Research Article

Queen Arwa University Journal
مجلة جامعة الملكة أروى
QAUSRJ

Stunting Status and Associated Risk Factors among Some Primary School Children in Sana'a City, Yemen

Mohammed Alsebaeai [1,2], Soha Al-Seraji [2], Amat Almazba [2], Asma Alnuzaili [2], Basema Botily [2], Entesar Othman [2], Hadeel Al-Sayaghi [2], Haidarah Haidarah [2], Haneen Moshta [2], Nadia Ayd [2], Reham A Karthami [2], Wafa,a Al-Shaibi [2]

[1]Department of Food Science and Technology, College of Agriculture and Food Science, Ibb University, Yemen.
[2]Department of Therapeutic Nutrition, Faculty of Medical Sciences, Azal University for Human Development, Yemen.

2025

Research Article Data:

PUBLISHER	Queen Arwa University
DOI	10.58963/qausrj.v29i29.313
P-ISSN	2226-5759
E-ISSN	2959-3050
Reception Date	25 June 2025
Accepted Date	25 July 2025
Published Date	31 July 2025
License ©	(CC BY 4.0)

Citation:
Alsebaeai, M., Karthami, R. ., Ayd, N. ., Moshta, H., Haidarah, H., Al-Sayaghi, H. ., Othman, E. ., Botily, B. ., Alnuzaili, A. ., Almazba, A. ., Al-Seraji, S. ., & Al-Shaibi, W. . (2025). Stunting Status and Associated Risk Factors among Some Primary School Children in Sana'a City, Yemen. Queen Arwa University Journal, 29(29), 10. https://doi.org/10.58963/qausrj.v29i29.313

Corresponding authors:
Author: Mohammed Alsebaeai
Phone: 967774488038+
Published Email: malsobaee22@gmail.com

Organization/University/ Center:
Affiliation: Queen Arwa University
Research funder: Not found.

Research field/specialization:
Clinical Pharmacy, General Pharmacy

QR code:
Scan QR code to visit this journal on your mobile device.
امسح الكود لزيارة موقع المجلة

Abstract:

This cross-sectional study aimed to assess the prevalence and associated factors of stunting among children aged 6 to 9 years attending private and government primary schools in Sana'a, Yemen. A total of 188 students were selected using a statistically representative sampling method. Data were collected through a structured questionnaire capturing demographic characteristics, along with anthropometric measurements focusing on height-for-age as an indicator of stunting. The results revealed that 43.6% of the children were stunted, indicating a high prevalence of chronic undernutrition, while 56.4% had normal height-for-age. Analysis showed no statistically significant associations between stunting and variables such as gender, school level, parental education, parental occupation, maternal smoking, or maternal khat chewing. These findings suggest that stunting remains a serious nutritional concern among school-aged children in Sana'a and may be driven by broader socioeconomic or environmental factors. Targeted interventions and comprehensive nutrition programs are urgently needed to address this issue.

Keywords:
Antibiotics, Questionnaires, Multivariate Analysis

ROR: 03vggq617
ISSN : 2226 - 5759

ترجمة الى العربية

حالة التقزم وعوامل الخطر المرتبطة بها بين أطفال بعض المدارس الابتدائية في مدينة صنعاء، اليمن

محمد السباعى [1,2]، سهى السراجى [2]، أمة الغني المزبة [2]، أسماء التزيلي [2]، بسمة البوتيلي [2]، انتصار عثمان [2]، هديل السياغي [2]، حيدرة حيدرة [2]، حنين مشطا [2]، نادية عيد [2]، ريهام الكرظمي [2]، وفاء، الشعيبي [2]

[1] قسم علوم وتكنولوجيا الأغذية، كلية الزراعة وعلوم الأغذية، جامعة إب.
[2] قسم التغذية العلاجية، كلية العلوم الطبية، جامعة آزال للتنمية البشرية.

2025

الملخص

هدفت الدراسة المقطعية إلى تقييم انتشار التقزم والعوامل المرتبطة به بين الأطفال الذين تتراوح أعمارهم بين 6 و9 سنوات المسجلين في المدارس الابتدائية الخاصة والحكومية في صنعاء، اليمن. تم اختيار عينة مكونة من 188 طالبًا. جُمعت البيانات من خلال استبيان منظم شمل الخصائص الديموغرافية، إلى جانب القياسات الأنثروبومترية التي ركزت على طول الى العمر كدلالة على التقزم. أظهرت النتائج أن نسبة 43.6% من الأطفال كانوا متقزمين، مما يشير إلى انتشار مرتفع لسوء التغذية المزمن، بينما كان لدى 56.4% معدل طول الى عمر طبيعي. لم تظهر التحليلات وجود ارتباطات ذات دلالة إحصائية بين التقزم ومتغيرات مثل الجنس، مستوى المدرسة، تعليم الوالدين، مهنة الوالدين، تدخين الأم، أو تعاطي الأم للقات. تشير هذه النتائج إلى أن التقزم لا يزال يمثل مشكلة غذائية خطيرة بين الأطفال في سن المدرسة في صنعاء، وقد تكون العوامل الاجتماعية الاقتصادية والبيئية الأوسع هي المحركة الأساسية له. هناك حاجة ملحة لتدخلات مستهدفة وبرامج تغذية شاملة لمعالجة هذه المشكلة.

الكلمات المفتاحية

سوء التغذية، الطلاب، الاطفال، المدارس، اليمن

1. Introduction

Malnutrition is a significant concern across all healthcare settings. It is defined as a disturbance in nutritional status caused by inadequate nutrient intake or impaired nutrient metabolism, which may be associated with conditions such as hypertension (AlRabeei et al., 2015).

Chronic undernutrition is commonly manifested as stunting, which is assessed through the length- or height-for-age indicator. A child is considered stunted when their length-/height-for-age z-score falls more than two standard deviations below the age- and sex-specific median of a well-nourished reference population. Stunting is largely irreversible and results from prolonged inadequate nutrition and recurrent infections, particularly during the critical first 1,000 days—from conception to a child's second birthday—when nearly all stunting occurs (Ngo et al., 2016).

Stunting, or impaired linear growth, is a significant public health concern affecting millions of children globally, especially in developing countries. Multiple factors contribute to this condition, including inadequate nutrition, recurrent infections, and poor socioeconomic conditions. Continued research is essential to identify the underlying causes and to develop effective strategies for prevention and intervention(Rushing & Selim, 2019). Recent studies have also highlighted the broader implications of poor nutrition on academic performance. The study revealed a significant positive relationship between regular breakfast consumption and academic performance among university students, highlighting the essential role of early-life nutrition in supporting both physical growth and cognitive function. These findings underscore the importance of implementing targeted nutritional interventions in early childhood to enhance overall health and educational attainment (Alsebaeai et al., 2024).

In developing countries, particularly among the poorest and most vulnerable segments of the population, malnutrition persists and is a widespread problem. In terms of numbers, the bulk of the world's under-nutrition problems are localized. In most countries, children from the poorest 20% of households experience the highest

levels of malnutrition. However, the extent of inequality in malnutrition between poor and wealthy families differs by country. For example, research has shown significant disparities in Peru, while in Egypt, the difference is minimal. As of the year 2000, child malnutrition rates were considerably higher in low-income nations (36%) compared to middle-income countries (12%), and just 1% in the United States. Despite recent improvements, approximately half of the children remain underweight in Asia, which is the highest level in the world (Moestue & Huttly, 2008).

Since malnutrition is significantly less common among school-aged children and adolescents compared to younger children, there has been relatively limited research focused on these older age groups. Furthermore, challenges in linking anthropometric measurements to the nutritional status of adolescents seem to have restricted further investigation in this field (Prista et al., 2003).

It is important to conduct studies using children who are just beginning school (6-9 years of age) because at this age, growth deficit reflects a reliable growth history of the child and offers an appropriate moment to study risk factors (Amigo et al., 2001). Malnutrition is a medical condition that arises from either a deficiency or an excess—relative or absolute—of one or more essential nutrients. Limited research has been conducted on the nutritional status, particularly stunting, among primary school children aged 6 to 9 years in both private and government schools. This study aimed to assess the prevalence of stunting among children aged 6 to 9 years attending private and government primary schools in Sana'a, Yemen.

2. Research methodology

2.1. Study design

A cross-sectional study was conducted to determine Stunting status of private and government primary school children, 6-9 years of age in Sana'a, Yemen.

2.2. Study area

The study was conducted at private (Alrashid) and government primary school (Alhora), Sana'a, Yemen.

2.3. Study Sampling

The sample size was calculated using Epi Info software (version 7.0, CDC), based on a population size of 274,172 surviving primary school children in Sana'a City, (Center, 2012), and an expected stunting prevalence of 26.4% (Al-Haidari et al., 2021). This calculation yielded an initial required sample size of 297 children. However, the final number of participants included in the study was 188, due to several limiting factors, including difficulties in obtaining approvals from educational authorities, restricted access to certain schools, and limitations in time and available resources.

2.4. Inclusion and exclusion criteria

All children enrolled in the selected primary schools in Sana'a City were eligible for inclusion in the study, provided they were present at school during the data collection period. Children who were absent from school at the time of the survey were excluded from participation.

2.5. Data Collection Methods

A structured questionnaire was utilized to collect both demographic information and data related to nutritional assessment. The dependent variable in this study was the nutritional status of the children, specifically measured by the presence or absence of stunting, as determined through height-for-age indicators. The independent variables encompassed a range of demographic and socioeconomic factors, including the child's gender (male or female), school name (Al-Rashid or Al-Hora), and class level (Levels 1 to 5). Parental education levels were recorded and categorized as none, primary, secondary, or tertiary education for both fathers and mothers. Additionally, parental occupations were classified into four groups: farmer, government employee, private sector employee, and unemployed. The study also included data on the mother's smoking habit, documented as either yes or no. These variables were statistically analyzed to

explore their potential association with the children's nutritional status, particularly the prevalence of stunting.

2.6. Data Analysis

Data analysis was conducted in both Anthro plus (2007) and SPSS (v26). Before launching analysis process, anthropometrical Z scores were calculated by WHO Anthro plus software program, using WHO growth standards 2006 as the reference value. We used one anthropometric indicator to assess infant's nutritional status: length-for age (L/A) based on WHO 2006 Growth Standards (de Onis, 2006) and the classification of nutritional status for stunting was based on the Height-for-Age Z-score (HAZ) according to World Health

Organization (WHO) standards. Children with a HAZ ≥ -2 were classified as having normal height-for-age, while those with a HAZ < -2 were classified as stunted, indicating chronic malnutrition. SPSS version 26 was utilized to perform descriptive statistics, including frequencies and percentages, and to conduct inferential analysis to explore the associations between stunting and potential risk factors.

2.7. Ethical Considerations

The study was initially approved by Azal University for Human Development in Sana'a city, as well as by the relevant school authorities. Oral informed consent was obtained from all students who participated in the study.

3. Results and Discussion

3.1. The distribution of Demographics factors among selected sample

Table 1 displays the distribution of Demographics factors among selected sample The demographic analysis of the study participants reveals notable distributions across gender, school type, class levels, parental education, parental occupation, and lifestyle habits. Among the 188 participants, 25% were male, while females made up the majority at 75%, indicating a higher representation of female students. The participants were nearly equally distributed between Alrashid (50.5%) and Alhora (49.5%) schools.

Table 1 Socio-Demographic characteristics of the study population (n=188)

Variable	Number of participate	Percentage of participate
		Gender
Male	47	25.0%
Female	141	75.0%
		Name of school
Alrashid	95	50.5%
Alhora	93	49.5%
		Class level
level 1	55	29.3%
level 2	30	16.0%
level 3	57	30.3%
level 4	37	19.7%
level 5	9	4.8%
		Education of fathers
Primary	55	29.3%
Secondary	30	16.0%
Tertiary education	57	30.3%
Non	60	31.9%
		Education of mothers
Primary	44	23.4%
Secondary	65	34.6%
Tertiary education	19	10.1%
Non	60	31.9%
		Fathers' occupation
Farmer	4	2.1%
Government	18	9.6%
Private	101	53.7%
Non employed	65	34.6%
		Mothers' occupation
Farmer	148	78.7%

Variable	Number of participate	Percentage of participate
Government	14	7.4%
Private	20	10.6%
Non employed	6	3.2%
Smoking habit (Mother)		
Yes	48	25.5%
No	140	74.5%
Chewing Khat (Mother)		
Yes	100	53.2%
No	88	46.8%

Regarding class level, the highest proportion of students belonged to class 3 (30.3%), followed by class 1 (29.3%), while the lowest representation was in class 5 (4.8%). Parental education levels varied, with 31.9% of fathers having no formal education, while 30.3% had tertiary education. In contrast, a higher proportion of mothers had secondary education (34.6%), but 31.9% lacked formal education, suggesting that a significant percentage of students come from households where at least one parent has minimal schooling.

Among fathers' occupations, the majority (53.7%) worked in the private sector, while 34.6% were unemployed, and only a small fraction (2.1%) were farmers. In contrast, a large majority of mothers (78.7%) were engaged in farming, while 10.6% worked in private jobs, 7.4% in government jobs, and 3.2% were unemployed.

Lifestyle habits among mothers indicate that 25.5% were smokers, while the remaining 74.5% did not smoke. Additionally, 53.2% of mothers reported chewing Khat, a common cultural practice, while 46.8% did not. These findings highlight significant social and economic patterns, including gender disparities in education, employment variations, and lifestyle habits, which could have implications for family well-being and children's health.

3.2. The prevalence of Stunting among selected sample

The findings presented in Table 2 indicate that stunting remains a significant public health concern among the selected sample. Out of the total participants, 43.6% were classified as having low height-for-age, a clear indicator of stunting, while 56.4% had normal growth. This relatively high prevalence of stunting suggests chronic undernutrition and possibly long-term exposure to inadequate dietary intake, recurrent infections, or poor maternal health and nutrition. The fact that nearly half of the children surveyed are stunted highlights the urgent need for targeted interventions addressing nutritional deficiencies, particularly in early childhood, where growth is most critical. These results align with global data from low- and middle-income countries, where stunting continues to affect a large proportion of children, especially in areas with limited access to health services, clean water, and adequate nutrition. The high prevalence also suggests possible socioeconomic or environmental factors at play, warranting further investigation into the determinants of stunting within this specific population.

Stunting, defined as low height-for-age, reflects long-term nutritional deprivation and is associated with impaired cognitive development, poor school performance, and reduced economic productivity in adulthood (de Onis & Branca, 2016). In Yemen, the ongoing conflict, food insecurity, poverty, and limited access to healthcare services have all contributed to persistent undernutrition among children (Ogbu et al., 2022). The fact that nearly half of the school-aged children in the study exhibit signs of stunting underscores the urgent need for targeted nutritional interventions, school feeding programs, and broader efforts to improve food security and child health in the region.

Table 2 The prevalence of Stunting among selected sample

Variable	Number of participate	Percentage of participate
Stunting		
No	106	56.4%
Yes	82	43.6%

3.3. The relationship between different factors and Stunting status

3.3.1. The impact of Gender on Stunting status

Table 3 presents the distribution of gender across different stunting statuses. Among

individuals classified as having normal nutritional status, 28 were male (26.4%) and 78 were female (73.6%). In contrast, within the stunted group, 19 were male (23.2%) and 63 were female (76.8%). These results show that females represent a higher proportion in both nutritional categories, with a slightly greater representation among the stunted group. Males, on the other hand, appear to have a marginally higher proportion in the normal group compared to the stunted group. Although the percentage differences are relatively small and the P-value (0.61) indicates no statistically significant association between gender and stunting status, the trend may suggest subtle gender-related patterns in nutritional outcomes. The greater prevalence of stunting among females could reflect underlying socio-cultural or dietary factors that disproportionately affect female nutrition, warranting further investigation with a larger sample and more detailed variables.

While some studies have reported slight gender differences in stunting- often with higher rates among boys- these differences are not always consistent or significant across populations (Wamani et al., 2007). In place like Yemen, where widespread malnutrition is driven by factors such as poverty, food insecurity, and conflict, environmental and socio-economic conditions are likely to have a more profound impact on nutritional status than gender alone (Thompson et al., 2012).

3.3.2. The impact of School Type on Stunting status

Table 3 summarizes the distribution of stunting status by school type, comparing private and government schools. Among students with normal nutritional status, 62 (58.5%) attended private schools, while 44 (41.5%) attended government schools. In the stunted group, 44 (53.7%) students were from private schools compared to 38 (46.3%) from government schools. The proportions indicate a relatively balanced distribution of stunting cases between private and government schools, with a slightly higher percentage of both normal and stunted students enrolled in private schools. The statistical analysis yielded a P-value of 0.507, indicating no significant association between school type and stunting status in this sample. These findings suggest that stunting prevalence does not differ substantially by type of school, though further studies with larger samples may be needed to explore other factors influencing nutritional outcomes in different educational settings.

Differences in school type can reflect broader disparities in socio-economic status, access to resources, and school feeding programs. Studies have shown that children attending public schools in low-income settings are more likely to suffer from undernutrition due to limited access to food, healthcare, and educational resources compared to those in private schools (Ayalew et al., 2020). However, the near-significant result here may suggest that other confounding variables, such as household income, parental education, or community infrastructure, also play critical roles in determining a child's nutritional status (Black et al., 2013).

3.3.3. The impact of Class Level on Stunting status

Table 3 illustrates the distribution of stunting status across different class levels. Among students with normal nutritional status, the highest proportions were observed in class 3 (34.9%) and class 1 (30.2%), followed by classes 4 (18.9%), 2 (13.2%), and 5 (2.8%). In contrast, the stunted group showed a somewhat more even distribution across classes, with class 1 (28.0%), class 2 (19.5%), class 4 (20.7%), class 3 (24.4%), and class 5 (7.3%). Although there appears to be a slight variation in stunting prevalence across different class levels, the differences were not statistically significant (P-value = 0.293). This suggests that stunting status is relatively consistent across class levels within the study population. Further research could explore whether factors such as age, grade-specific dietary patterns, or school environment contribute to stunting risk at different educational stages.

Stunting is primarily the result of chronic undernutrition during the early years of life, particularly the first 1,000 days from conception to a child's second birthday (de Onis & Branca, 2016). As such, factors like early childhood nutrition, maternal health, and household living conditions have a far greater influence on stunting than a child's current class level in school. By the time children reach school age, the effects of stunting have typically

already taken hold, and academic grade level is unlikely to reverse or significantly impact growth outcomes (Black et al., 2013).

3.3.4. The impact of parental Education on Stunting status

Tables 3 explore the relationship between parental education levels and stunting status among children. Among children with normal nutritional status, most fathers had tertiary education (51.9%), followed by secondary education (23.6%), basic education (22.6%), and a small percentage with no formal education (1.9%). A similar distribution was observed in the stunted group, where 52.4% of fathers had tertiary education, 22.0% had secondary education, 19.5% had basic education, and 6.1% had no formal education. Although stunting was found across all education levels, including higher education categories, the association was not statistically significant (P-value = 0.480). Notably, the proportion of stunted children whose fathers had no formal education (6.1%) was higher than in the normal group (1.9%), suggesting a potential influence that may warrant further investigation. In the mother's educational level. With in the normal group, 36 mothers (34.0%) had basic education, 22 (20.8%) had secondary, 39 (36.8%) had tertiary, and 9 (8.5%) had no formal education. Among stunted children, 24 mothers (29.3%) had basic education, 22 (26.8%) had secondary, 26 (31.7%) had tertiary, and 10 (12.2%) had no formal education. While stunting appeared across all maternal education levels, a slightly higher percentage of stunted children had mothers with no formal education (12.2%) compared to the normal group (8.5%). However, this association was also not statistically significant (P-value = 0.567). These findings suggest that neither paternal nor maternal education levels show a strong independent association with stunting in this population, though lower levels of parental education may still play a contributory role and should be explored further in larger or more focused studies.

Although parental education—particularly that of the mother—is often linked to better child nutritional outcomes, the influence of the father's education alone tends to be less consistent across different settings (Saunders & Smith, 2010). In some contexts, higher paternal education may be associated with better household income and access to food, healthcare, and health-related knowledge. However, in conflict-affected and low-resource environments like Yemen, these potential benefits may be outweighed by broader systemic challenges such as poverty, food insecurity, and lack of access to essential services. Similarly, mother's education levels show no clear pattern influencing stunting, as children of mothers with primary (33.7%) and tertiary education (37.0%) had similar proportions in the normal nutritional status category, and the p-value (0.913) indicates no significant relationship.

3.3.5. Association between parental Occupation and Stunting Status

Tables 3 examine the association between parental occupation and stunting status among

children. Among children with normal nutritional status, most fathers were engaged in private jobs (55.7%), followed by non-working fathers (32.1%), those with government jobs (11.3%), and a small proportion of farmers (0.9%). A similar pattern was observed in the stunted group, where 51.2% of fathers had private jobs, 37.8% were non-working, 7.3% held government jobs, and 3.7% were farmers. Although the proportion of farmers was slightly higher among stunted children, the overall distribution did not show a statistically significant difference (P-value = 0.393), suggesting that father's occupation may not be a strong determinant of stunting in this population. Also, Table 3 displays the distribution of stunting by mother's occupation. In both the normal and stunted groups, the majority of mothers were farmers, accounting for 79.2% and 78.0%, respectively. Other occupations included private jobs (9.4% in the normal group and 12.2% in the stunted group), government jobs (7.5% vs. 7.3%), and non-working mothers (3.8% vs. 2.4%). The distribution was consistent across groups, with no statistically significant difference (P-value = 0.896). These findings indicate that neither father's nor mother's occupation is significantly associated with stunting status in this sample. However, further research into specific occupational or socioeconomic factors and their broader environmental contexts may yield deeper insights into their influence on child nutritional outcomes.

While parental occupation is often considered a proxy for socioeconomic status and household income, its impact on child nutrition can vary depending on broader contextual factors. In conflict-affected and economically unstable settings like Yemen, even employed parents may struggle to access adequate food, healthcare, or sanitation due to systemic challenges (Yang et al., 2025). Additionally, maternal occupation might not significantly influence stunting if it does not translate into improved caregiving, income, or food security within the household (Victora et al., 2008).

Table 3 The relation between demographic factors and nutritional status (Stunting) among children

Variable	Nutritional status (Stunting)		p-value
	Normal	Stunting	
Gender			
Male	28(26.4%)	19(23.2%)	0.610
Female	78(73.6%)	63(76.8%)	
Marital Status			
Private	62(58.5%)	44(53.7%)	0.507
Government	44(41.5%)	38(46.3%)	
Class level			
1	32(30.2%)	23(28.0%)	0.293
2	14(13.2%)	16(19.5%)	
3	37(34.9%)	20(24.4%)	
4	20(18.9%)	17(20.7%)	
5	3(2.8%)	6(7.3%)	
Educational Status of father			
Basic education	24(22.6%)	16(19.5%)	0.480
Secondary university	25(23.6%)	18(22.0%)	
Tertiary education	55(51.9%)	43(52.4%)	
No formal education	2(1.9%)	5(6.1%)	
Educational Status of Mother			
Basic education	36(34.0%)	24(29.3%)	0.567
Secondary university	22(20.8%)	22(26.8%)	
Tertiary education	39(36.8%)	26(31.7%)	
No formal education	9(8.5%)	10(12.2%)	
Father Occupation			
Farmer	1(0.9%)	3(3.7%)	0.393
Government	12(11.3%)	6(7.3%)	
Private	59(55.7%)	42(51.2%)	
Non employed	34(32.1%)	31(37.8%)	
Mothers' occupation			
Farmer	84(79.2%)	64(78.0%)	0.896
Government	8(7.5%)	6(7.3%)	
Private	10(9.4%)	10(12.2%)	
Non employed	4(3.8%)	2(2.4%)	
Smoking habit (Mother)			
Yes	31(29.2%)	17(20.7%)	0.184
No	75(70.8%)	65(79.3%)	
Chewing Khat (Mother)			
Yes	59(55.7%)	41(50.0%)	0.440
No	47(44.3%)	41(50.0%)	

1.1.1. The impact of Maternal Lifestyle and Stunting status

Table 3 examines the association between maternal smoking habits and stunting status. Among children with normal nutritional status, 31 (29.2%) had mothers who smoked, compared to 17 (20.7%) in the stunted group. Mothers who did not smoke accounted for 70.8% of the normal group and 79.3% of the stunted group. Although the percentage of smokers was higher in the normal group, the difference was not statistically significant (P-value = 0.184), suggesting that maternal smoking may not have a direct impact on stunting in this sample. Similarly, also Table 3 shows the distribution of stunting status by maternal khat chewing habits. In the normal nutrition group, 59 (55.7%) mothers reported chewing khat, compared to 41 (50.0%) in the stunted group. Mothers who did not chew khat represented 44.3% of the normal group and 50.0% of the stunted group. The association between maternal khat chewing and stunting was also not statistically significant (P-value = 0.440). These results indicate that neither maternal smoking nor khat chewing habits were significantly associated with stunting among children in this study; however, further research could explore other maternal behavioral or environmental factors that might influence child nutrition.

These findings are consistent with other studies that suggest lifestyle behaviors such as smoking or Khat chewing may have less direct influence on child growth outcomes than factors like maternal nutrition, household food security, and healthcare access (Black et al., 2013). While smoking and Khat use may impact maternal health, their indirect influence on child stunting appears limited in this context,

especially when more dominant risk factors like poverty and food insecurity are present.

4. Conclusion

This study highlights a high prevalence of stunting (43.6%) among children aged 6 to 9 years in both public and private schools in Sana'a, Yemen. The lack of significant associations between stunting and key demographic factors such as gender, parental education and occupation, maternal smoking, and khat chewing suggests that stunting in this context may be influenced by more complex, underlying factors not captured in the current analysis. These may include food insecurity, poor dietary diversity, inadequate healthcare, or environmental conditions. Addressing stunting requires multi-sectoral efforts, including improved access to nutritious food, parental education on child feeding practices, and school-based nutrition and health monitoring programs.

5. References

Al-Haidari, S. A., Mahdy, M. A. K., Al-Mekhlafi, A. M., Al Murisi, W. M. S., Thabit, A. A. Q., Al-Amad, M. A., Al-Shamahi, H., Bahashwan, O. S., & Al Serouri, A. (2021). Intestinal schistosomiasis among schoolchildren in Sana'a Governorate, Yemen: Prevalence, associated factors and its effect on nutritional status and anemia. PLOS Neglected Tropical Diseases, 15(9), e0009757. https://doi.org/10.1371/journal.pntd.0009757

AlRabeei, N., Dallak, A., & AlBarakani, M. (2015). Prevalence of malnutrition among infants in Sanaa city, Yemen. THE ULUTAS MEDICAL JOURNAL, 1(1), 1. https://doi.org/10.5455/umj.2015.1.1

Alsebaeai, M., Al-Rahabi, L., Al-Sarmy, N., Taher, A., & Alsebaeai, M. (2024). Relationship between Breakfast and Academic Grades of Medical Students College in Queen Arwa University, Yemen. Queen Arwa University Journal, 28(28), 7. https://doi.org/10.58963/qausrj.v28i28.302

Amigo, H., Bustos, P., Leone, C., & Radrigán, M. E. (2001). Growth Deficits in Chilean School Children. The Journal of Nutrition, 131(2), 251-254. https://doi.org/10.1093/jn/131.2.251

Ayalew, M., Bayray, A., Bekele, A., & Handebo, S. (2020). Nutritional Status and Educational Performance of School-Aged Children in Lalibela Town Primary Schools, Northern Ethiopia. International Journal of Pediatrics, 2020, 1-9. https://doi.org/10.1155/2020/5956732

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet, 382(9890), 427-451. https://doi.org/10.1016/s0140-6736(13)60937-x

Center, N. I. (2012). The most important main indicators in Sana'a Governorate. N. I. Center. http://www.yemen-nic.info/gover/sanaa/service/#.

de Onis, M. (2006). WHO Child Growth Standards based on length/height, weight and age. Acta Paediatrica, 95(S450), 76-85. https://doi.org/10.1111/j.1651-2227.2006.tb02378.x

de Onis, M., & Branca, F. (2016). Childhood stunting: a global perspective. Maternal & Child Nutrition, 12(S1), 12-26. https://doi.org/10.1111/mcn.12231

Moestue, H., & Huttly, S. (2008). Adult education and child nutrition: the role of family and community. Journal of Epidemiology & Community Health, 62(2), 153-159. https://doi.org/10.1136/jech.2006.058578

Ngo, J., Ortiz-Andrellucchi, A., & Serra-Majem, L. (2016). Malnutrition: Concept, Classification and Magnitude. In Encyclopedia of Food and Health (pp. 610-630): Elsevier.

Ogbu, T. J., Rodriguez-Llanes, J. M., Moitinho de Almeida, M., Speybroeck, N., & Guha-Sapir, D. (2022). Human insecurity and child deaths in conflict: evidence for improved response in Yemen. International Journal of Epidemiology, 51(3), 847-857. https://doi.org/10.1093/ije/dyac038

Prista, A., Maia, J. A. R., Damasceno, A., & Beunen, G. (2003). Anthropometric indicators of nutritional status: implications for fitness, activity, and health in school-age children and adolescents from Maputo, Mozambique. The American Journal of Clinical Nutrition, 77(4), 952-959. https://doi.org/10.1093/ajcn/77.4.952

Rushing, B. R., & Selim, M. I. (2019). Aflatoxin B1: A review on metabolism, toxicity, occurrence in food, occupational exposure, and detoxification methods. Food and Chemical Toxicology, 124, 81-100. https://doi.org/10.1016/j.fct.2018.11.047

Saunders, J., & Smith, T. (2010). Malnutrition: causes and consequences. Clinical Medicine, 10(6), 624-627. https://doi.org/10.7861/clinmedicine.10-6-624

Thompson, B., Cohen, M. J., & Meerman, J. (2012). World Food Insecurity and Malnutrition: Scope, Trends, Causes and Consequences. In The Impact of Climate Change and Bioenergy on Nutrition (pp. 21-41): Springer Netherlands.

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., & Sachdev, H. S. (2008). Maternal and child undernutrition: consequences for adult health and human capital. The Lancet, 371(9609), 340-357. https://doi.org/10.1016/s0140-6736(07)61692-4

Wamani, H., Åstrøm, A. N., Peterson, S., Tumwine, J. K., & Tylleskär, T. (2007). Boys are more stunted than girls in Sub-Saharan Africa: a meta-analysis of 16 demographic and health surveys. BMC Pediatrics, 7(1). https://doi.org/10.1186/1471-2431-7-17

Yang, W., Xiang, Z., Hu, H., Zheng, H., & Zhao, X. (2025). The impact of family socioeconomic status on adolescent mental and physical health: the mediating role of parental involvement in youth sports. Frontiers in Public Health, 13. https://doi.org/10.3389/fpubh.2025.1540968

Index of Tables

Contents