

Relationship between the mothers' nutritional status with that of a child population from São Tomé Príncipe, "Africa"

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Abstract

Objectives: analyse the relation between the nutritional status of children with 0 to 60 months in São Tomé and Príncipe (STP) and their mothers.

Methods: characterization of the nutritional status of 1,169 children for the weight / length ratio (W/L) (≤ 24 months) and Body Mass Index (BMI) for age (> 24 months) and their mothers. The Chi Square or Fisher tests were used for the study on the relation between the nutritional status of the mother and children, as appropriate.

Results: fifty-five percent (55%) of the children are female (median = 21 months). There was a high percentage of global acute malnutrition in the children aged $0 \leq 24$ months (30.2%) and $24 \leq 60$ months (22%) as well as global chronic malnutrition (32% and 41.1% respectively). We observed a high percentage of overweight /obese mothers (31.6%), with 16.5% of them being of a low height. We observed a significantly higher percentage of children with global acute malnutrition 47.5%) when compared with that which was reported for children of normal mothers (27.9%) or overweight /obese (22%) ($p < 0,001$) mothers.

Conclusions: It was observed a high prevalence of acute and chronic global malnutrition in the children studied and a high prevalence of overweight /obese mothers. We observed a statistically significant association between maternal and acute global malnutrition of the children.

Key words Maternal nutrition, Child nutrition, Malnutrition

Introduction

Although there is currently a decline in the prevalence of global malnutrition in the under-five population, 120 million children are still underweight in developing countries, 200 million are stunted (chronic malnutrition) and approximately 30 million are wasted (acute malnutrition), confirming that different forms of malnutrition remain a serious-worldwide public health problem.^{1,2}

In São Tomé and Príncipe (STP), an economically disadvantaged African country, 1 in 15 children dies before the age of 5, and malnutrition may account for more than 50% of these deaths.^{3,4} On a global scale, malnutrition is associated with one third of the deaths in children under the age of 5.¹

The paradoxical phenomenon of the coexistence in the same family of chronically undernourished children and their overweight/obese mothers has been observed in several studies, suggesting an emerging problem in developing countries.⁵

Nutritional status has several implications for the health and the welfare of populations, particularly in periods of rapid growth and development, such as pregnancy and early childhood.⁶ The negative consequences of malnutrition range from the impairment of physical and psychosocial development as well as irreversible cognitive impairment, to the reduction of productive and learning capacity, and even the risk of deaths associated with chronic diseases.⁷

The causes and consequences of malnutrition in children under the age of five indicate pregnancy and the period preceding it, as well as childhood, right from birth, as a window of opportunity in which an adequate nutritional intervention can provide adequate growth and development.^{1,8} Thus, the mother represents an important link between the child and the environment, since an intimate mother-child relationship is established from gestation and throughout childhood, until the biological and social independence of the child.^{9,10}

Some studies have found that chronic malnutrition during childhood and obesity in adulthood may have common determinants, both biological and socio-environmental.^{10,11} A study conducted by the University of São Paulo / Brazil noted that most undernourished children had overweight/obese mothers.¹¹ Other authors observed that low height of mothers was associated with child malnutrition, both in mothers with weight deficits and those with overweight / obesity.⁵ On the other hand, the emerging parental paradox observed in developing countries where children with chronic malnutrition and obese mothers cohabit side by side is a huge challenge in

children under the age of five.^{10,12,13} The relationship between the nutritional status of the mother-child binomial is poorly studied, and thus it is of interest to better understand this relationship. Therefore, it is important to analyze the nutritional status among family members throughout the different periods of life.^{10,12} It is central to emphasize the nutritional assessment of the child considering their family context and their interaction with the environment.

Methods

It is a sectorial study, with a non-probabilistic sample (for convenience), that assessed the children between the ages of 0 to 6 attended at the health units in the six districts of São Tomé and Príncipe (Africa), between February and May, 2011. First, 1,285 children were selected based on the records of children enrolled in the national vaccination program in the year 2010. Among these, 118 children were excluded because they could not be measured or weighed. Children with congenital malformation delays in the psychomotor development, and chronic pathologies with repercussion in the nutritional state were also excluded.

The nutritional assessment protocol included the weight and length/height measurement according to the international methodology and technique recommended.¹⁴ The characterization of the nutritional status was done by the weight / length ratio (W/L) (≤ 24 months) and Body Mass Index (BMI) of *Quetelet* [$BMI = \text{weight (kg)} / \text{height (cm)}^2$] for the ages (24 – 60 months) obtained through the *z-scores* in accordance with the WHO *Anthro* (version 3.1, April 2012) software, according to the child growth charts of the World Health Organization (WHO).¹⁵ The nutritional state was classified according to the predefined cutoffs.¹⁶ The mother's nutritional assessments were determined by the BMI using the WHO recommendation.¹⁷ Low maternal height was considered to be the height below one meter and fifty five centimeters ($< 1,55$ m).⁵

A pilot study was previously carried out to test the protocol and the training team who collected the data.

The study was approved by the Ethics Committee of Hospital Dr. Ayres Meneses and Centro Hospitalar São João – Porto - Portugal.

Collected data was introduced in the *MedQuest* online tool. Categorical variables were described as absolute frequencies (n) and relative frequencies (%). Median and percentiles or mean and standard deviation were used for continuous variables, taking

into account the normality of the variables.

A chi-square test and Fisher's exact test were used, as appropriate, when testing a hypothesis about categorical variables.

The significance level used was 0.05. Statistical analysis was performed using the *Statistical Package software for Social Sciences* v. 20.0. The results were presented by total sample and each age group: $0 \leq 24$; $>24 \leq 60$ months and according to the mother's height ($< 1,55m$ e $\geq 1,55m$).

Results

Of the 1.169 children studied, the majority (54.7%) belonged to the female sex. The mean age was $25,2 \pm 18$ months (minimum =0; maximum =60) with a median age of 21 months. The majority of children (56.5%) was between 0 and 24 months. A high percentage of acute global children malnutrition at this age (31.8%) and between 24 and 60 months (10.9%) was observed. Regarding the length/ height deficit for the age, 6.9% of the children presented this condition. 32.7% and 40.8% of the children with chronic global malnutrition, respectively, at the ages of <24 months and ≥ 24 months and stunting rate of 11.6% in the total sample (Table 1).

Although the majority of mothers had a normal BMI, 31.9% of them were overweight/ obese. Of the total sample ($n=1.169$), 16.4% had a low height ($<1,55m$) and 33.3% of them were overweight/ obese (Table 2).

The percentages of acute and chronic global malnutrition in children according to maternal nutrition status are presented in Figure 1. Children with obese mothers were more likely to present chronic global malnutrition than global chronic malnutrition. On the contrary, the proportion of children with acute malnutrition was higher than those with chronic malnutrition among malnourished mothers. Both in the group of mothers with height below 1.55m ($n=192$), as well as in the ones with the height above 1.55m ($n=977$), there are significantly higher frequencies of global acute malnutrition in children of malnourished mothers, compared to eutrophic or obese mothers, respectively 47%, 27.9% and 22.0% when the total sample is considered (Table 3).

There are no significant associations between the nutritional status of mothers and the percentage of children with global chronic malnutrition, taking into account maternal height ($<1.55m$ and $\geq 1.55m$) (Table 4).

Table 1

Nutritional status characterization of children 0 to 60 months. São Tomé e Príncipe (Africa), 2011.

	Global Acute Malnutrition		
	≤ 24 months (n=661)	>24 months (n=508)	Total (n=1169)
Nutritional Status			
W/L or BMI, %			
<-3	2.3	2.8	2.5
≥ -3 e <-2	6.2	2.2	4.4
≥ -2 e <-1	23.3	5.9	20.1
≥ -1 e <2	66.7	66.6	71.0
≥ 2 e <3	1.2	1.4	1.3
≥ 3	0.3	1.2	0.7
Global Chronic Malnutrition			
	≤ 24 months (n=661)	>24 months (n=508)	Total (n=1169)
Nutritional Status			
H/A, %			
<-3	2.1	2.6	2.3
≥ -3 e <-2	9.7	8.9	9.3
≥ -2 e <-1	20.9	29.3	24.6
≥ -1 e <2	64.8	58.1	61.8
≥ 2 e <3	1.7	1.0	1.4
≥ 3	1.1	0.2	0.7

W/L= weight for length; BMI = Body Mass Index

Table 2

Nutritional status characterization of mothers, by BMI and height. São Tomé e Príncipe (Africa), 2011.

Mothers		
Age ($\bar{X} \pm SD$)	28±7	
Nutritional Status (BMI)	n	%
<18.5	59	5.0
[18.5 - 25[	738	63.1
[25 - 30[	257	22.0
[30 - 35[	79	6.8
[35 - 40[	29	2.5
≥40	4	0.6
Height		
< 1.55 m	192	16.4
Nutritional Status (BMI)		
<18.5	7	3.6
[18.5 - 25[	121	63.0
[25 - 30[	48	25.0
[30 - 35[	10	5.2
[35 - 40[	5	2.6
≥40	1	0.5
≥1.55cm	977	83.6
Nutritional Status (BMI)		
<18.5	52	5.3
[18.5 - 25[	617	63.2
[25 - 30[	209	21.4
[30 - 35[	69	7.1
[35 - 40[	24	2.5
≥40	6	0.6

BMI = Body Mass Index.

Table 3

Association between mother's nutritional status (BMI) and height, according to children's acute malnutrition (W/L and BMI). São Tomé e Príncipe (Africa), 2011.

Mother's height < 1.55 m (n=192)							
Mother's BMI							
W/L (≤24m) BMI (>24m)	<18.5 (n=7)		15.5-24.99 (n=121)		≥25 (n=64)		<i>p</i> *
	n	%	n	%	n	%	
Children's malnutrition status							0.014
≥ -1	2	28.6	79	65.3	50	78.1	
<-1	5	71.4	42	34.7	14	21.9	
Children's malnutrition status							0.043
≥ -2	5	71.4	113	93.4	62	96.9	
<-2	2	28.6	8	6.6	2	3.1	
Mother's height ≥ 1.55 m (n=977)							
Mother's BMI							
	<18.5 (n=52)		15.5-24.99 (n=617)		≥25 (n=308)		<i>p</i> *
	n	%	n	%	n	%	
Children's malnutrition status							0.003
≥ -1	29	55.8	453	93.5	240	77.9	
<-1	23	44.2	164	26.6	68	22.1	
Children's malnutrition status							0.375
≥ -2	46	88.5	577	93.5	285	92.5	
<-2	6	11.5	40	6.5	23	7.5	
Global (n=1169)							
Mother's BMI							
	<18.5 (n=59)		15.5-24.99 (n=738)		≥25 (n=372)		<i>p</i> *
	n	%	n	%	n	%	
Children's malnutrition status							<0.001
≥ -1	31	52.5	532	72.1	290	78.0	
<-1	29	47.5	206	27.9	82	22.0	0.119
Children's malnutrition status							
≥ -2	51	52.5	690	93.5	347	93.3	
<-2	8	13.6	48	6.5	25	6.7	

*Pearson's chi-squared test: W/L= Weight for Length; BMI = Body Mass Index.

Table 4

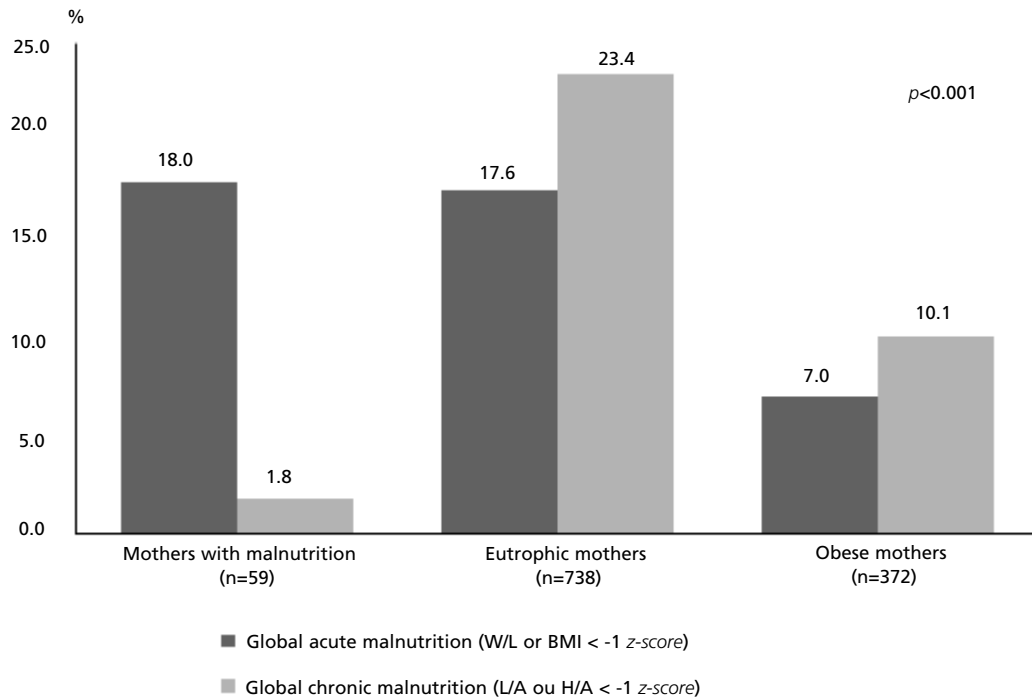
Association between mother's nutritional status (BMI) and height, according to children's chronic malnutrition (L/A and H/A). São Tomé e Príncipe (Africa), 2011.

		Mother's height < 1.55 m (n=192)						
		Mother's BMI						
L/A (≤24m)	H/A (>24m)	<18.5 (n=7)	15.5-24.99 (n=121)	>=25 (n=64)			<i>p</i> *	
		n	%	n	%	n	%	
Children's malnutrition status								-0.282
	≥ -1	2	28.6	70	57.9	33	51.6	
	<-1	5	71.4	51	42.1	31	48.4	
Children's malnutrition status								0.226
	≥ -2	4	57.1	100	82.6	50	78.1	
	<-2	3	42.9	21	17.4	14	21.9	
		Mother's height ≥ 1.55 m (n=977)						
		Mother's BMI						
L/A (≤24m)	H/A (>24m)	<18.5 (n=52)	15.5-24.99 (n=619)	>=25 (n=308)			<i>p</i> *	
		n	%	n	%	n	%	
Children's malnutrition status								0.312
	≥ -1	36	69.2	394	63.9	211	68.5	
	<-1	16	30.8	23	36.1	97	31.5	
Children's malnutrition status								0.503
	≥ -2	46	88.5	553	89.3	282	91.6	
	<-2	6	11.5	66	10.7	26	8.4	
		Global (n=1169)						
		Mother's BMI						
L/A (≤24m)	H/A (>24m)	<18.5 (n=59)	15.5-24.99 (n=738)	>=25 (n=372)			<i>p</i> *	
		n	%	n	%	n	%	
Children's malnutrition status								0.670
	≥ -1	38	64.4	464	62.9	244	65.6	
	<-1	21	35.6	274	37.1	128	34.4	
Children's malnutrition status								0.591
	≥ -2	50	84.7	651	88.2	332	89.2	
	<-2	9	15.3	87	11.8	40	10.8	

*Pearson's chi-squared test: L/A= Length for age; H/A =Height for age; BMI= Body Mass Index

Figure 1

Children's acute and chronic global malnutrition, by mother's nutritional status.



W/L = Weight by length; L/A = Length by age; H/A = Height by age; BMI = Body mass index.

Discussion

Child malnutrition, as a multifactorial disease resulting from the interrelation of factors such as poverty, infections and reduced energy and protein intake, remains a major public health problem in children under 5 years of age in developing countries.^{4,12} In the present study, the prevalence of global acute malnutrition found in both age groups (≤ 24 months: 31.8%, $> 24 \leq 60$ months: 10.9%) (Table 1) is higher than in other studies, where a higher prevalence of acute malnutrition was also observed in children younger than 24 months.^{4,10,12,18}

11.6% of the total sample was identified as having moderate / severe chronic malnutrition (length/height for age < -2 Zsc). These results were lower than those reported by the UNICEF / WHO in São Tomé, where percentages of malnutrition ranged from 29 to 35% in this same age group from 1986 to 2008.⁴ Yet, considering the prevalence of global chronic malnutrition (length/height for age < -1 zscore), a higher percentage of malnutrition was observed in children older than 24 months (40.8%) when compared to children under 24 months

(32.7%). High prevalence of chronic malnutrition is usually associated with insufficiency / inefficiency of public policies as well as appropriate health/nutrition interventions to both mother and child.¹

The early nutritional assessment and orientation of the mother and child helps to identify potential risk situations for malnutrition and prevents the occurrence of adverse consequences arising from the synergy between malnutrition and infection, reducing the prevalence of acute malnutrition and avoiding chronic malnutrition. This action also contributes to the reduction of the risk of future overweight and obesity in adolescence and adulthood, which are associated with a higher risk of developing chronic-degenerative diseases, such as diabetes, hypertension and other non-communicable diseases.¹⁸⁻²¹ Therefore it is considered that this should be a priority in public health policies, especially in countries with a high prevalence of child malnutrition.^{1,3}

Several studies have observed that in a similar background to that of São Tomé, children with an adequate nutritional monitoring have significant improvements in their nutritional status and health,

with a consequent decrease in risks associated with malnutrition.^{18,21} Thus, guidance and monitoring of maternal and child nutritional status constitutes an investment, with proven benefits to the present and future generations.^{1,10,22}

The high prevalence of maternal overweight obesity (Table 2) has been reported as a consequence of chronic malnutrition during the mother's childhood.^{5,10} Populations exposed to chronic food restriction during childhood and consequent malnutrition, are frequently shorter, which is usually associated with a high predisposition to the development of obesity and metabolic complications in adolescence and adulthood.^{5,10} This condition may be related to the decrease in the energy expenditure of these children.²³ A study conducted by the University of São Paulo, Brazil, also observed that the majority of undernourished children had overweight / obese mothers.¹¹ Thus, it is fundamental to recognize that both infant / child malnutrition and maternal obesity may have a common etiology, both of which are significantly associated with poverty and adverse conditions of their environment.^{4,24}

The results observed in the present study identified 33.3% of overweight/obesity in mothers with short stature (<1.55m) and 16.4% in mothers with a height of ≥ 1.55 m. It was also observed that among the overweight/obese mothers, 22.0% of children had global acute malnutrition (weight for height or BMI <-1 *Z-score*) and 34.4% had global chronic malnutrition (length/height for age <-1 *Z-score*). Maternal obesity was more associated with global chronic malnutrition in children (10.1%) (length/height for age). These results corroborate the findings of other recent studies that reported the association of chronic malnutrition in children with maternal overweight / obesity.²⁵ It should be emphasized that the parents' height, and in this particular case that of the mother, should not be considered only as dependent on genetic factors, but also as a result of environmental factors.

There has been an increase in the prevalence of obesity even in developing countries, with the occurrence of malnutrition and overweight / obesity in the same family.²⁶ This situation is particularly reported

among children with chronic malnutrition (stunting) and overweight / obese mothers, both in developing countries or in nutritional transition, associated with the economic development, and being more prevalent in Latin American countries than in Africa.^{27,28} In the present study, a significant association between maternal and child nutrition status was observed, with a higher prevalence of global acute malnutrition in the children of malnourished mothers, despite the maternal height. A significant association between maternal malnutrition and the prevalence of wasting (weight for height or BMI <-2 *Z-score*) was only seen in mothers with a height less than 1.55 m. The multiplicity of indicators of malnutrition identified in this study and in other population studies leads us to relate malnutrition only to the lack of economic and / or food resources in a reductionist view of the problem,¹⁰ making it necessary to have a thorough knowledge of the socioeconomic and cultural context, along with an understanding of the complexity of their interactions, with the purpose of establishing timely strategies to solve the problem of malnutrition during childhood.³

The inherent challenge in conducting epidemiological studies in low-resource countries allows for an awareness of the possible bias of anthropometric parameters, which may be due to intrinsic errors in measurements by different professionals and also to the equipment used with little resolution capacity and deficient gauging, which may have influenced the results found in this study.

In summary, there was a high prevalence of global acute and chronic malnutrition, along with a high prevalence of overweight / maternal obesity in São Tomé and Príncipe. A significant association was identified between maternal malnutrition and global acute malnutrition in children, with maternal obesity being more associated with chronic malnutrition in children. A greater and more effective nutritional intervention, particularly focusing on women in the reproductive age, pregnant women, and in the child's first years of life would be desirable.

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