World Nutrition, June 2026;17(2): 177-185
DOI: https://doi.org/10.26596/wn.2026172177-185

WORLD NUTRITION
The Official Journal of the World Public Health Nutrition Association
Journal homepage: https://www.worldnutritionjournal.org
ISSN: 2041-9775

Research Article

Factors associated with malnutrition among private versus public nursery school children in Kumba, Cameroon

Aristide G.S. Kamda*[,1], Gillian N. Asoba[1], Dieudonne Nebane[2], Blanche V. Eyabi[1], Olivia A. Anagim[1], Bolda E. Maralossou[1], Elie Fokou[1]

[1]Department of Social Economy and Family Management, Higher Teacher's Teaching Training College, University of Buea, Kumba, Cameroon; [2]Department of Guidance and Councelling, Higher Teacher's Teaching Training College, University of Buea, Kumba, Cameroon, [3]Department of Biochemistry, Faculty of Sciences, University of Yaoundé I, Yaoundé, Cameroon

OPEN ACCESS

***Corresponding Author**
Kamda A.G.S.
silapeuxkamda@gmail.com
ORCID: 0000-0003-4943-8065

Article History
Received: May 04, 2026
Reviewed: June 06, 2026
Revised: June 22, 2026
Accepted: June 27, 2026
Published: June 30, 2026

Citation
Kamda A.G.S., Asoba G.N., Nebane D., Eyabi B.V., Anagim O.A., Maralossou B.E., & Fokou E. (2026). Factors associated with malnutrition among private versus public nursery school children in Kumba, Cameroon. *World Nutrition*, 17(2), June, 177–185.
https://doi.org/10.26596/wn.2026172177-185

Academic Editor
Ted Greiner, PhD

Copyright © 2026 Kamda A.G.S. et al. Published by WPHNA. This is an open-access article distributed under the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Highlights/Key Messages

- Pupils in public schools exhibited significantly higher rates of undernutrition than their private school counterparts.
- Education level of caregivers, family size, and possession of a school lunch box were primary drivers of undernutrition in public schools.
- Private school children were more prone to obesity or being overweight.
- Low education level of caregivers directly correlated with higher risks of child stunting and wasting.

Background
The prevalence of malnutrition among children in Cameroon remains high, particularly among those residing in rural areas. The present examines young children in an urban area, Kumba, in the South-West Region of Cameroon.

Objective
The aim of this study was to assess in a comparative manner the factors associated with malnutrition among public and private nursery school children in Kumba.

Methods
A cross-sectional quantitative survey design was conducted among 312 children aged 3-5 years from 6 public and private nursery schools and their caregivers. Children were selected via a multistage random sampling technique, and their weight and height were measured using the WHO Anthro software to determine levels of underweight, stunting, wasting, overweight, and the Composite Index of Anthropometric Failure (CIAF). Data were analyzed using SPSS version 26.0 to accommodate a multistage cluster design, employing Pearson's Chi-square tests for categorical variables, Student's t-tests for continuous variables, and forced-entry binary logistic regression to identify significant socio-economic, demographic, and school-type determinants of malnutrition at $p < 0.05$.

Results
The overall prevalence of wasting, stunting and overweight among the children was 6.7%, 14.1% and 13.7%, respectively, with a CIAF of 19.5%. Wasting and stunting were more prevalent in public schools. Overweight prevalence was higher in private schools. Children attending public schools were 6.99 times more likely to be stunted than those attending private schools [AOR, 6.99; 95% CI, 2.24-21.86]. Home-packed lunch boxes lowered odds of wasting [AOR, 0.044; 95% CI, 0.011-0.17] and stunting [AOR, 0.085; 95% CI, 0.02-0.24].

Conclusion
Children from socioeconomically advantaged backgrounds, whose families could afford private education and packing school lunch boxes, had lower risks for stunting and wasting. Overweight was less prevalent among public school children. Parents across both public and private nursery schools must be educated on essential child nutrition practices to curb malnutrition.

Keywords: malnutrition, socio-demographic factors; lunch box, public and private nursery school children, children's caregivers

Introduction

Malnutrition among young students has consequences for their health and cognitive and physical development. These impairments lead to learning difficulties, mood disorders, elevated risks of adult chronic diseases, and a persistent intergenerational cycle of poverty (Victora et al., 2016). Childhood malnutrition arises from an imbalance of caloric and nutrient intake coupled with recurrent diseases, manifesting as wasting, stunting, underweight conditions, micronutrient deficiencies, and pediatric obesity. Globally recognized by UNICEF (2015) as a major public health crisis, malnutrition is particularly severe in low- and middle-income nations. The prevalence of malnutrition among children in Cameroon remains high, particularly among the poor and those residing in rural areas (Manjong et al., 2021). According to a 2021 survey in four vulnerable regions of Cameroon (Far North, North, Adamaoua and East), including refugee populations, 29% of children under five are malnourished. Chiabi et al. (2024) documented a 10.8% prevalence of malnutrition among nursery school children in the North-West region. In developing nations undergoing epidemiological transition, undernutrition mainly affects lower-income children, while overweight and obesity are more common among wealthier families (Lobstein et al., 2004). Consequently, public schools that primarily serve lower-income students often show higher rates of undernutrition, whereas private schools that serve affluent families report higher rates of overweight and obesity (Dabone et al., 2011; Kavitha et al., 2014).

Preschool or nursery school children in Cameroon, generally two to six years of age, are vulnerable to malnutrition due to their rapid growth and development, increased susceptibility to infection, and dependence on caregivers for adequate food and care (Islam et al, 2025). This issue stems from a combination of poor feeding habits, food insecurity, lack of healthcare and sanitation, low parental education, short birth spacing, and gender inequalities that limit women's decision-making and economic power (INS & ICF, 2020). Due to differences in culture, ethnicity, socioeconomic characteristics, and geographical region, these risk factors may vary across different areas. Kumba municipalities are located in the South-West region of Cameroon, which has become embroiled in an escalating armed conflict since 2017, with severe consequences on the nutritional status of the population.

Studies investigating malnutrition and related factors may provide relevant information to support more effective public policies to address this significant public health concern. Nevertheless, most studies conducted in Cameroon have focused primarily on children aged 6 to 24 months. Determining the factors associated with malnutrition among public and private nursery school children could provide baseline data to better understand its causes. Hence, this study was conducted to assess the factors associated with malnutrition among children attending public and private nursery schools in Kumba municipalities.

Methods

Research Design

This study employed a cross-sectional quantitative analytical design to investigate the factors associated with malnutrition among nursery school children 3-5 years old, comparing public and private institutions in Kumba, Cameroon, from January 15th to March 20th, 2025. To gather socio-economic and demographic data, trained research assistants conducted structured, face-to-face interviews with consenting caregivers who were fluent in Pidgin. The questionnaire was adapted from previously validated instruments by Agbozo et al. (2016) and Ali et al. (2022), with modifications made to fit the specific local context of Kumba. To ensure linguistic accuracy and cultural relevance, the tool was initially developed in English, translated into Pidgin, and back-translated to English by language experts. Additionally, the children's nutritional status was evaluated through standardized anthropometric measurements.

Study area

The study was conducted in three government schools (Government Nursery School GNS Ekemba; G.N.S. Kumba-Town; GNS Kumba-Mbeng) and three private schools (St. Thomas Nursery School; Canaan Baptist Nursery Schools; Mother Agnes Memorial Bilingual Nursery School) of Kumba municipalities (Kumba I, II and III). According to unpublished data from the Meme Divisional Delegation of Basic Education, there were 1517 nursery school children attending 33 nursery schools in those areas, of which 15 were public, and 18 were private. Since 2017, Kumba has been experiencing the effects of an armed conflict currently affecting the North-West and South-West Regions of Cameroon. This so-called "Anglophone crisis" has severely affected the nutritional status of its populations, particularly children, leading to widespread displacement and hunger (Ngide et al., 2024).

Study Population

To be eligible for inclusion, children must have been 3-5 years old and enrolled in their respective schools for at least one full academic year. Children with physical disabilities or serious illnesses that could significantly impact their nutritional status were excluded. Additionally, the caregivers of the selected children were invited to participate and provide relevant socioeconomic and demographic information. Final enrollment required caregivers to provide informed consent, voluntarily completing and signing a consent form on behalf of themselves and their children.

Sample Size

The following formula by Magnani, (1997) was used to determine the sample size.

$$N = \frac{t^2}{m^2}\, x\, P(1-P) \quad \text{----------} \rightarrow (1)$$

Where "N" is the desired sample size, "t" is the confidence level at 95% (standard value of 1.96), and "p" represents the estimated prevalence of malnutrition in the population. According to Sumbele et al. (2020), the prevalence of malnutrition among nursery and primary school children is 24.4%; 'm' is the desired level of precision (i.e., the margin of error). m = 0.05

$$N = \frac{1.96^2}{0.05^2}\, x\, 0.244(1-0.244) \quad \text{----------} \rightarrow (2)$$

Thus, after accounting for a 10% non-response rate, the final sample size was 312.

Sampling Techniques

Study participants were selected using a multistage probability sampling method. The three municipalities of Kumba (Kumba I, II and III) were considered as clusters.

Sampling of Schools

To optimize statistical power for comparative analysis and eliminate confounding geographical variables, a balanced, disproportionate allocation approach was implemented, selecting exactly one public and one private school per subdivision via simple random sampling within each cluster. This resulted in a total of six selected schools (three private and three public). A list from the Meme Divisional Delegation of Basic Education functioned as the sample frame. A predetermined sample interval of 3 was applied within each municipality to determine the final selections.

Sampling of Children

Within each selected school, children enrolled in nursery I and II constituted the study population. The total sample size (641) was allocated to each selected school using proportion to population size. The distribution of children in the schools was 97, 114, 123, 108, 72, and 127. The number of children targeted per school was 47, 55, 60, 53, 35, and 62, respectively. Study participants were selected using a computer-generated simple random sampling technique. Invitations were then sent to the primary caregivers of the selected children. To minimize non-response bias and ensure a robust sample, participants who were unable to attend the scheduled school-based interviews were visited at their residences. During these home visits, trained research assistants administered the questionnaires under the exact same protocol and standardized conditions used in the schools.

Research Instruments and Data Collection Methods

The variables collected through administered questionnaires were categorized into three foundational domains: household demographics (child's age, sex, and family size), which reflect biological vulnerabilities and sibling competition for resources; caregivers' socio-economic status (educational level, occupation, and estimated household income), which directly dictates food accessibility and healthcare-seeking capacities; and school dietary habits (possession of a school lunch box), serving as a proxy for the child's daily nutritional intake and meal consistency (Hlahla et al, 2023; Tangwa et al, 2024).

Anthropometric measurements were taken following WHO standard anthropometry guidelines (WHO, 1995). Standing height was measured to the nearest 0.1 cm using a stadiometer (Leicester® Height Measure, Seca, UK). An electronic bathroom weighing scale (TEFAL, German) with a capacity of 150 kg and 0.1 g precision was used to measure body weight.

The nutritional status of the nursery school children was determined using WHO standard protocols for children aged 2–5 years (WHO, 2006). Z-scores were calculated using WHO Anthro V 3.2.2 software for weight-for-height (WHZ, wasting), height-for-age (HAZ, stunting), and weight-for-age (WAZ, underweight), and the values were compared with reference standards to determine the children's nutritional status. A height-for-age (HAZ) z score below -2SD indicated stunting. A child with a z-score below -2SD (low weight-for-age) is considered underweight. A participant with a z-score below -2 SD (weight-for-height) was considered to have wasting (WHO, 2006). Overweight was defined as a WHZ greater than +2 SD.

Data Analysis

Data screening, scoring, and coding were performed manually. Data capture and analysis were conducted using the Statistical Package for the Social Sciences (version 26.0) survey modules to accommodate the multistage cluster design used during data collection. Both descriptive and inferential statistics were used in analyzing and reporting findings. We used Pearson's Chi-square tests (χ^2) to compare categorical variables between public and private nursery school children, presenting the data as frequencies and percentages. For continuous variables, we applied Student's t-tests and reported the results as means with standard deviations (SD). Binary logistic regression using a forced-entry method was employed to assess the associations between independent variables (school type, household demographics, caregivers' socio-economic status, and school dietary habits) and the dependent variables (wasting, stunting, overweight, and underweight). All selected independent variables were entered simultaneously into the models to mutually adjust for potential confounders and ensure the best model fit. The level of significance was set at $p < 0.05$ at 95% confidence interval.

Institutional Review Board

The study was approved by the Institutional Review Board of the Faculty of Health Sciences at the University of Buea, Cameroon, under reference N0 2025/1845-11/UB/SG/IRB/FHS, and was conducted in accordance with the Declaration of Helsinki.

Results

Socio-economic and demographic characteristics of nursery school children in public and private nursery schools and their caregivers

Table 1 presents the socio-demographic and economic characteristics of pupils in public and private schools and their caregivers living in the Kumba municipalities. Possession of a lunch box, education, main occupation, and family size were primary differences between public and private nursery schools. No significant differences ($p > 0.05$) were observed for gender or age.

Mean anthropometric data of children attending nursery schools in Kumba. Table 2 shows that private school children were larger in size.

Table1. Socio-economic and demographic characteristics of nursery school children and their caregivers attending public and private nursery schools in Kumba, Cameroon, 2025 (N = 312).

Variables	Public N=177 n (%)	Private N=135 n (%)	Overall N=312 n (%)	χ^2	P Value
Gender of children					
Male	85(48.0)	67(49.6)	152(48.7)	0.07	0.778
Female	92(51.9)	68(50.3)	160(51.2)		
Age (years) of children					
3-4	93(52.5)	80(59.2)	173(55.4)	1.40	0.237
4-5	84(47.4)	55(40.7)	139(44.5)		
Lunch box					
Yes	152(85.8)	127(94.0)	279(89.4)	5.44	0.02
No	25(14.1)	8(5.9)	33(10.5)		
Main occupation					
Housewife	65(36.7)	15(11.1)	80(25.6)	37.56	<0.001
Farmer	27(15.2)	11(8.1)	38(12.1)		
Merchant	39(22.0)	60(44.4)	99(31.7)		
Government employ	46(25.9)	49(36.2)	95(30.4)		
Education					
No formal education	65(36.7)	27(20.0)	92(29.4)	11.60	0.009
Primary education	56(31.6)	46(34.0)	102(32.6)		
Secondary education	33(18.6)	38(28.1)	71(22.7)		
Higher education	23(12.9)	24(17.7)	47(15.0)		
Marital status					
Single	28(15.8)	32(23.7)	60(19.2)	3.06	0.08
Married	149(84.1)	103(76.2)	252(80.7)		
Level of monthly income (FCFA*)					
< 100,000	54(30.5)	24(17.7)	78(25.0)	8.44	0.077
100,000 – 200,000	30(16.9)	23(17.0)	53(16.9)		
200,000-300,000	30(16.9)	28(20.7)	58(18.5)		
300,000-400,000	37(20.9)	29(21.4)	66(21.1)		
⩾400,000	26(14.6)	31(22.9)	57(18.2)		
Family size					
< 6	47(26.5)	49(36.3)	96(30.7)	9.63	0.002
⩾ 6	130(73.4)	86(63.7)	216(69.2)		

*1EUR=656 FCFA

Table 2. Mean anthropometric data of nursery school children attending nursery schools in Kumba, Cameroon, 2025.

Variables	Public	Private	Overall	t-test	P-value
Weight (kg)	15.6±2.1	16.7±2.0	16.1±2.2	-4.514	<0.001
Height (cm)	98.5±4.1	100.2±3.6	99.2±4.0	-3.72	<0.001
Height-for-Age Z-score	-0.8±1.2	-0.4±1.3	-0.6±1.2	-2.659	0.008
Weight-for-Height Z-score	0.4±1.3	0.8±1.3	0.6±1.2	-2.98	0.003
Weight-for-Age Z-score	-0.2±1.3	0.2±1.2	0.0±1.3	-3.49	0.001

Prevalence of malnutrition among nursery school children attending nursery schools in Kumba

Figure 1 shows that malnutrition was more prevalent among public nursery school students and overweight among private school pupils.

Prevalence of different forms of anthropometric malnutrition among school children in Kumba municipalities

Table 3 shows the proportions of nursery school children suffering from the three anthropometric indexes in combination or alone. The CIAF of the public-school children in our sample was 22.6 while the overall CIAF was 19.5.

Factors associated with wasting, stunting, underweight and overweight among nursery school children

The binary regression analysis presented in Table 4 shows that children in private schools had much lower risks of both wasting and stunting, and that carrying a lunch box to nursery school was associated with a lower risk of both. Additionally, stunting was significantly associated with a larger family size.

Table 5 shows that using a lunch box or attending a private school was associated with a lower risk of being underweight and private school pupils or living in a larger family were less likely to be overweight. None of the independent variables tested were significantly associated with being overweight or underweight. Although higher education and increased household income were associated with a greater likelihood of overweight among nursery school children, these same socioeconomic factors exerted a protective effect against underweight.

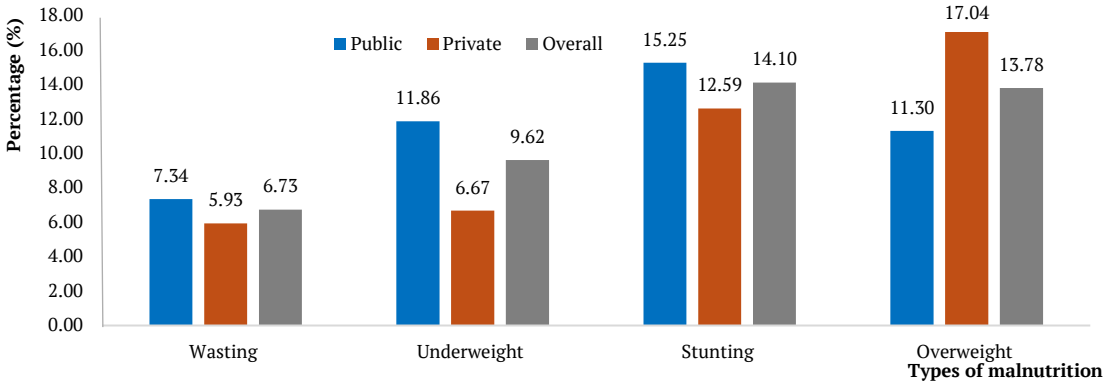


Figure 1. Prevalence of types of malnutrition among nursery school children attending public (N= 177) and private (N=135) nursery schools in Kumba, Cameroon, 2025

Table 3. The prevalence of various groups of anthropometric failure among study participants in Kumba, Cameroon, 2025 (N =312)

Categories	Public		Private		Overall	
	n	%	n	%	n	%
No failure	116	65.5	101	74.8	217	69.5
Wasting only	2	1.1	0	0.0	2	0.6
Wasting and underweight	5	2.8	3	2.2	8	2.5
Stunting, wasting, and underweight	6	3.3	5	3.7	11	3.5
Stunting and underweight	9	5.0	5	3.7	14	4.5
Stunting only	12	6.7	7	5.2	19	6.1
Underweight only	6	3.3	1	0.7	7	2.2
CIAF (%)	40	22.6	21	15.6	61	19.5
Single failure	20	11.3	8	5.9	28	9
Multiple failures	20	11.3	13	9.6	33	10.6

Stunting is defined as a height-for-age z-score below –2SD. Wasting is defined as a weight-for-height z-score below -2SD. Underweight is defined as weight-for-age below -2SD.

Table 4. Binary logistic regression of factors associated with wasting and stunting among nursery school children

Variables	Wasting		Stunting	
	AOR(95%CI)	P-value	AOR(95%CI)	P-value
School types				
Private	**1.00**		**1.00**	
Public	20.25 [2.26-180.96]	0.007	6.99 [2.24-21.81]	0.001
Lunch box				
No	**1.00**		**1.00**	
Yes	0.044[0.011-0.17]	0.001	0.085[0.02-0.24]	0.001
Main occupation				
Housewife	**1.00**		**1.00**	
Farmer	0.22[0.045-1.09]	0.064	0.662[0.202-2.16]	0.495
Merchant	0.50[0.08-3.11]	0.462	0.73[0.22-2.40]	0.615
Education				
Higher education	**1.00**		**1.00**	
Secondary education	5.93 [1.33-26.43]	0.019	1.083[0.39-2.97]	0.87
Primary education	3.91 [0.43-35.16]	0.223	2.58[0.24-27.91]	0.430
Marital status				
Married	**1.00**		**1.00**	
single	0.88 [0.26-2.98]	0.847	1.44[0.50-4.14]	0.495
Level of monthly income (FCFA*)				
< 100,000	**1.00**		**1.00**	
100,000 – 200,000	0.376[0.07-1.84]	0.229	0.82[0.25-2.60]	0.738
200,000-300,000	**0.42**[0.06-3.04]	**0.394**	0.90[0.24-3.25]	0.872
300,000-400,000	**0.14**[0.01-1.31]	**0.086**	0.98[0.22-5.91]	0.872
Family Size				
⩾ 6	**1.00**		**1.00**	
< 6	0.59[0.15-2.26]	0.45	0.18[0.057-0.587]	0.04

*1EUR=656 FCFA; CI= confidence interval, AOR = Adjusted odds ratio. Stunting is defined as a height-for-age z-score below –2SD. Wasting is defined as a weight-for-height z-score below -2SD

Table 5. Binary logistic regression of factors associated with overweight and underweight among nursery school children

Variables	Overweight		Underweight	
	AOR (95%CI)	P-value	AOR (95%CI)	P-value
School types				
Public	**1.00**		**1.00**	
Private	2.21[0.847-5.75]	0.105	0.60 [0.12-3.01]	0.541
Lunch box				
yes	**1.00**		**1.00**	
no	0.55[0.17-1.74]	0.316	17.9[3.9-81.1]	0.000
Main occupation				
Government employ	**1.00**		**1.00**	
Merchant	0.84[0.21-3.27]	0.802	0.30[0.05-1.71]	0.179
Farmer	1.15[0.28-4.63]	0.84		
Education				
Higher education	**1.00**		**1.00**	
Secondary education	0.39[0.097-1.619]	**0.197**	1.92[0.28-13.04]	0.504
Primary education	0.43[0.059-3.15]	0.406		
Marital status				
single	**1.00**		**1.00**	
Married	1.06[0.42-2.67]	0.894	2.52[0.61-10.31]	0.199
Level of monthly income (FCFA*)				
Less than 100.000	**1.00**		**1.00**	
100.000 – 200.000	1.26[0.10-15.40]	0.853	0.40[0.05-2.88]	0.365
200.000-300.000	2.14[0.34-13.29]	0.411	0.16[0.01-1.71]	0.132
Family Size				
More ⩾ 6	**1.00**		**1.00**	
Less < 6	2.084[0.91-4.75]	0.105	0.33[0.03-3.057]	0.332

*1EUR=656 FCFA ; CI=confidence interval; AOR = Adjusted odds ratio. Underweight is defined as a weight-for-age z-score below -2SD. Overweight is defined as a weight-for-height z-score above +2SD

Discussion

The main objective of this study was to assess the factors associated with malnutrition among nursery school children attending private and public nursery schools in Kumba municipalities. As has been the case in previous research in Sub-Saharan African countries, we found a close relationship between the type of school (public vs private) and the socio-demographic characteristics of parents, their nutritional status, and their level of activity (Agbozo et al., 2016; Ali et al., 2021).

Stunting (14.1%) was the highest form of malnutrition overall. Our overall prevalence of underweight (9.6%) is higher than the 1.4% reported by Chiabi et al. (2024) amongst nursery school children in the Mezam division (North-West region, Cameroon). The overall CIAF was 19.5, which includes all children who were wasted, stunted, or underweight. This CIAF is higher than the 10.8% reported among pre-school-aged children in the North-West region of Cameroon (Chiabi et al., 2024). The CIAF of the public-school children in our sample was 22.6. This discrepancy can be justified, among other reasons, by the socio-political crisis that has been affecting the South-West and North-West regions of Cameroon since 2017 and which has caused a decline in agricultural activities, restrictions in access to markets, and a reduction in household purchasing power, leading to food insecurity (Hirvonen et al., 2021). According to Chiabi et al. (2024), the prevalence of stunting among nursery school children in the North-West region is 7.8%, which is half of that reported in this study (14.10%). The disparity may also be due to geographic heterogeneity in risk factors, variation in eating habits, and the types of meals available across the population. Stunting (15.2%) and underweight (11.8%) were the most prevalent forms of malnutrition among public nursery school children, while overweight (17.0%) predominated in private schools. The CIAF assessment confirmed a higher prevalence in public (22.6%) than in private (15.6%) schools. Studies by Agbozo et al. (2016) and Ali et al. (2021) similarly reported higher levels of undernutrition among public school students in Ghana and Ethiopia. This difference likely stems from factors such as family income, size, education, school feeding programs, and lunch box availability. The impact of family income corroborates findings by Endris et al. (2017), as malnutrition often results from poverty and limited access to diverse foods (Siddiqui et al., 2020; Faezeh et al., 2023). Ultimately, undernutrition significantly impairs physical and mental development, reducing learning capacity, adulthood productivity, and fertility (Wilson et al., 2018; Thurstans et al., 2020; Ekholuenetale et al., 2020.

Wasting, stunting, and associated factors

The type of school attended (public vs. private) was found to be a determinant of stunting and wasting among nursery school children. This observation is consistent with studies conducted in India and across various Sub-Saharan African countries, which indicate that private school students have lower risks of undernutrition, largely reflecting broader socioeconomic disparities (Kavitha et al., 2014; Agbozo et al., 2016; Ali et al., 2022).

Conversely, children in private schools are more likely to be overweight than their public-school peers (Kyallo et al., 2013; Kavitha et al., 2014; Shi et al., 2017). Public school students often come from lower-income families living in poorer environments, facing food insecurity, inadequate access to clean water, and lower parental education (Agbozo et al., 2016; Igbokwe et al., 2017). Conversely, the higher prevalence of overweight pupils in private schools may be attributed to urbanization and lifestyle modifications. These include dietary shifts, reduced active commuting to school, the widespread use of energy-saving devices, and an increase in sedentary behavior—such as television viewing and computer gaming—which collectively foster an obesogenic environment (Popkin, 2005; Baniissa et al., 2020). Furthermore, children from private schools consume more junk foods like candy, which contributes to obesity primarily because they provide empty calories—high in fat, sugar, and salt—while lacking essential vitamins, minerals, iron, and protein found in healthy foods like “yoghurt-like-products” made from tiger nuts (Drewnowski et al., 2007; Kamda et al., 2025). Young students from high socio-economic backgrounds—disproportionately represented in private academies—have been found to be twice as likely as peers from lower-income backgrounds to bring unhealthy foods, such as candy, to school (Portia et al., 2004; Acharya, 2022).

Most cultures have historically developed dietary practices well-suited to their environments, thereby ensuring the nutritional well-being of their populations. However, rising wealth may precipitate a shift away from these cultural traditions, thereby impacting both the culture itself and the population's overall health. Children who find themselves in such affluent environments, in most cases, become accustomed to unhealthy eating habits, such as consumption of ultra-processed foods, that frequently lead to obesity.

Children who did not bring lunch boxes were independently associated with stunting and wasting. This observation aligns with previous literature (Ugochukwu et al. 2014; Yeshalem and Azezu, 2020). The plausible explanation is that children who eat meals at school are more likely to meet their nutrient requirements. Missing these meals deprives children of critical caloric and nutrient intake during a vital 5- to 6-hour school day, leaving them vulnerable to undernutrition and micronutrient deficiencies (Agbozo et al., 2016).

In contrast to our study, where associations with caregiver education levels were not statistically significant, prior literature has identified it as a major predictor of malnutrition (Vasfiye et al., 2024). Research evaluating dietary quality across socioeconomic spectrums (Kumar et al., 2024) demonstrated that parental educational achievement was a greater predictor of whether a child achieves the minimum dietary diversity threshold than income.

Pupils from families with ⩾6 members were more likely to experience stunting. Researchers have identified large family size as a risk factor for undernutrition elsewhere in

Africa (Bashir et al., 2021; Getasew et al., 2023). Additionally, a short birth interval leads to early cessation or disruption of breastfeeding, combined with inadequate care for older siblings (Smith et al., 2022).

There is a critical need for mass public awareness campaigns that align with healthy traditional values to support the growth of children, especially pre-school students in both public and private schools.

Limitation

An important limitation of this study is that the results obtained here are only representative of the population of nursery school pupils in which no nutritional intervention program is implemented. These results do not necessarily reflect the nutritional status of children of the same age who are out of school or who reside in a locality with no security crisis

Conclusions

Malnutrition has been a problem in many communities and populations worldwide due to various factors. This study investigated the specific factors associated with malnutrition among children attending public and private nursery schools in Kumba, Cameroon. The prevalence of wasting, stunting and underweight was higher among public nursery school pupils than their private school counterparts. Conversely, the prevalence of overweight was higher among pupils at private nursery schools. The absence of a school lunchbox increased the odds of undernutrition among these children. Other factors, such as attending private schools and a large family size, decreased the odds of undernutrition while increasing the odds of overweight. It is important for the government to facilitate the implementation of nutrition intervention programs to improve the nutritional status of children in schools. Such initiatives should not only provide meals that meet children's nutritional needs but also improve parents' education and socioeconomic status to enhance their children's food security.

Author Contributions

AGSK, FE and GNA contributed to the conceptualization, overall study design, and provided supervision. AGSK, DN and BVE contributed to the methodology. BVE and OAA conducted the investigation and field data collection, data curation, data analysis, and visualization of results. AGSK, DN and BEM wrote the original draft of the manuscript, while EF and GNA contributed to the final draft and submission of the manuscript. All authors have read and approved the final version for publication.

Declaration of Generative AI and AI-Assisted Technologies in Scientific Writing

Nothing to disclose.

Acknowledgements

The authors are grateful to all participants who took the time to complete the survey and provide valuable data for this study.

Data Availability Statement

Data are available upon reasonable request from the authors.

Funding

None

Conflict of Interest

The authors declare that they have no conflicts of interest.

Publisher's Note: *All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher. The publisher remains neutral with regard to jurisdictional claims.*

REFERENCES

Acharya L (2022). Consumption of junk food and its health effect on school students. *SunText Review of Arts and Social Sciences,* 3(1): 136. https://doi.org/10.51737/2766-4600.2022.036

Agbozo, F., Atito, P. & Abubakari, A. (2016). Malnutrition and associated factors in children: A comparative study between public and private schools in Hohoe Municipality, Ghana. *BMC Nutrition* 2(32):1–10. https://doi.org/10.1186/s40795-016-0073-7

Ali, M., Arif, M. & Shah, A.A. (2021). Complementary feeding practices and associated factors among children aged 6–23 months in Pakistan. *PLoS One* 16:e0247602. https://doi.org/10.1371/journal.pone.0247602

Ali M., Kassahun C., Wubneh C., Mekonen EG., Workneh B.S. (2022). Determinants of undernutrition among private and public primary school children: A comparative cross-sectional study toward nutritional transition in northwest Ethiopia. *Nutrition* 96:111575. https://doi.org/10.1016/j.nut.2021.111575

Baniissa W., Radwan H., Rossiter R., Fakhry R., Al-Yateem N., Al-Shujairi A., Hasan S., … Awad M.A. (2020). Prevalence and determinants of overweight/obesity among school-aged adolescents in the United Arab Emirates: a cross-sectional study of private and public schools. *BMJ Open* 10(12):e038667. https://doi.org/10.1136/bmjopen-2020-038667

Bashir, M., Sadiq, M., Khan, M., Khan, A. & Ho, A., (2021). Prevalence, level and factors associated with malnutrition in children under-five years of age and their parents' awareness about children nutrition in Quetta city. *Open Journal of Pediatrics and Child Health*, 6(1):20-25. https://dx.doi.org/10.17352/ojpch.000033

Chiabi A., Ngum R., Niba L.L., Mambap A.T., Angwafor S., Ashuntantang G. (2024). Patterns and determinants of undernutrition in pre-school age children in the North West Region of Cameroon. *Medical Discoveries,* 3(5):1149. https://www.meddiscoveries.org/articles/1149.html

Dabone, C., Delisle, H.F. & Receveur, O. (2011). Poor nutritional status of schoolchildren in urban and peri-urban areas of Ouagadougou (Burkina Faso). *Nutrition Journal,* 10(1):34. https://doi.org/10.1186/1475-2891-10-34

Drewnowski A. (2007). The real contribution of added sugars and fats to obesity. *Epidemiologic Reviews,* 29(1):160–171. https://doi.org/10.1093/epirev/mxm011

Ekholuenetale, M., Barrow, A., Ekholuenetale, C., E. & Tudeme, G. (2020). Impact of stunting on early childhood cognitive development in Benin: Evidence from demographic and health survey. *Egyptian Pediatric Association Gazette*, 68. https://doi.org/10.1186/s43054-020-00043-x

Endris, N., Henok, A. & Lamessa, D. (2017). Prevalence of malnutrition and associated factors among children in rural Ethiopia. *BioMed Research International,* 2017:6587853. https://doi.org/10.1155/2017/6587853

Faezeh A., Maryam M., Behzad N., Shirin N. (2023). Factors affecting inequality in the quality diets: A scoping review. *Value in Health Regional Issues*, 37;105-112. https://doi.org/10.1016/j.vhri.2023.05.003

Getasew. B., Behailu, D., Helen, A. & Kassahun, A. (2023). Determinants of nutritional status among primary school students in Dilla Town; Application of an ordinal logistic regression model. *Heliyon*, 9(3):e13928. https://doi.org/10.1016/j.heliyon.2023.e13928

Hirvonen, K., de Brauw, A., & Minten, B. (2021). The long-term impacts of the COVID-19 pandemic on food security and diets. *Report to the World Bank*. https://www.worldbank.org/

Hlahla M.O., Kunene L.A., Mphekgwana P.M., Madiba S., Monyeki K.D., Modjadji P. (2023) Comparison of malnutrition indicators and associated socio-demographic factors among children in rural and urban public primary schools in South Africa. *Children*, 10(11):1749. https://doi.org/10.3390/children10111749

Igbokwe, O., Adimorah, G., Ikefuna, A., Ibeziako, N., Ubesie, A., Ekeh, C. & Kenechukwu, I. (2017). Socio-demographic determinants of malnutrition among primary school aged children in Enugu, Nigeria. *Pan African Medical Journal*. 28:248. https://doi.org/10.11604/pamj.2017.28.248.13171

INS & ICF. (2020). Enquête Démographique et de Santé du Cameroun 2018. Yaoundé, Cameroun et Rockville, Maryland, USA: INS (Institut National de la Statistique) and ICF.

Islam, B., Ibrahim, T., I., Wang, T., Wu, M. & Qin, J. (2025). Current trends in household food insecurity, dietary diversity, and stunting among children under five in Asia: A systematic review. *Journal of Global Health Reports* 15:04049. https://doi.org/10.7189/JOGH.15.04049

Kamda, A. G. S., Changam, H. M., Bouelet, I. S., Mbassi, G. M., Yiagnigni, A. R., Nyangono, C., Roger, P., Achu, M.& Fokou, E. (2025). Effect of pretreatment methods on the sensory and nutritional properties of a yoghurt-like product made from tiger nuts (*Cyperus esculentus* L.). *Exploration of Foods and Foodomics* 3:101096. https://doi.org/10.37349/eff.2025.101096

Kavitha, H. S., Kulkarni, P. & Ashok, N. C. (2014). A comparative study of nutritional status between government and private primary school children of Mysore city. *International Journal of Health and Allied Sciences*, 3(3):164. https://doi.org/10.4103/2278-344X.138596

Kumar R., Mahmood T., Naeem N., Khan S.A., Hanif M., Pongpanich S. (2024). Minimum dietary diversity and associated determinants among children aged 6-23 months in Pakistan. *Scientific Reports*, 14(1):2639. https://doi.org/10.1038/s41598-024-51705-4

Kyallo, F., Makokha, A. & Mwangi, A. M. (2013). Overweight and obesity among public and private primary school children in Nairobi, Kenya. *Health* 5:8C. https://doi.org/10.4236/health.2013.58A3012

Lobstein, T., Baur, L. & Uauy, R. (2004). Obesity in children and young people: a crisis in public health. *Obesity Reviews* 5(1):4–104. https://doi.org/10.1111/j.1467-789X.2004.00133.x

Magnani, R. (1997). *Sampling guide. Food and Nutrition Technical Assistance (FANTA) Project, Academy for Educational Development*. Full text here

Manjong, F. T., Verla, V. S, Egbe, T. O. & Nsagha, D. S. (2021). Undernutrition among under-five indigenous Mbororo children in the Foumban and Galim health districts of Cameroon: A cross-sectional study. *Pan African Medical Journal* 38:352. https://doi.org/10.11604/pamj.2021.38.352.25030

Ngide, H. E., Ngeh, L. S. &, Ngala B. S. (2024). Armed Conflict: Impact on Women and Children in the South West Region, Cameroon. *International Journal of Research and Innovation in Social Science* 8(11). https://doi.org/10.47772/IJRISS.2024.8110128

Popkin, B. M. (2005). Using research on the obesity pandemic as a guide to a unified vision of nutrition. *Public Health Nutrition* 8:724–9. https://doi.org/10.1079/PHN2005776

Portia, J., Marcela, R., Marcela, C. & Carlos, C. (2004). Junk food consumption and childnutrition in Chile. *Revista médica de Chile* 132(10):1235-42. https://doi.org/10.4067/s0034-98872004001000012

Shi, J., Tan, D., Xie, H., Yang, B., Liu, R., Yu, D., Lu, Y., Mei, B. & Wang, Z. (2017). Unequal distribution of overweight adolescents in immigrant-rich areas: analysis of disparities among public and private school students in Shanghai, China. *International Journal of Environmental Research and Public Health* 14:252. https://doi.org/10.3390/ijerph14030252

Siddiqui, F., Salam, R. A., Lassi, Z. S. & Das, J. K. (2020). The intertwined relationship between malnutrition and poverty. *Frontiers in Public Health* 8:453. https://doi.org/10.3389/fpubh.2020.00453

Smith L.E., Chagwena D.T., Bourke C., Robertson R., Fernando S., Tavengwa N.V., Cairns J., … Prendergast A. (2022). Child Health,

Agriculture and Integrated Nutrition (CHAIN): Protocol for a randomised controlled trial of improved infant and young child feeding in rural Zimbabwe. *BMJ Open* 12:e056435. https://doi.org/10.1136/bmjopen-2021-056435

Sumbele, I. U., Nkain, A. J., Ning, T. R., Anchang-Kimbi, J. K. & Kimbi, H. K. (2020). Influence of malaria, soil-transmitted helminths and malnutrition on haemoglobin level among school-aged children in Muyuka, Southwest Cameroon: A cross-sectional study on outcomes. *PLoS One* 15(3):e0230882. https://doi.org/10.1371/journal.pone.0230882

Tangwa M., Epo B.N., Baye F. (2024). Maternal education and child malnutrition in Cameroon: Does housing quality matter? *Social Sciences & Humanities Open* 9(7):100901. https://doi.org/10.1016/j.ssaho.2024.100901

Thurstans, S., Opondo, C., Seal, A., Wells, J., Khara, T., Dolan C., Briend, A., … Kerac, M. (2020). Boys are more likely to be undernourished than girls: A systematic review and meta-analysis of sex differences in undernutrition. *BMJ Global Health* 5:1–17. https://doi.org/10.1136/bmjgh-2020-004030

Ugochukwu, E. F., Onubogu, C. U., Edokwe, E. S. & Okeke, K. N. (2014). Nutritional contents of lunch packs of primary school children in Nnewi, Nigeria. *Annals of Medical & Health Sciences Research Journal* 4(2):S108–S114. https://doi.org/10.4103/2141-9248.138024

UNICEF. (2015). Improving child nutrition: the achievable imperative for global progress. United Nations Children's Fund, 132pp.

Vasfiye, B. D., Sema, Ç., Melikşah, E. (2024). The effect of ` socioeconomic factors on malnutrition in Syrian children aged 0–6 years living in Turkey: A cross-sectional study. *BMC Public Health* 24:2472. https://doi.org/10.1186/s12889-024-19791-1

Victora, C. G., Rajiv B., Aluísio, J. D., Giovanny V. A., Susan, H., Julia, K., Simon, … Nigel, C. R. (2016). Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet* 387(10017):475–90. https://doi.org/10.1016/S0140-6736(15)01024-7

Wilson, A. L., Bradley, J., Kandeh, B., Salami, K. D'Alessandro, U., Pinder, M. & Lindsay, S. W. (2018). Is chronic malnutrition associated with an increase in malaria incidence? A cohort study in children aged under 5 years in rural Gambia. *Parasites and Vectors* 11(1):451. https://doi.org/10.1186/s13071-018-3026-y

WHO. (1995). Physical status: The use of and interpretation of anthropometry, Report of a WHO Expert Committee. Geneva: World Health Organization. https://iris.who.int/handle/10665/37003

WHO. (2006). WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight for-height and body mass index-for-age. Geneva: World Health Organization. https://iris.who.int/items/a20b2093-580a-4ac0-8766-07dde0d75bca

Yeshalem, M. D. & Azezu, A. N. (2020). The relationship between school meals with thinness and stunting among primary school students, in Meket Wereda, Ethiopia: Comparing schools with feeding and non-feeding program. *BMC Nutrition* 6:34. https://doi.org/10.1186/s40795-020-00358-3