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RESEARCH ARTICLE

Prevalence and Factors Associated with Stunting among the Public Primary School at Mahajanga I, Madagascar

Ramanampamonjy MTM[1*], Ranaivo NAR[1], Rahariniainasoa A[1], Rabarison HZO[1] and Andrianarimanana KD[1,2]

[1]*Department of Pediatrics, Zafisaona Gabriel Mahajanga University Hospital, Madagascar*

[2]*Mahajanga Faculty of Medicine, Mahajanga University, Madagascar*

***Corresponding author:** *Ramanampamonjy Mahera Tiana Marina, Department of Pediatrics, Professor Zafisaona Gabriel Mahajanga University Hospital, Madagascar, Tel: +261343377971*

Abstract

Introduction: Stunting is a good long-term indicator of the nutritional status of children. The aim of this study was to determine the prevalence and factors associated with stunting in public primary school children.

Methods: A cross-sectional survey was conducted over a period of 4 months in 4 public primary school of Mahajanga I. Students aged 5 to 14-years-old were included.

Results: Two hundred and sixty-two pupils were included in the study. The mean age was 8.89 ± 2.07 years. The prevalence of growth retardation was 28.6% (n = 75) of which 5% (n = 13) had the severe form. The age range was 10 to 14 years (AOR = 9.89 [4.9-19.9]; p = 0.0001), once or never deworming (AOR = 2.4 [1.20-5.09]; p = 0.014) and food consumption score acceptable (AOR = 0.32 [0.15-0.71]; p = 0.005) were significantly associated with stunting.

Conclusion: Children in their early teens were the most affected. Strategies must put in place to reduce the incidence of stunting before this period.

Keywords

Associated factor, Prevalence, School age, Stunting

Abbreviations

WHO: World Health Organization; HFIAS: Household Water Source, Household Food Insecurity Access Scale; HDDS: Household Dietary Diversity Score; FCS: Food Consumption Score

Introduction

Schoolchildren go through major physical and mental changes, which affect both their growth and school performance. Nutrition is one of many key factors affecting children's mental and cognitive development [1]. Growth retardation implies a height for age more than two standard deviations below the median of the World Health Organization (WHO) child growth standards [2]. Stunting is a real public health issue. Malnutrition among school-age children in developing countries, particularly in Africa, is linked to morbidity, inadequate care, dietary intake and the socio-economic and cultural status of the family [3,4]. Stunting is the most serious and common form of malnutrition. It has long-term effects at individual and societal levels, including reduced cognitive and physical development, reduced productive capacity and poor health [2]. Indeed, children with stunted growth have a reduced capacity to learn at school, perform poorly at school and are more likely to repeat or drop out. This could increase the risk of not completing primary or secondary education [4]. It affects more than 162 million children under the age of 5 worldwide [2]. Among stunted children, 55% live in Asia and 39% in Africa [5]. In Madagascar, the stunting situation is critical, affecting 40% of children by 2021 [6]. The nutritional status of schoolchildren plays a key role in the transition from health to adolescence and adulthood [7]. It therefore seemed appropriate to carry out the present study. The objectives were to estimate

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the prevalence of stunting in children and adolescents aged 5 to 14 in public elementary school (PES), and to identify the factors associated with stunting.

Methods

Study area and study population

A cross-sectional survey was conducted over a 4-month period (March 1 to June 31, 2022) in the public primary school of Mahajanga I. The urban commune of Mahajanga I is located in the Boeny Region, on the northwest coast of Madagascar. It covers an area of 53 km^2. The urban commune of Mahajanga I comprises 26 districts. According to the latest census in 2020, its population is estimated at 258,068. The town of Mahajanga I has 16 Public primary schools with a total of 1,424 pupils.

Pupils aged 5 to 14 years attending these schools and whose parents or legal guardians had given their consent been included. Children with chronic pathologies were excluded from the study.

Sample size and sampling methods

The sample size was determined using the Scwartz formula, assuming a confidence level of 95%, a margin of error of 5% and a proportion of stunted growth of 35% [8]. The final sample size calculated was 308 students.

To select the schools concerned, the 16 public primary schools were stratified according to pupil numbers, then 4 schools were selected after simple random sampling to choose the school and study class to be included in the survey according to the strata obtained. Finally, we determined the number of students to be included in each selected school.

Variables to be studied

The dependent variable in this study was stunting. It was defined as a height for age more than two standard deviations below the median of the WHO child growth standards. Independent variables were age, gender, monthly income, parental occupation, childcare arrangement, and parental education, deworming frequency, household water source, Household Food Insecurity Access Scale (HFIAS), Household Dietary Diversity Score (HDDS) and Food Consumption Score (FCS).

Data analysis

Data was collected using a pre-tested survey form initially prepared in French. Some sections intended for parents were translated into Malagasy. Anthropometric height-for-age measurements were calculated using WHO AnthroPlus® software, and data analysis was performed using SPSS® software.

A binary logistic regression model was first used to identify factors associated with stunting. All variables with a p-value < 0.2 in the bivariate analysis were entered into the multivariable logistic regression model. The adjusted Odd ratio and 95% confidence interval were estimated to assess the strength of the association, and a p-value < 0.05 was considered statistically significant in the multivariate analysis.

Results

Prevalence of stunting

Two hundred and sixty-two (262) pupils were included in the study (Figure 1). The prevalence of stunting in this study was 28.4% (n = 75), of which 5% had the severe form (n = 13) and 23.4% the moderate form.

Socio-demographic characteristics

The average age of the students was 8.89 ± 2.08 years. Table 1 describes the socio- demographic characteristics of the pupils.

Regarding childcare arrangements, the majority of children (89.7%, n = 235) lived with both parents. Nineteen children lived with a single parent (7.3%) and 8 children were raised by a guardian (3.1%) (Table 2).

The water source for 63 pupils (24%) was a well. The remaining 199 pupils had access to an improved water source (76%) (Table 3).

Risk factors associated with growth retardation

Table 4 shows the results of multivariate logistic regression analysis. Age group, deworming and FCS were significantly associated with growth retardation.

Discussion

Studies on stunting in children have largely focused on children under five. Few studies have documented that of children aged 5 and over, particularly in this region of Madagascar where the study was carried out. In addition, growth assessment is an important tool for monitoring the health and nutritional status of children, identifying deviations from normality and also providing a measure of the well-being of the population as a whole [4]. His study highlighted the factors associated with stunting in school-age children. These data could then serve as a reference for future studies. Nevertheless, as this is a survey, the risk of recall bias or insincerity in responses could be a limitation of the present study.

Prevalence of stunting

In this series, 28.4% of the population studied was stunted, of which 23.4% was moderate and 5% was severe. This result was slightly below that found by Aiga, et al. in Antananarivo 2019, with 34.9% [8]. African studies such as in Ethiopia found 46.1% [3]. Adedeji, et al. in Nigeria found only 10.5% but this was significantly higher among children attending public schools [9]. The Burkina Faso study found a prevalence of 32.9% [10]. On other continents, such as Bangladesh and India,

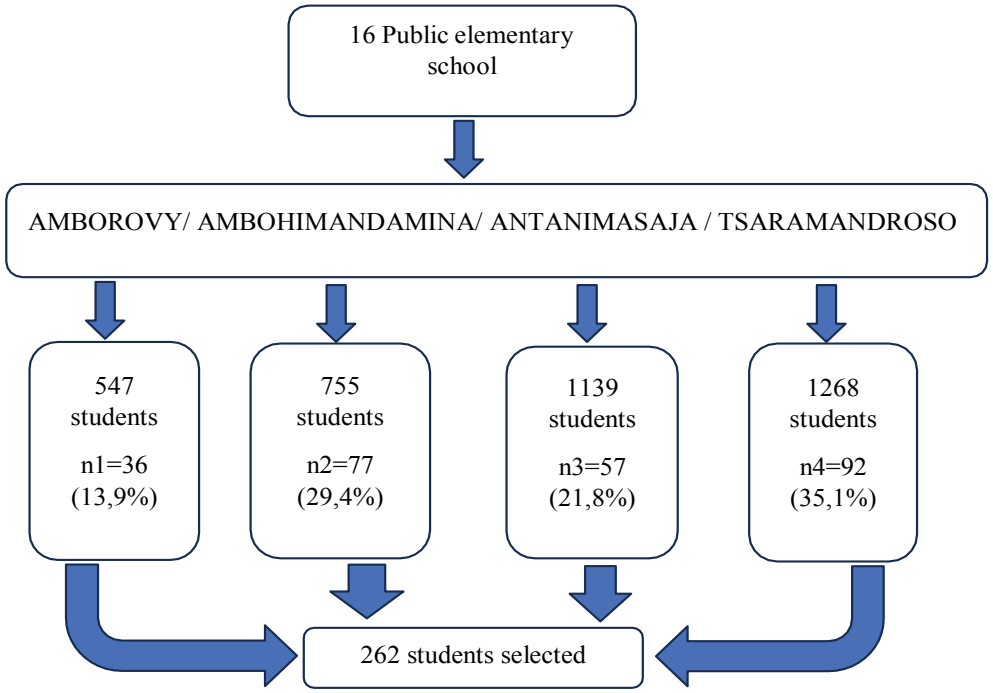

Figure 1: Distribution of study population by selected school.

Table 1: Socio-demographic characteristics of the study population.

Characteristics	Total n = 262	Percentage (%)
AA Age group (year)		
5-9	162	61.8
10-14	100	38.2
Gender		
Masculine	128	48.9
Feminine	134	51.1
Number of family		
≤ 5	110	42
Between 5 and 10	151	57.6
≥ 10	1	0.4
Number of children		
≤ 2	144	55
Between 3 et 5	114	43.5
≥ 6	4	1.5

they found 60% and 19.9% respectively [11,12]. Results vary from one study to another, and may depend on differences in socio-economic status, culture, eating habits, environmental factors and use of public services in the study area. In our case, it should be noted that children attending public elementary school are mostly from disadvantaged families, because schooling is free. Private schools are more expensive. It would be interesting to carry out a similar study involving private schools to make a comparison.

Factors associated with stunting

The 5-9 age groups accounted for 61.9% of the study population, 51.1% of who were female. However, most cases of stunting were found in the 10-14 age group (77.3%) and constituted a risk factor (adjusted OR 9.8 [4.9-19.9] p = 0.0001). Ouédraogo, et al. also found that schoolchildren aged 10 to 15 were 4.38 times more likely to be stunted than children aged 5 to 9 (adjusted OR: 4.38 [2.9-6.61], p < 0.001) [10]. A study in Nigeria also found a significant link between stunting and children over the age of 10 (p = 0.031) [13]. Stunting is chronic malnutrition. The onset of adolescence calls for increased nutritional requirements. A nutritional problem already present in childhood can worsen as the child grows. Children who are chronically malnourished at an early age and whose nutritional status does not improve as they get older continue to fall behind as

Table 2: Relationship between sociodemographic variables and growth retardation.

	Stunting		Total	OR*[IC]	p
	YES	NO	%		
Age group					
5-9	17 (22.7%)	145 (77.5%)	162 (61.8%)	12.6 [6.1-26.2]	0.0001
10-14	58 (77.3%)	42 (22.5%)	100 (38.2%)		
Gender					
Masculine	40 (53.3%)	88 (47.1%)	128 (48.9%)	0.5 [0.28-1.24]	0.216
Feminine	35 (46.7%)	99 (52.9%)	134 (51.1%)		
Salary (ariary)					
≤ 200000	63 (84%)	140 (74.9%)	203 (77.5%)	2.2 [0.75-6.69]	0.109
< 200000	12 (16%)	47 (25.1%)	59 (22.5%)		
Child care					
2 parents	66 (88%)	169 (90.4%)	235 (89.7%)	0.75 [0.22-2.5]	0.643
Single parent or guardian	9 (12%)	18 (9.6%)	27 (10.3%)		
Father's activity					
Unemployed	7 (10.6%)	3 (1.8%)	10 (4.3%)	0.19 [0.04-0.89]	0.035
Employed	59 (89.4%)	166 (98.2%)	225 (95.7%)		
Father's level of education					
Illiterate	1 (1.5%)	3 (1.8%)	4 (1.7%)	1.11 [0.46-2.8]	0.85
Primary	21 (31.8%)	17 (10.1%)	38 (16.2%)	0.23 [0.06-0.82]	0.001
Secondary	16 (24.2%)	53 (31.4%)	69 (29.4%)	1.11 [0.46-2.8]	0.85
High school	23 (34.8%)	79 (46.7%)	102 (43.4%)	1	
University	5 (7.6%)	17 (10.1%)	22 (9.4%)	0.59 [0.8-4.1]	0.59
Mother's occupation					
Housewife	38 (52.1%)	72 (40.4%)	110 (43.8%)	0.55 [0.25-1.17]	0.124
With work	35 (47.9%)	106 (59.6%)	141 (56.2%)		

Table 3: Relationship between deworming frequency, water source, food safety indicators and growth retardation after univariate analysis.

	Stunting		Total	OR [IC]	p
	YES	NO	%		
Deworming					
Every 3 ou 6 months	21 (28%)	108 (57.8%)	129 (49.2%)	4.04 [1.79-9.14]	0.001
Once or never	54 (72%)	79 (42.2%)	133 (50.8%)		
Access to water					
Unimproved	19 (25.3%)	44 (23.5%)	63 (24%)	0.57 [0.21-1.56]	0.28
Improved	56 (74.7%)	143 (76%)	199 (76%)		
HFIAS					
Safety	5 (5.3%)	22 (11.8%)	27 (9.9%)	1.02 [0.16-6.2]	0.979
Insecure	71 (94.7%)	165 (88.2%)	236 (90.1%)		
HDDS					
< 4	57 (76%)	16 (8.6%)	34 (13%)	0.45 [0.15-1.33]	0.15
> 4	59 (78.7%)	171 (91.4%)	228 (87%)		
FCS					
Limited or insufficient	59 (78.7%)	95 (50.8%)	154 (58.8%)	0.28 [0.11-0.72]	0.009
Acceptable	16 (21.3%)	92 (49.2%)	108 (41.2%)		

they grow older, taking them further and further away from a normal nutritional status [10]. It would be wise to detect stunted growth as early as possible, so that action can be taken and appropriate follow-up carried out. Parents in these schools need to be made aware of the importance of this screening, so that they can

Table 4: Variables associated with growth retardation after multivariate analysis.

Explanatory variables		Adjusted OR [IC]	p
Age group	10-14 ans	9.8 [4.9-19.9]	0.0001
Father's activity	unemployment	0.46 [0.96-2.26]	0.34
Father's level of education Deworming	Primary	0.64 [0.25-1.61]	0.34
FCS	Once or never	2.47 [1.20-5.09]	0.014
	Acceptable	0.32 [0.15-0.71]	0.005

take their children to healthcare facilities for regular anthropometric measurements. Educating parents about their children's nutritional needs is also important. Health-care staff in health-care facilities should also get into the habit of measuring the height of every child, regardless of age or reason for consultation.

Stunting affected 46.7% of girls and 53.3% of boys, but no link was identified between genders and stunting. Ouédraogo, et al. found no significant difference between girls and boys for stunting [10] Just like Senbanjo, et al. [13]. Both girls and boys can be susceptible to stunting without distinction.

To assess household food security, 3 parameters were taken into account: HFIAS, FCS and HDDS. In our study, only 27 households were food secure (10.3%) according to the HFIAS, most had an HDDS ≥ 4 (87.9%) and having an acceptable diet according to the FCS reduced the risk of stunting (adjusted OR= 0.32 [0.15-0.71]; p = 0.005). Aiga, et al. instead found lower HDDS associated with underweight [8]. A study in Ethiopia found HDDS below 4 to be a risk factor for stunting (adjusted OR = 1.89 [1.08-3.3]; p = 0.001) [3]. The HFIAS is a continuous measure of the degree of food insecurity in the household over the past four weeks (30 days). The higher the score, the more food insecure the household [14]. The HDDS is used to categorize the household diet. It represents the variability of food groups in the basket over the course of a day, to confirm whether the household diet is diversified in terms of both macronutrients and micronutrients. The score, ranging from 0 to 12, is calculated by adding up the number of food groups consumed the previous day [15].

The FCS is an indicator of household access to food, obtained by combining dietary diversity and food consumption frequency [16]. This indicator expresses the level of accessibility, availability and use of foodstuffs at household level. However, this score reflects only one week's consumption and does not measure seasonal variations or consumption outside the household, which is important in urban areas. Food diversity can be different in urban and rural environments. It is often much higher in urban centers, where food markets are well stocked and easily accessible, provided you have adequate purchasing power. These different scores are probably influenced by household wealth. Evaluating these scores would enable us to intervene and assess an intervention program. The implementation of a program will attempt to target households where food insecurity is present, as well as to fill in the foodstuffs least consumed but which would be essential for the child based on the surveys carried out, since a good diet is essential for children's growth. A balanced diet, containing sufficient calories from carbohydrates, fats and proteins, as well as adequate quantities of vitamins and minerals, is important for growth.

Finally, we found that no deworming or only annual deworming increased the risk of growth retardation. Unlike other authors who found no statistically significant link, such as Aiga, et al. and Getaneh, et al. [3,8]. A study in Egypt found that schoolchildren with parasitic infestation were associated with stunted growth [17]. The WHO recommends treating all schoolchildren at regular intervals with deworming medication in areas where helminth infection is common [18]. Intestinal parasitic infections are a major public health problem in areas where climatic conditions, poor hygiene and poverty favor their persistence. In the Boeny region, where Mahajanga is located, less than 20% of the population claim to use at least one latrine [19]. The majority of intestinal parasites are transmitted via the feco-oral route. Intestinal parasitic infestations affect digestive capacity and the absorption of nutrients essential for growth [17]. We need to promote regular deworming campaigns in schools.

Conclusions

The prevalence of stunted growth in school-age children remains significant. The multiple long- term consequences are worrying. We must stress the importance of systematically monitoring children's growth in health centers. This would enable early detection of various growth disorders, and educate parents about their children's nutritional needs and diet. The introduction of a school feeding program and a regular deworming campaign could also help to improve the nutritional status of these children.

Conflict of Interest

The authors declare that they have no conflict of interest.

Remerciement

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Statement of Equal Author's Contribution

Ramanampamonjy Mahera Tiana Marina carried out the design, data collection, statistical analyses, as well as data interpretation and writing of the manuscript; Ranaivo Ny Antsa Rinasoa and RAHARINIAINASOA Annie contributed to the design of the study and the writing of the manuscript; Rabarison Hery Zo Onsynio helped with data collection and statistical analysis; Andrianarimanana Koecher Diavolana revised the manuscript and approved the final version.

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