk daily. However, it was found that some children disliked plain milk, resulting in inadequate milk consumption. Therefore, it is crucial to promote the importance of milk consumption to both children and parents to ensure they meet their nutritional needs. Programs should also focus on cultivating habits and

training children to become accustomed to drinking milk regularly.[44] To promote optimal nutritional status in Muslim school-age children, it is necessary to modify inappropriate dietary behaviors, such as reducing the consumption of crispy snacks, pastries, sweetened beverages, fried foods, and fatty meats while increasing the intake of nutritious foods rich in protein, calcium, vegetables, and fruits. Promoting appropriate dietary behaviors should consider cultural and religious influences, such as providing education on Islamic nutritional principles, promoting the consumption of beneficial halal foods, and engaging religious leaders in educational campaigns. Furthermore, creating environments conducive to healthy eating behaviors, such as limiting access to unhealthy foods in schools and encouraging home cooking, is essential. These strategies will contribute to optimal nutritional status in Muslim school-age children, positively affecting health, learning, and overall development.

Limitations

The cross-sectional study design is limited to Muslim students in one region, further restricting the generalizability of the survey results. Therefore, future studies should consider surveying a larger, more diverse sample population with a probability-based sampling method.

Conclusions

Muslim school-age children face nutritional challenges that exceed health targets, including overweight, obesity, and stunting. The number of siblings in a family significantly influences children's nutritional status. While large families may encounter competition for food resources, proper food allocation and healthy eating habits can still ensure adequate nutrition for each child. Addressing these issues requires an integrated approach, involving collaboration among healthcare professionals, schools, and families. Promoting healthy eating behaviors, alongside utilizing Islamic religious settings and engaging religious leaders, can facilitate positive change. Culturally and religiously sensitive interventions, blending scientific guidelines with Islamic teachings, will create effective health promotion messages. Comprehensive collaboration is essential for achieving health goals and the optimal development of Muslim school-age children.

Data Sharing Statement

Additional data is not available.

Ethical Approval and Consent to Participate

All procedures performed in studies involving human participants followed the ethical standards of the Ethical Institutional Consideration. The researchers conducted the study following the Declaration of Helsinki. This study received approval from the Ethics Committee on Human Research at Walailak University on August 4, 2022 (approval number WUEC-22-227-01), as mandated before data collection. Informed consent was obtained from parents and all individual participants involved in the study by the researchers. The children aged 9-12 years and parents provided written consent. Research information was stored securely, with data coded for confidentiality.

Acknowledgments

We sincerely thank the Research Institute for Health Sciences and the Excellence Center of Nursing Institute at Walailak University for their invaluable support. We would also like to acknowledge the School of Nursing, Walailak University, and all the participants involved in this study for their contribution. This paper has been uploaded to Preprints.org as a preprint: https://www.preprints.org/manuscript/202406.1209/v1

Author Contributions

All authors reviewed the manuscript. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This research received no external funding.

Disclosure

The authors report no conflicts of interest in this work.

References

1. UNICEF. Programming guidance: nutrition in middle childhood and adolescence. New York, NY: UNICEF; 2021. Available from: https://www.unicef.org/nutrition/middle-childhood-and-adolescence. Accessed Feb 27, 2025.
2. Food Security Information Network. global report on food crises. joint analysis for better decisions. Available from: http://www.wfp.org. Accessed Feb 27, 2025.
3. World Health Organization. Obesity and overweight. Geneva; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. Accessed Oct 24, 2024.
4. National Statistical Office. Report of 17 selected provinces: multiple indicator cluster survey 2019. National Statistical Office: Bangkok, Thailand, 2021. Available from: https://www.unicef.org/thailand/reports/mics-6-report-17-selected-provinces. Accessed May 31, 2022.
5. Poh BK, Wong JE, Lee ST, et al. Triple burden of malnutrition among Malaysian children aged 6 months to 12 years: current findings from SEANUTS II Malaysia. *Public Health Nutr*. 2023;26:1–36. doi:10.1017/S1368980023002239
6. Pongcharoen T, Rojroongwasinkul N, Tuntipopipat S, et al. Southeast asian nutrition surveys II (SEANUTS II) Thailand: triple burden of malnutrition among Thai children aged 6 months to 12 years. *Public Health Nutr*. 2024:1–39. doi:10.1017/S1368980024000053
7. Bureau of Nutrition. Department of health, ministry of public health. survey of health literacy and desired health behaviors in school-aged children in 2019. Nonthaburi: Department of Health. Available from: https://hp.anamai.moph.go.th/th/ewt-news-php-nid-1532/193576. Accessed Aug 2, 2022.
8. Flemming GM, Bussler S, Körner A, et al. Definition and early diagnosis of metabolic syndrome in children. *J Pediatr Endocrinol Metab*. 2020;33:821–833. doi:10.1515/jpem-2019-0552
9. Al-Hamad D, Raman V. Metabolic syndrome in children and adolescents. *Transl Pediatr*. 2017;6:397–407. doi:10.21037/tp.2017.10.02
10. Wongchan W. Prevention of metabolic syndrome of late school-age children: self-management. *J Royal Thai Army Nurses*. 2020;21:26–34.
11. Hailegebriel T. Prevalence and determinants of stunting and thinness/wasting among schoolchildren of Ethiopia: a systematic review and meta-analysis. *Food Nutr Bull*. 2020;41(4):474–493. doi:10.1177/0379572120968978
12. Sturgeon JP, Njunge JM, Bourke CD, et al. Inflammation: the driver of poor outcomes among children with severe acute malnutrition. *Nutr Rev*. 2023;81(12):1636–1652. doi:10.1093/nutrit/nuad030
13. Bhusal CK, Bhattarai S, Chhetri P, et al. Nutritional status and its associated factors among under-five-year-old Muslim children of kapilvastu district, Nepal. *PLoS One*. 2023;18:e0280375. doi:10.1371/journal.pone.0280375
14. Calcaterra V, Cena H, Magenes VC, et al. Sugar-sweetened beverages and metabolic risk in children and adolescents with obesity: a narrative review. *Nutrients*. 2023;15(3):702. doi:10.3390/nu15030702
15. Rousham EK, Goudet S, Markey O, et al. Unhealthy food and beverage consumption in children and risk of overweight and obesity: a systematic review and meta-analysis. *Adv Nutr*. 2022;13(5):1669–1696. doi:10.1093/advances/nmac032
16. Chong CY, Tan CX, Tsai M-C, Tan SS, Hariyono H, Tan ST. Gender differences in dietary intake and physical activity among university students: a post-COVID-19 pandemic study. *Nutr Food Sci*. 2024;54(7):1190–1201. doi:10.1108/NFS-01-2024-0015
17. Chaimongkol L, Daree N, Kabae I. Breakfast skipping in school children: a case study of schools in the municipality and non-municipality area of Muang, Pattani Province. *J Nutr Assoc Thailand*. 2021;56:36–49.
18. Al Yazeedi B, Berry DC, Crandell J, et al. Family influences children's nutrition and physical activity patterns in Oman. *J Pediatr Nurs*. 2021;57:56. doi:10.1016/j.pedn.2020.07.012
19. Herrera A, Sarmiento C, et al. Overweight and obesity: family factors, diet, and physical activity in school children from middle to high socioeconomic level in Cali, Colombia. *Biomedica*. 2022;42(Special 1):100–115. doi:10.7705/biomedica.6396
20. Devindran D, Ulaganathan V, Oeh ZY, et al. Association between dietary diversity and weight status of aboriginal primary school children in Negeri Sembilan, Malaysia. *Malays J Med Sci*. 2022;29:101–112. doi:10.21315/mjms2022.29.1.10
21. Vastrad P, Neelopant S, Prasad UV, et al. Undernutrition among rural school-age children: a major public health challenge for an aspirational district in Karnataka, India. *Front Nutr*. 2023;10:1209949. doi:10.3389/fnut.2023.1209949
22. Ernawati F, Efriwati N, Nurjanah N, et al. Micronutrients and nutrition status of school-aged children in Indonesia. *J Nutr Metab*. 2023;2023:4610038. doi:10.1155/2023/4610038
23. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans. 2020-2025. ed. Washington, DC: U.S. Government Printing Office. Available from: https://www.dietaryguidelines.gov/sites/default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf#page=31. Accessed Feb 28, 2025.
24. National Cancer Institute. Prevention: diet and alcohol - fruit and vegetable consumption. Bethesda (MD): National Cancer Institute; 2024. Available from: https://progressreport.cancer.gov/prevention/diet_alcohol/fruit_vegetable. Accessed Feb 28, 2025.
25. McEachern LW, Ismail MR, Seabrook JA, Gilliland JA. Fruit and vegetable intake is associated with food knowledge among children aged 9–14 years in Southwestern Ontario, Canada. *Children*. 2022;9(10):1456. doi:10.3390/children9101456
26. Office Permanent Secretary, Ministry of Public Health. Strategic plan for a healthy Thai lifestyle (2011–2020). Nakhon Si Thammarat: National Health Development Plan No. 11. Available from: https://hpc11.anamai.moph.go.th/th. Accessed May 25, 2024.
27. Bureau of Nutrition. Department of health, ministry of public health. National Environmental Health Information System (NEHIS). Nonthaburi: Department of Health. Available from. https://dashboard.anamai.moph.go.th/nehis/default/index. Accessed May 28, 2024.
28. Nakhon Si Thammarat Provincial Statistical Office. Nakhon si Thammarat provincial statistical report 2020. Bangkok: National Statistical Office. Available from: https://drive.google.com/file/d/116h9aGC0N36lMNQhoUh18Qh2mbphmrvb/view. Accessed Jul 28, 2022.

29. Lillahkul N, Supanakul P. Way of life of Muslim people in Thailand's Southern Provinces, and health-promoting lifestyle. *Southern College Network J Nurs Public Health*. 2018;5:302–312.
30. Waloh W, Perngmark P, Boonyasopun U. Effects of self-efficacy promoting through family participation upon food consumption knowledge and nutritional status among upper-primary school underweight Muslim children, Pattani Province: a pilot study. *Princess Naradhiwas Univ J*. 2023;15:98–120.
31. Simelane MS, Chemhaka GB, Zwane E, et al. A multilevel analysis of individual, household, and community level factors on stunting among children aged 6–59 months in Eswatini: a secondary analysis of the Eswatini 2010 and 2014 multiple indicator cluster surveys. *PLoS One*. 2020;15:e0241548. doi:10.1371/journal.pone.0241548
32. Yani DI, Rahayuwati L, Sari CWM, et al. Family household characteristics and stunting: an update scoping review. *Nutrients*. 2023;15(1):233. doi:10.3390/nu15010233
33. Pichaitum S, Juntarawiji Y, Hanrungcharotorn U. Association between family factors and parenting style and nutritional status among students grades 4–6 in schools under the office of the basic education commission in Muang District. *Phitsanulok Nurs J*. 2020;47(4):88–99.
34. Bureau of Nutrition. Department of health, ministry of public health. guide using the growth criteria for children ages 6–19. Nonthaburi: Department of Health. Available from: https://multimedia.anamai.moph.go.th/associates/guide-using-the-growth-criteria-for-children-ages6_19. Accessed August 2, 2022.
35. Bureau of Nutrition. Department of health, ministry of public health. assessment of food consumption behavior of children aged 6–18 years. Nonthaburi: Department of Health. Available from: https://nutrition2.anamai.moph.go.th/th/book/206999. Accessed August 2, 2022.
36. Best JW, Kahn JV. *Research in Education*. 8th ed. Butler University, Emeritus, University of Illinois; 1998:384.
37. Bloom BS, Madaus GF, Hastings JT. *Handbook on Formative and Summative Evaluation of Student Learning*. New York, NY: McGraw-Hill; 1971.
38. Chen A, Azuan N, Harun N, et al. Nutritional status and dietary fatty acid intake among children from low-income households in Sabah: a cross-sectional study. *Hm Nutr Metab*. 2024;36:200260. doi:10.1016/j.hnm.2024.200260
39. Wrottesley SV, Mates E, Brennan E, et al. Nutritional status of school-age children and adolescents in low- and middle-income countries across seven global regions: a synthesis of scoping reviews. *Public Health Nutrition*. 2023;26(1):63–95. doi:10.1017/S1368980022000350
40. Bureau of Nutrition.Department of health, ministry of public health. annual nutrition surveillance report 2022. Nonthaburi: Department of Health. Available from: https://nutrition2.anamai.moph.go.th. Accessed Dec 26, 2024.
41. Meller FO, Assunção MC, Schäfer AA, et al. Is the number of siblings associated with dietary patterns in adolescents? The 1993 birth cohort of Pelotas (Brazil). *PLoS One*. 2017;12(3):e0174087. doi:10.1371/journal.pone.0174087
42. Wareesree T. Association between family factors and parenting styles and nutritional status among students grades 4-6 in schools under the office of the basic education commission in the 4th regional health area. *J Roi Kaensarn Academy*. 2023;8(10):681–695.
43. Jinakun C, Noonil N, Aekwarangkoon S. The relationship between the type of food consumption and nutrition status in primary school students in Nakhon Si Thammarat Province. *J Royal Thai Army Nurses*. 2023;24:104–111.
44. National Statistical Office. Ministry of digital economy and society. the 2017 food consumption behavior survey. Bangkok: Ministry of Digital Economy and Society. Available from: https://www.nso.go.th/nsoweb/nso/survey_detail/aL. Accessed March 15, 2024.