

Nutritional Status of Schoolchildren in the Amazon Rainforest Interior of Multi-ethnic Suriname: the Influence of Age, Sex and Ethnicity
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ABSTRACT

Objective: Adequate nutrition is critical for normal development during childhood. The nutritional status of schoolchildren living in the interior Suriname, South America, is of growing concern to the Medical Mission Primary Healthcare Suriname (MM) that provides healthcare in this region. This study aims to evaluate the nutritional status of these schoolchildren.

Methods: Medical Mission Primary Healthcare Suriname 2015 interior schools' screening data on height, weight and demographics of all schoolchildren aged 4–14 years was used in this cross-sectional retrospective study. Malnutrition was defined as BMI <-2SD and stunting as height-for-age z-score <-2SD. Potential determinants of malnutrition and stunting: age, sex and ethnicity, were assessed using logistic regression analysis.

Results: Of 3.863 schoolchildren, 51% were young (4-8 years), 49% older (9-14 years), 50% male, and 82.6%, 15.3% and 2.1% were of Maroon, Amerindian, and mixed ethnicity, respectively. 5.4% of the schoolchildren were malnourished and 9.2% were stunted, including 1.6% who were severely stunted (<-3SD). In multivariable analysis, younger age (OR 1.8; 95%, CI 1.4-2.4) and Maroon children (OR=2.2; 95%, CI 1.3-3.8 compared to Amerindians) were more often malnourished, sex was not of influence. Boys (OR=1.7; 95%, CI 1.4-2.2), older children (OR 1.4; 95%, CI 1.1-1.8) and Amerindians (OR=2.4; 95%, CI 1.8-3.0 compared to Maroons) were more often stunted.

Conclusion: 5.4% of Suriname's interior schoolchildren were malnourished and 9.2 % were stunted. Younger and Maroon children were more often malnourished, whereas older children, boys and Amerindians were more often stunted. Future studies are needed to determine causes of malnutrition and stunting and may support adaptation of MM schoolchildren nutrition programmes.

Keywords: Ethnicity, nutritional status, rainforest, schoolchildren, Suriname

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INTRODUCTION

Adequate nutrition is essential in early childhood to ensure healthy growth, proper organ formation and function, a strong immune system, and neurological and cognitive development, more than one-third of under-five deaths are attributable to under-nutrition (1). The Demographic and Health Surveys (DHS) comparative report, which looks at the nutritional status of children younger than 3 years of age, stresses that malnutrition continues to be a major public health problem in developing countries around the world (2). Worldwide 156 million children are stunted and mainly living in Asia and Africa. One in seven children is underweight (1) and about 92 million children (15%) are underweight in less developed regions, although fortunately there is a downward trend in recent years (2). Children with multiple deficits have an increased risk of mortality and may benefit most from better nutrition and other child survival interventions (3).

The Medical Mission Primary Healthcare (MM), which is responsible for healthcare in the interior of Suriname, South American, has concerns about children being malnourished in this region, especially in certain rural areas where means of supply are limited. MM has numerous data on nutritional status prevalence rates of all schoolchildren living in Suriname's interior however, the association between nutritional status and factors such as age, gender, ethnicity and region has not yet been explored in detail.

This study aims to evaluate the nutritional status of these schoolchildren between 4 and 14 years of age. Nutritional status of schoolchildren was measured and the contribution of the potential influencing factors age, gender, ethnicity and region was assessed. The results of this study may lead to revision of MM child health policy protocols and strategies for malnutrition prevention.

SUBJECTS AND METHODS

Available MM 2014–2015 school screening data of all children between 4 and 14 years of age living in the interior of Suriname containing information on weight (kg), height (cm) and demographics were used for anthropometric assessment in this cross-sectional retrospective study. The children were divided into two age groups, young (4-8 years) and older (9-14 years). Three ethnic categories were identified: Maroon, Amerindian and Mixed & Other. Interior regions were classified as rural and semi-rural based on predetermined conditions such as accessibility by road, availability of electricity and/or tap water, and readily access to food stores. Anthropometric variables where computed using the World Health Organisation (WHO) Child Growth Standards SPSS Syntax File (ref) for children 0-5 years and WHO Anthro macro package Reference 2007 (ref) for SPSS and Igrowth for children 5 to 19 years of age standard deviation (4). Malnutrition was defined according to WHO standards as Body Mass Index (BMI) $<-2SD$ and stunting was defined as height-for-age z-score $<-2SD$.

Statistical analysis

Potential determinants of malnutrition and stunting: age, gender, ethnicity and urbanization, were assessed using descriptive, bivariable and multivariable logistic regression analysis. A confidence interval (CI) of 95 %, with a 5% margin of error was used, and a p -value of <0.05 was considered statistically significant. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 20.0 for Windows.

RESULTS

Of the 5.822 data entries from children that participated in the school screening program, 3.863 schoolchildren were eligible for the study after exclusion of children with double and incomplete data. Of these 3.863 children 51% were young (4-8 years) and 49% older (9-14 years), 82.6%, 15.3% and 2.1% were of Maroon (n=3.192), Amerindian (n=591), and mixed ethnicity (n=80) respectively. Sex was equally distributed. In bivariable analysis, 5.4% of the schoolchildren were malnourished and 9.2% were stunted, including 1.6% who were severely stunted (<-3SD). In multivariable analysis, younger children (OR=1.8; 95% CI, 1.4-2.4) and Maroon children (OR=2.2; 95% CI, 1.3-3.8 compared to Amerindians) were more often malnourished. Both sex and urbanization did not influence nutritional status (Table 1).

Boys (OR=1.7; 95%, CI, 1.4-2.2), older children (OR 1.4; 95%, CI, 1.1-1.8) and Amerindians (OR= 2.4; 95% CI, 1.8-3.0 compared to Maroons) were more stunted as were children living in rural areas (OR= 2.5; 95% CI, 1.9-3.2) (Table 2).

Table 1. Bi- and multi-variable analysis of characteristics and other determinants of malnutrition (BMI <=2) of 3863 schoolchildren aged 4–14 living in Suriname's interior.

	BMI < -2 n = 208 (%) n (%)	BMI ≥ -2 n = 3.655 n (%)	Bivariable OR (95% CI)	P	Multivariable OR (95% CI)	P
Gender						
Male	112 (5.8%)	1.821 (94.2%)	1.2 (0.9-1.6)	0.26	1.2 (0.9-1.6)	0.255
Female	96 (5%)	1.834 (95%)	1	.	1	
Age group				<0.001		<0.001
4-8 years	134 (6.9%)	1.820 (93.1%)	1.8 (1.4-2.4)	1	1.8 (1.4-2.4)	
9-14 years	74 (3.9%)	1.835 (91.6%)	1		1	
Ethnic group				0.007		0.008
Amerindian	16 (2.7%)	575 (97.3%)	1		1	
Maroon	189 (5.9%)	3.003 (94.1%)	2.3 (1.4-3.8)		2.2 (1.3-3.8)	
Mixed	2 (1.4%)	78 (96.3%)	1.4 (0.4-4.9)		1.5 (0.4-5.4)	
Region/Urbanization				0.495		0.595
Semi-rural	87 (5.1%)	1.617 (94.4%)	1		1	
Rural	121 (5.6%)	2.038 (94.4%)	1.1 (0.8-1.5)		1.1 (0.8-1.4)	

BMI according to WHO Child Growth Standards (z-scores), OR: Odds Ratio; 95% CI: 95% confidence interval

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Table 2. Bi- and multi-variable analysis of characteristics and other determinants of stunting of 3863 schoolchildren aged 4–14 living in Suriname's interior.

	Stunted *	Non stunted*			
	<- 2 SD	≥ -2 SD	Bivariable OR (95% CI)	P	Multivariable OR (95% CI)
	n = 357	n = 3.506			P
	n (%)	n (%)			
Gender				<0.001	
Male	224 (11.6%)	1.709 (88.4%)	1.8 (1.4-2.2)		1.7 (1.4-2.2)
Female	133 (6.9%)	1.797 (93.1%)	1		1
Age group				<0.001	
4-8 years	153 (7.8%)	1.801 (92.2%)	1		1
9-14 years	204 (10.7%)	1.705 (89.3%)	1.4 (1.1-1.8)		1.4 (1.1-1.8)
Ethnic group				<0.001	
Amerindian	100 (16.9%)	491 (83.1%)	2.3 (1.8-3.0)		2.4 (1.8-3.0)
Maroon	225 (8%)	2.937 (92%)	1		1
Mixed	2 (2.5%)	78 (97.5%)	0.3 (0.1-1.2)		0.4 (0.1-1.7)
Region/Urbanization				<0.001	
Semi-rural	91 (5.3%)	1.613 (94.7%)	1		1
Rural	266 (12.3%)	1.893 (87.7 %)	2.5 (1.9-3.2)	.	2.5 (2.0-3.2)

Stunting according to WHO Child Growth Standards (z-scores), OR: Odds Ratio; 95% CI: 95% confidence interval

DISCUSSION

Our study results indicate that 5.4% of Suriname's interior schoolchildren between 4 and 14 years of age were malnourished and 9.2 % of these children were stunted. Younger children and children of Maroon descent were more often malnourished, whereas stunting was more prevalent in older children, boys, children of Amerindian descent and children living in rural regions.

In Latin America and the Caribbean, malnutrition still represents a considerable health concern, in children younger than 6 years old from Haiti, Guatemala, and Honduras, the prevalence of weight/age below -2 SD is greater than 15% in Ecuador and El Salvador, it is about 11% (5) whereas levels of stunting vary and are highest in Haiti (29%), followed by Belize (22%) and Guyana (17%) (6), similar to children living in urban slums in India (23%) (3) and comparatively low to Asian children (34.9%) (6)

Results on the influence of sex on stunting are contradictory: we found stunting to be more prevalent in boys, as in China where boys from age 5 onwards tended to have higher risk of under-nutrition than girls. Girls aged around 12 and older were less likely to suffer from under-nutrition, while boys' higher risk of under-nutrition persisted throughout adolescence (7). In contrast, in Indian school-age slum children overall 33% of children were wasted and 18.5% were stunted, and more girls (22.4%) were found to be stunted (7). In Jamaica, stunting was found to be low (3%), underweight was 9% of which more boys (10.6%) than girls (7.1%) were thin. (8).

Children of Maroon descent were more often malnourished, whereas Amerindian children were more stunted. This is in line with an earlier observation in CARICOM countries that country level inconsistencies of undernutrition may be explained by geography, ethnicity, and schooling (6). In Latin America, rates of undernutrition among indigenous children are usually higher than those of non-indigenous children. In Brazil, specifically, stunting in

indigenous children was two to five times higher than rates for nonindigenous children due to unfavorable socioeconomic and environmental conditions, poor energy and nutrient intake as well as recurrent infectious and parasitic diseases (9).

Children from rural areas in Suriname's interior had a 2.5-fold risk for stunting compared to children living in urban areas. In China urban children were 40% less likely to be stunted ($OR = 0.62; p < 0.01$) or underweight ($OR = 0.62; p < 0.05$) than rural children (10) as was seen in Ecuador where stunting prevalence in children was double in rural areas (37%) compared to urban areas (18%) (11).

CONCLUSION

The prevalence of malnutrition and stunting in Suriname's interior schoolchildren is 5.4 % and 9.2%, respectively and is comparable with other countries in the region. Future studies are needed to investigate the causes of malnutrition and stunting on a broader level to make definite conclusions. These can be used to support adaptation of MM schoolchildren nutrition programmes. In this respect a multi sectoral approach is crucial with a health in all policies approach for adequate interventions where possible confounding factors such as dietary habits and socioeconomic status should be studied in detail and where young Maroon males and Amerindian children must receive special attention regarding their nutritional status.

AUTHORS' NOTE

CSC Essed wrote the manuscript and participated in data analysis and interpretation, S Mac Donald-Ottevanger conducted data analysis and interpretation, B Jubitana oversaw data collection and participated in study design, CWR. Zijlmans conceived study design, participated in data interpretation and critically revised the manuscript. All authors approved the final version. The authors declare that they have no conflicts of interest.

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