Original Article

Anthropometric Measurements of Preschool Children in North Cameroon

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Abstract. Nearly 30% of the world's population is currently suffering from one or more of the many forms of malnutrition. In Cameroon, 32% of under-five children suffer from moderate and chronic under nutrition, and 13% from the severe chronic form. This study aimed at evaluating the nutritional status of preschool children using anthropometric indices and the relationship of these to the mothers' socioeconomic status in a regional setting in Cameroon. It was a cross sectional, descriptive and analytic study in which the anthropometric indicators of 375 preschool children were measured. Z scores of height for age, weight for height and weight for age were calculated using the WHO references. These Z scores were correlated with the mother's age, her level of education, her marital status and the size of household. Z scores < 2.0 for at least one of the following parameters viz; weight-to-age, weight-to-height and height-to-age were noted in 64 (17.1%) children. Similarly Z scores > 2.0 for at least one of the two parameters, weight-to-height and weight-to-age, were noted in 8 (2.1%) children. Hence, the overall prevalence of malnutrition among pre-school children was 19.2% and 8.5% were underweight, wasting was observed in 7.5% and obesity was observed in 0.5% of the children. Being underweight was significantly correlated with household size (P=0.036), and stunting was significantly associated with maternal age (P=0.02). Malnutrition is frequent in apparently healthy pre school children in northern Cameroon and significantly associated with the selected socio-economic parameters of the mothers. Hence, anthropometric measurements should be done during routine school health visits. This helps to diagnose growth faltering and timely referral to hospitals for appropriate management.

Key words: Anthropometry - Preschool children - Garoua - Cameroon - Z-scores

1. Introduction

According to the World Health Organization (WHO), about 11 million children below five years still die each year in the world, with malnutrition accounting for more than 50% of these deaths (1,2). In developing countries, 30% of the population and almost 1/3 of the children (777 million persons) are chronically undernourished; 150 million children stunted, and another 150 million underweight (1, 3, 4).

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Another increasing form of malnutrition is overnutrition which exists in all developing regions, even in those which are hunger stricken (5). According to the 2004 Demographic Health Survey (DHS) (6) in Cameroon, 32% of under-five children were stunted, 5% wasted, and 18% underweight.

Studies have demonstrated that malnutrition in under-fives could cause poor intellectual development thus poor school performance in later years (7). Malnutrition also affects physical growth, morbidity, mortality, and the capacity to physical effort (8). Overweight and obesity cause diabetes mellitus, heart disease and stroke during adulthood (9-11).

In Cameroon, only the 2004 DHS (6) and Ateba Emvoutou in 2006 (12) published studies on

Table 1. The Z scores of the different anthropometric measurements.

Anthropometric measurement	Categories of Z score	Number of children	Percentage in each category
Weight-for-age*			
	Z-score < -3	3	0.88
	-3 ≤ Z-score < -2	26	7.7
	-2 ≤ Z-score ≤ 2	306	90.3
	2 < Z-score ≤ 3	3	0.9
	Z-score > 3	1	0.3
Height-for-age*			
	Z-score < -3	7	2.06
	-3 ≤ Z-score < -2	27	7.97
	-2 ≤ Z-score ≤ 2	297	87.61
	2 < Z-score ≤ 3	6	1.77
	Z-score > 3	2	0.59
Weight-for-height			
	Z-score < -3	3	0.8
	-3 ≤ Z-score < -2	25	6.7
	-2 ≤ Z-score ≤ 2	340	90.7
	2 < Z-score ≤ 3	5	1.3
	Z-score > 3	2	0.5

* the precise ages of 36 children were not known

anthropometry in pre school children. We thus undertook this study to have a 'snap- shot' view of malnutrition in preschool children in the northern part of the country.

2. Materials and methods

Study setting: The study was carried out in Garoua town in the northern region of Cameroon with a population of 500.000 inhabitants. It has a dry season lasting 9 months and a short rainy season of 3 months, and a savanna vegetation. The diet is comprised mainly of cow meat, and cereals (millet and maize). It had 31 kindergarten schools with 1676 pupils enrolled in the 2008-2009 academic year. This part of Cameroon is a nomadic area and most parents prefer that their children go and look after cattle than go to school. There is no school canteen, and in school the children eat food brought from home. Planting is usually done in the month of September, and this is a lean period during which there is food scarcity in most families.

Type of study: A cross sectional, descriptive study from 14th September to 8th October 2009.

Study population: The source population was composed of apparently healthy preschool children attending nursery schools in Garoua town. Any child suspected to be ill or known to have a chronic disease was excluded, so as not to include children with non-nutritional anthropometric anomalies.

Sample size: The sample size was calculated from the formula: p = 32%, the prevalence of chronic malnutrition in Cameroon; i= error margin of 5% and ε = confidence level of 1.96). The minimal sample size (N) was 335. Clustering sampling (13) was used to determine the exact number of pupils for the study from each nursery. The total number of pupils in the town of Garoua in the academic year 2008-2009 was 1676 in 31 nursery schools. The number of clusters was: total number of pupils/number of nursery schools x the cluster effect of 3 = 19. The number of pupils in each cluster = 335/19 =18 pupils.

The total number of pupils is 19x19 = 342; taking 15 clusters with 25 pupils from each nursery, the total number of pupils for the study was 375. A two stage cluster sampling was done. The first stage was a simple random sampling comprised of draws without replacement for the 15 clusters and each school constituting a cluster, and the second stage a systematic random sampling using a table of random numbers in

Table 2. Z scores of weight for age and the mothers' socio-demographic variables (N=197).

Variables		Z – score <-2 Number	- 2≤Z score≤2 Number	Z –score>2 Number	Total	p
Age of mother (years)	< 20	1	4	0	5	0.57
	20-30	13	108	1	122	
	30-40	5	58	0	63	
	> 40	0	7	0	7	
Total		22	175	0	197	
Matrimonial status	Married	15	145	1 0	161	0.56
	Unmarried	3	28	0	31	
	Widow	1	4	0	5	
Total		22	175	0	197	
Level of Education	None	6	18	0	24	0.082
	Primary	8	55	0	63	
	Secondary	5	90	1	96	
	University	0	14	0	14	
Total		22	175	0	197	
Size of household	< 5	3	62	0	65	0.036
	5-9	8	86	1	95	
	10-14	6	20	0	26	
	≥15	2	9	0	11	
Total		22	175	0	197	
Profession	Public servant	0	27	0	27	0.30
	Private sector	2	7	0	9	
	Informal sector	17	143	1	161	
Total		22	175	0	197	

each cluster with the list of pupils, till the 25 pupils for each cluster were obtained.

Data collection: A Health Scale – Mic balance to measure the weight of each child to the nearest 0.1kg was used. Height was measured to the nearest 0.1cm using a height board placed on a flat surface against a wall. During measurements the children (accompanied by one of the teachers) were undressed (by one of the investigators, D.N.) and barefooted. The mid upper arm circumference (MUAC) was measured to the nearest 0.1cm with a normal non-stretch tape (the mid upper arm point is half the distance between the tip of the shoulder blade and tip of the elbow). All the measurements were made by one of the investigators (D.N.). A form containing the medical history of the child, the mother's age, marital status, level of education, profession and the size of the household was filled when the parents came to collect the children at the end of classes. The ages were ascertained from the birth certificates and the size of the household included the children, parents and any other person living permanently with the family.

Data analysis: Data was analyzed using the SPSS 10.1 software and curves obtained from WHO anthro v2.0.4 software. We compared the different indices of our study population to the WHO reference population. The chi squared test was used to analyze the data with a threshold statistical significance of 0.05.

Ethical considerations: The study was approved and authorized by the ethical committee of Cameroon's Ministries of Public Health and Basic Education. Informed written consent was obtained from the parents of the children before inclusion in the study.

Table 3. Z scores of height for age and the mothers' socio-demographic variables (N = 197).

Variables		Z – score <-2 Number	- 2≤Z score≤2 Number	Z –score>2 Number	Total	p
Age of the mother (years)	< 20	0	4	1	5	0.02
	20-30	12	108	2	122	
	30-40	6	55	2	63	
	> 40	0	7	0	7	
Total		23	169	5	197	
Matrimonial Status	Married	17	141	3	161	0.08
	Unmarried	1	29	1	31	
	Widow	0	4	1	5	
Total		23	169	5	197	
Level of education	None	6	18	0	24	0.35
	Primary	11	50	2	63	
	Secondary	6	88	2	96	
	University	0	13	1	14	
Total		23	169	5	197	
Size of household	< 5	2	62	1	65	0.09
	5-9	6	86	3	95	
	10-14	6	19	1	26	
	≥15	4	7	0	11	
Total		23	169	5	197	
Profession	Public servant	0	27	0	27	0.51
	Private sector	0	8	1	9	
	Informal sector	18	139	4	161	
Total		23	169	5	197	

3. Results

Our sample comprised 178 (47.5%) males and 197 (52.5%) females giving a sex ratio of 0.9. The mean age was of 49.34 months (range 24 to 80 months). Sixty four children (17.1%) had at least one of the weight-to-age Z score, weight-to-height Z score and height-to-age Z score less than – 2. Similarly 8(2.1%) children had at least one of the two indices (weight-to-height or weight-to-age) greater than + 2 Z scores. Hence, the overall prevalence of malnutrition among pre-school children was 19.2%. 8.5% were underweight, wasting was observed in 7.5% and obesity was observed in 0.5% of the children. Being underweight was significantly correlated with household size (p=0.036), and stunting was significantly associated with maternal age (p=0.02). The Z scores of the different anthropometric indices are shown in table I, and the mothers' socio-demographic variables are shown in tables 2-4.

Figures 1, 2 and 3, show the distribution of the different anthropometric indices of our study population compared to the WHO reference population. We noted a deviation of the curves of the different Z score curves of our study population compared to the WHO reference curves. We noted a statistically significant relationship between the weight-for-age Z score and the size of the household (p=0.036) and between the height-for-age Z score and the mother's age (p=0.02). We did not note any statistically significant link between the weight-for-height Z scores and any of the mothers' socio-economic variables.

4. Discussion

Weight for height Z scores (WHZ): There were 28 (7.5%) children with wasting (Z score < -2) and 2(0.5%) cases of obesity (Z score > 3).

Table 4. Z scores of weight for height and the mothers' socio-demographic variables (N=201).

Variables		Z – score <-2 Number	- 2≤Z score≤2 Number	Z –score>2 Number	Total	p
	< 20	0	6	0	6	
	20-30	12	112	1	125	
Age of mother	30-40	4	59	0	63	0.958
(years)	> 40	0	7	0	7	
Total		17	183	1	201	
Matrimonial status	Married	14	150	0	164	
	Unmarried	2	28	1	31	0.354
	Widow	0	6	0	6	
Total		17	183	1	201	
Level of education	None	3	23	0	26	
	Primary	6	57	1	64	0.722
	Secondary	6	91	0	97	
	University	1	13	0	14	
Total		17	183	1	201	
	< 5	4	63	0	67	
Size of household	5-9	8	88	1	97	0.889
	10-14	3	23	0	26	
	≥15	1	10	0	11	
Total		17	183	1	201	
	Public servant	1	26	0	27	
Profession	Private sector	1	8	0	9	0.101
	Informal sector	14	150	1	165	
Total		16	184	1	201	

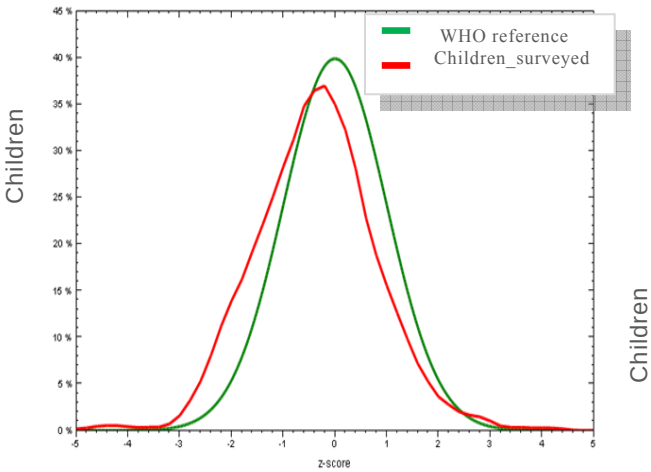

Fig. 1. Distribution of the study population according to the weight- for- height Z score compared to the WHO reference population.

Wasting is often due to insufficient feeding during a recent period before the survey or to weight loss following an illness (6). The high rate of wasting in our study can be explained by the fact that the study took place just after the lean season.

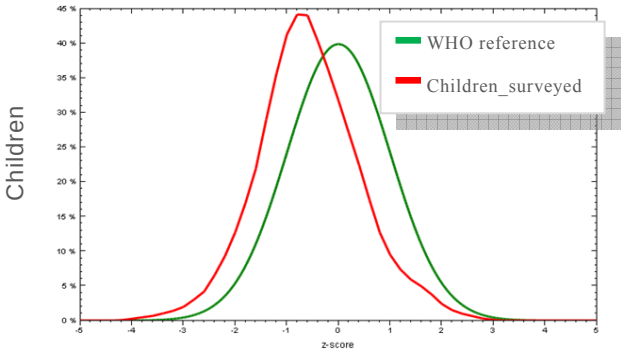

Fig. 2. Distribution of the study population according to the weight- for- age Z score compared to the WHO reference population.

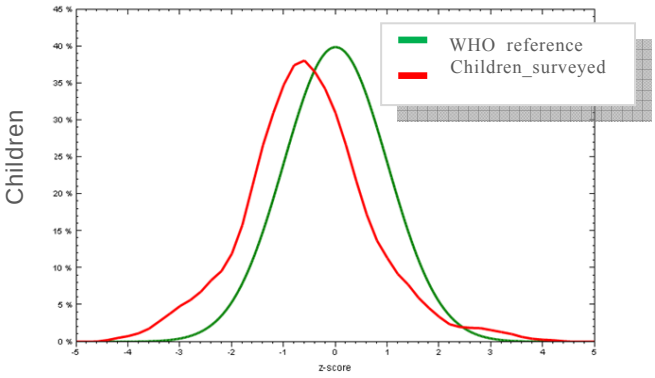

Fig. 3. Distribution of the study population according to the height- for- age Z score compared to the WHO reference population.

Our results are similar to that of Aboussaleh et al in Morocco (14), where using the body mass index they found 7.6% with wasting and no case of overweight. On the contrary this rate was far lower than that of Drabo et al (15) who using the body mass index found 65.4% of underweight; his prevalence of overweight (1.9%) and obesity (0.27%) are similar to ours. Sutanu et al (16), in India found 29.4% wasting with 9.5% severe (Z score < -3). There was no statistically significant correlation neither between the weight- for-height Z score and sex of the children nor any of the socio economic variables of the mothers. For Azzaoui et al (17) in Morocco, wasting was significantly and negatively correlated with the parents' level of education.

Weight for age Z scores (WAZ): We observed that 29 (8.5%) of the children were underweight, with 7.7% moderately and 0.88% severely. This measurement reflects both past (chronic) and/or present (acute) malnutrition but does not distinguish between the two (6,18). Ateba Emvoutou (12) in 2006 noted a prevalence of 7.05% in preschool children in Yaounde. El Haoui et al (19) in Morocco found a prevalence of 12.6%, whereas Sutanu et al (16) and Drabo et al (15) respectively had 33.7% (with 7.92% of severe) and 65.4% . Our prevalence is lower than that from the 2004 Demographic Health Survey (DHS) (6) in Cameroon which reported that 18% of children under 5 years in Cameroon were moderately underweight and 4% severely. There was a statistically significant relationship between weight-for-age Z scores and the size of household (p=0.036). No statistically significant relationship was noted for sex of the children. This is understandable as it is likely that the larger the family size the smaller the food portions per person in the household. Haoui et al (19) found a significant correlation between the size of household and school performance of pupils (p=0.04). According to the 2004 DHS (6) in Cameroon the mother's level of education was correlated with being underweight: 7% of children whose mothers had at least secondary education were moderately underweight compared with 16% for those with primary education _and 33% for illiterate mothers.

Height for age Z scores (HAZ): We noted 34 cases (10.03%) of stunting, with 7.97% moderate and 2.06% severe. Stunting is generally due to inadequate feeding and/or to infectious diseases which lasted relatively over a long period or recurred many times. It is an indicator of the quality of the environment and more generally the level of socio-economic development of a given population (6, 18). Our finding is higher than that of Sanoko et al (20) who had 2.6%, and lower than that of Suttanu et al (16) who noted 17.9% stunting, with 4.98% severe. According to the 2004 DHS in Cameroon (6), 32% of children less than 5 years are moderately underweight and 13% severely underweight.

In our study, stunting was more frequent in girls, but this relationship was not statistically significant. This is contrary to the observation by Wamani et al (21) who after a meta-analysis of 16 DHS found that stunting affected mostly boys, and concluded that in children less that 5 years in sub Saharan Africa, males are more likely to be underweight than girls. We had a statistically significant positive correlation between the height-for-age Z score and the mother's age. A possible explanation of this finding is that young mothers are often inexperienced with a low level of education and do not always master the rules of basic hygiene and feeding for their children. Aboussaleh et al (14) found 24.3% stunting with a statistically significant correlation between the weight for age Z score, the size of household and the mother's level of education. For Azzaoui et al (17), there was also a statistically significant correlation with the size of household.

Mid upper arm circumference (MUAC): NO child was observed to have an arm circumference less than 12.5cm which is considered the threshold for malnutrition in children aged 6 months to 5 years. This could be explained by the fact that the arm circumference is used for screening in emergency situations but is not usually used for evaluation of malnutrition. It is a good predicting indicator of risk of imminent death (18, 22).

Comparison of Z scores with the standard WHO reference curves: We noted a left shift of the different Z score curves (figures 1, 2 and 3) of our study population compared to the WHO reference curve. So, the median of our population for the three indices was lower than the WHO standard.

This study has some limitations worth noting. The ages of 36 children were not available, so it is possible that we might have missed some cases of stunting, underweight or even over weight and obesity in these children. Also the feeding habits and calorie intake of the children were not assessed.

5. Conclusion

We conclude that there are cases of malnutrition (wasting, underweight, stunting and obesity) in apparently healthy preschool children in this northern part of Cameroon. Younger maternal age is associated with stunting. Being underweight is associated with large households. We therefore recommend to the health and school authorities of the region that anthropometric measurements of school children be systematically taken during routine health visits and that nutrition courses be included in the kindergarten school curriculum.

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