MAGNITUDE OF THINNESS, UNDERWEIGHT AND STUNTING AMONG SCHOOL AGE CHILDREN IN MPWAPWA RURAL DISTRICT, CENTRAL TANZANIA.

AK Hussein and C Moshiro

Summary

Objectives: To assess the nutrition status among school age children in a rural community.
Design: A cross sectional anthropometric survey.
Setting: Mpwawa rural district, Central Tanzania.
Methods: 639 children from ten randomly selected primary schools and 195 out-of-school children living close to the selected schools were included in the survey. Nutrition status was assessed using anthropometric indicators of Body Mass Index-for-age (BMI-for-age), weight-for-age (wt/age) and height-for age (ht/age).
Results: A total of 834 children were included in the assessment. Their ages ranged from 7-18 years; 47.2% were males and 52.8% were females. The prevalence of thinness (BMI-for-age <5th percentile), underweight (weight–for-age <-2 Z-scores), and stunting (weight-for height <-2 Z-scores) among the study subjects were 34.7%, 39.3% and 42.7% respectively. Boys were found to be more affected than girls irrespective of indicator used. Findings also show that in general school going children were worse off than out of school children. It was further found that the prevalence of thinness (low BMI-for-age) was higher if the father was dead (p=0.045) but it was not associated with the education level of parents or household size.
Conclusion: The magnitude of protein energy malnutrition among the school age children studied was found to be high. More detailed nutrition studies are needed.

Keyword: Nutrition Status, BMI-for Age, School age Children, Tanzania.

Introduction

Protein Energy Malnutrition (PEM) has been recognized as the most important nutrition disorder of public health importance in Tanzania.[1] Most available estimates of PEM prevalence in Tanzania are for infants and pre-school children. The nutrition status of the school age children who are estimated to make up a third of the Tanzanian population, has been assessed by several researchers using anthropometry as part of their health status assessment, during the assessment of other nutritional disorders, in relation to parasitic infections or in assessing impact of de-worming programmes.[1,2,3,4,5] These studies have mainly targeted school going children and the findings have been presented using different anthropometric indices (mainly weight-for-age) expressed in different scales and cut off points. Very few studies have used Body Mass Index–for-age (BMI-for-age) that has been recommended by the World Health Organisation WHO Expert Group on Anthropometry as the best anthropometric indicator for use during adolescence.[6] In this paper we present the findings of a nutrition assessment survey among school age children that included both school going and out of school children; using the anthropometric indices of BMI-for-age expressed in percentiles and weight-for-age (wt/age) and height-for-age (ht/age) expressed in Z-scores.

Correspondence to: Hussein AK, Muhimbili University College of Health Sciences, Box 5856, Dar es Salaam.

[1]Dept. of Community Health, Institute of Public Health [2] Dept. of Epidemiology and Biostatistic,

Methodology

Study area and study population

A cross sectional nutrition assessment survey was carried out in April 1998 in Mpwapwa rural district, Dodoma region in Central Tanzania. Mpwapwa is one of the four districts of Dodoma region having a population of approximately 430,943, a third of whom are estimated to be school-age children (6-18 years). Mpwapwa district has two major seasons, a rainy season from December to April with a rainfall of 500 mm and a dry season between May and November. The majority of people are peasant farmers who practice mixed farming. The target population was all school age children including those who were enrolled and attending school as well as those who were not enrolled in schools.

Sampling strategy

The minimum number of in school children required for the survey was calculated to be 600**.** From the district education authorities we obtained a list containing the names of the 94 primary schools in the district. Ten schools were randomly selected and from these, the in school population was obtained. In each selected school, at least two classes were randomly selected for interviews and measurements. Once a class was selected, all the pupils in that class were included in the survey. A minimum of sixty children were covered per selected school. The out of school children included in the survey were obtained from areas close to the selected schools, the assumption being that they would have similar characteristics to the children enrolled in school. The proportion of in school children to that of out of school children that were included in the survey was based on the fact that on average only about seven out of ten of the eligible children in Tanzania were enrolled in the school system (WHO, 1999). Since the minimum number of in school children required was 600, the required number of out of school children was therefore calculated to be 260. Households with out of school children were identified with the help of Ward Executive Officers (WEOs) and Village Executive Officers (VEOs). All eligible children in those households were identified and listed. Children were classified as being out of school if they voluntarily declared that they had never been enrolled in school or were primary school dropouts. This definition did not include children who had completed primary school (standard seven) even if

they were less than 18 years of age. Parents or guardians confirmed their status.

Data collection

Each selected child was interviewed using a standard questionnaire form. Information collected included age, sex, schooling status; socioeconomic status of parents, household food availability, two-week self reported morbidity and school information for those in school. Data on household food availability, self reported morbidity would be presented elsewhere. For each child, measurements of weight and height were taken according to WHO recommended measurement protocols[6]. Weight was measured using a bathroom scale which was adjusted to zero prior to weighing each child and recorded to the nearest 0.1 of a kilogram. A Stanley microtoise apparatus was used for taking height measurements which were recorded to the nearest 0.1 cm. Age was determined by referring to schools records, birth and baptismal certificates, Mother and Child Health (MCH) clinic cards, and when these records were not available it was approximated based on local events.

Informed consent

Consent to interview and examine the children was obtained after explaining the purpose of the study to teachers and their pupils as well as community leaders and parents as was appropriate. For children below 10 years of age permission was sought from their parents/guardians through the pupils themselves or directly from parents /guardians for those out of school.

Data processing and analysis

Data entry was done using EPI-Info software version 6.0 and analysed using SPSS software package. Z-scores of anthropometric indices were calculated for weight-for-age (wt/age) and height-for-age (ht/age). A child was classified as wasted or stunted when his/her calculated Z-score was below –2 Z-score of its corresponding NCHS/WHO reference value for weight or height respectively[6]. The BMI of each child was calculated by dividing the child's weight in kilograms by its height in meters squared. The calculated BMI for each child was compared to the NCHS/WHO sex and age specific body mass reference tables[6]. A child was classified as thin (low body mass) if his/her BMI-for-age was below the 5th percentile; normal (normal body mass) when his/her BMI was $\geq$ 5th percentile and < 85th percentile, and as being at risk of obesity (excess body mass) if his/her BMI-for-age value was $\geq$ 85th percentile of the NCHS/WHO reference value[6]. As BMI-for-age reference values are available only for individuals aged 9-24 years of age, 24 children below the age of 9 years were excluded in all tables which have BMI-for-age as the anthropometric indicator.

Results

A total of 845 children were included in the survey and 834 of them fulfilled the inclusion criteria. Those children who were in school were 639 (76.6%) and 195 (23.4%) were out of school. The 195 out of school children covered constituted 75% of targeted number of out of school children (260) to be included in the survey; as they were the ones who met the inclusion criteria- i.e. were in the age range 6-18 years and had never been to school. Table 1 shows their age and sex distribution by schooling status. The ages of the children ranged from 7 to 18 years, with the mean age (SD) being 14.9 ($\pm$1.6) for those in school and 11.7 ($\pm$3.0) for those out of school. The majority of the children who were in school were between 13 and 15 years of age while for those out-of-school, most children were in the age range 10 to 12 years. Among the in school children studied, the proportion of girls was higher than that of boys (i.e. 57.1% vs 42.9%), while among the out of school children there were more boys than girls (61.5% vs 38.5%).

Table 1: Distribution Of Study Sample By Age, Sex And Schooling Status

Age (Yrs)	Schooling Status							
	In school				Out of School			
	Male (N=274)		Female (N=365)		Male (N=120)		Female (N=75)	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
7-9	1	(0.5)	0	(0.0)	30	(25.0)	16	(21.3)
10-12	10	(3.6)	26	(7.1)	51	(42.5)	33	(44.0)
13-15	147	(53.6)	217	(59.5)	19	(15.8)	14	(18.7)
16-18	116	(42.3)	122	(33.4)	20	(16.7)	12	(16.0)

Table 2 shows that 281 out of 810 (34.7%) school children were thin (low BMI-for-age) with more males being affected compared to females (i.e. 42.9% vs 27.4% respectively). The proportion of in school males with low body mass was significantly higher than for those out of school i.e. 47.8% vs 30.2% respectively (p=0.002). Amongst females, the proportion with low body mass was slightly higher for those who were out of school compared to those in school (32.3% Vs 26.6%). However, this observed difference was not statistically significant (p=0.34).

Table 2: Prevalence of Thinness In The Study Sample By Sex And Schooling Status

Sex	Schooling Status	Thinness	
		no./total	(%)
Male	In	131/274	(47.8)
	Out	32/106	(30.2)
	Overall Male	163/380	(42.9)
		97/365	(26.6)
Female	In		
	Out	21/65	(32.3)
	Overall Female	118/430	(27.4)
Overall		**281/810**	**34.7)**

NB: 20 children were aged below 9 years and have been excluded in this table.

Table 3 depicts the nutrition status of the school aged children sampled who were aged 9-18 years according to BMI-for-age by some selected household characteristics. It is seen that the biological parents of the most of the respondents were alive (89.2% of fathers and 94.4% of mothers). There was a tendency of the prevalence of thinness being higher if the father was dead among out of school children. This association was found to be marginally significant for out of school children (p=0.045) whereas there was no association found for in school children (p=0.53).

Table 3: Prevalence Of Low BMI-For-Age By Selected Household Characteristics And Schooling Status.

Household Characteristic	School ing Status			
	In School		Out of School	
	no./total	(%)	no./total	(%)
1. Whether Father Alive (N=807)				
Yes	206/572	(36.0)	50/148	(33.8)
No	16/39	(41.0)	3/23	(13.0)
2. Whether Mother Alive (N=805)	212/600	(48.0)	50/160	(31.3)
Yes	16/39	(41.0)	3/11	(27.3)
No				
3. Father's Education Level (N=720)				
No Formal Education				
Primary Education	39/118	(33.1)	11/50	(22.0)
Secondary Education	164/432	(38.0)	31/87	(35.6)
Don't Know	13/40	(32.5)	1/1	(100.0)
	12/49	(24.5)	10/33	(30.3)
4. Father's Occupation (N=715)				
Peasant/Herder	163/425	(38.3)	46/132	(34.8)
Employed	37/128	(28.9)	2/12	(16.7)
Business	6/17	(35.3)	2/4	(50.0)
5. Mother's Occupation (N=760)				
Peasant/Herder	118/451	(26.2)	47/157	(30.0)
Food Vendor	12/33	(36.4)	2/5	(40.0)
Employed	8/28	(28.6)	1/3	(33.3)
Business	4/18	(22.2)	0/1	(0.0)
6. Whether living with both parents (N=807)	169/455	(37.1)	40/110	(36.4)
Both Parents	28/92	(30.4)	5/34	(14.7)
Mother Only	11/21	(52.4)	1/5	(20.0)
Father Only	20/71	(28.2)	7/122	(31.8)
Relatives				
7. Household Size (N=805)				
≤ 5	88/245	(35.9)	25/83	30.1)
> 5	140/394	(35.5)	28/88	(31.8)

The overall prevalence of thinness amongst children whose mothers were dead (38.0%) was higher than amongst those whose mothers were alive (34.5%). The difference however was not statistically significant (p=0.47). Amongst out of school children, a larger proportion of those whose mothers were alive (31.3%) were thin compared to those whose mothers were dead (27.3%), the difference being not statistically significant (p=0.95).

The level of education of both parents were not found to be significantly associated with nutrition status of the study respondents according to BMI-for-age for both in and out of school children.

Table 3 also shows that the prevalence of thinness was lower amongst children whose fathers were employed compared to other occupation categories (i.e. 28.9% and 16.7% for in school and out of school children respectively). When mothers' occupations are compared, it is seen that the lowest proportion of thinness for in school children (22.2%) was observed for those whose mothers were engaged in business activities.

The nutrition status of study respondents was also compared by considering whether the child was living with both parents or not. Table 3 shows that the lowest proportions of thinness for in school children was among those who were living with relatives (28.2%) while for out-of- school children it was among those who were living with mothers only (14.7%). For both in and out-of- school children, household size was not found to influence nutrition status.

From table 4 it is seen that the overall proportions of underweight and stunting in the study population were 39.3% and 42.7% respectively**.** The prevalence of underweight was found to be higher among boys (50.8%) compared to girls (29.1%). The proportion of underweight for the in-school-children was higher compared to those who were out-of-school for both sexes i.e. 58.8% vs 32.5% for boys and 30.1% vs 24.0% for girls. The difference observed for boys was found to be statistically significant (p<0.0001).

Table 4: Prevalence Of Underweight And Stunting By Sex And Schooling Status

Sex	Schooling Status	Underweight		Stunting	
		no./total	(%)	no./total	(%)
Male	In	161/274	(58.8)	167/274	(60.9)
	Out	39/120	(32.5)	56/120	(46.7)
	Overall Males	200/394	(50.8)	223/394	(56.6)
Female	In	110/365	(30.1)	108/365	(29.6)
	Out	18/75	(24.0)	25/75	(33.3)
	Overall Females	128/440	(29.1)	133/440	(30.2)
Overall		328/834	(39.3)	356/834	(42.7)

It is further seen that a higher proportion of boys (56.6%) were stunted compared to girls (30.2%). Amongst boys, the prevalence of stunting was significantly higher among those in-school compared to those out-of-school (p=0.008). For girls, stunting was higher for those out-of-school (33.3%) than among those who were in-school (29.6%). However, the difference was not statistically significant (p=0.52).

Figure 1: Prevalence Of Underweight By Age, Sex And Schooling Status

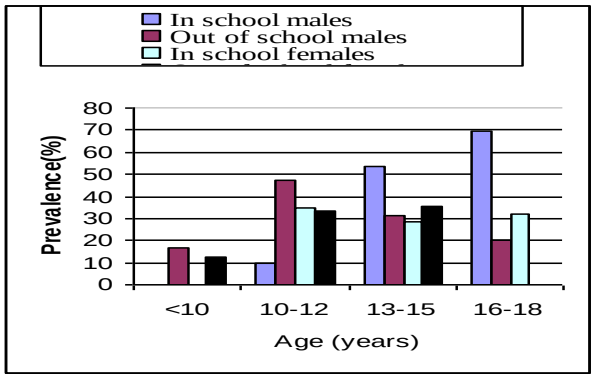

Figure 1 shows that while none of the in-school-children below 10 years was underweight, in all the other age categories boys were more underweight compared to girls. For out-of-school children, boys were more underweight in all age groups except for those in the age group10 to 12 years. The highest prevalence of underweight was observed amongst out-of-school boys aged 16 to 18 years (69.8%).

Figure 2.

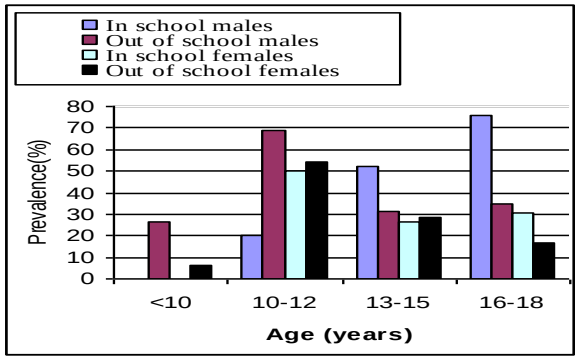

Figure 2 shows that the highest rate of stunting (75.9%) was observed among in-school boys aged 16 to 18 years followed by out-of-school boys aged 10 to 12 years (68.6%). None of the in-school children aged less than 10 years were stunted. Among out-of-school children, boys were more stunted than girls in all age groups.

Discussion

Study findings show that there is a high magnitude of malnutrition among school age children in Mpwapwa district according to all the anthropometric indicators used, with those in-school being more affected than those out-of-school. This finding is in contrast to the observation made among rural school children in Tanga Tanzania, where Beasley et al[5] established that non-enrolled school children were more stunted, wasted and anemic compared to enrolled school children. As out of school children spend more time at home or in the vicinity of their homes it is likely that they have more access to food compared to school going children who spend a lot of their time at school. In rural settings, school going children have to walk long distances to school, and in order to reach school on time they have to leave their homes very early in the morning and often miss their morning meal. Although out of school children who had completed primary school and were in the required age range were excluded from the study, the authors consider that had they been included this would not have influenced the study findings differently.

Findings of this study show that generally boys were more affected compared to girls of the same age. Research done among school children in Sri Lanka and Malaysia have established similar findings where higher proportions of boys were underweight, wasted or stunted compared to girls[6,7]. Other researchers in Tanzania have also documented that boys are thinner than girls[8]. Kihamia et al[9], however observed that at younger ages (8-10 years) boys tended to be more underweight than girls, while at older ages (11-14 years) they found the reverse.

The prevalence of thinness (34.7%) established in this study is comparable to the figure of 34% obtained by Kohi and Charles[8] but higher than that of 23.4% established by Tatala et al[1]. Boys were found to be almost twice as thin (42.9%) compared to girls (27.4%). This finding concurs with those established by Allen and Gillepsie[9] in their extensive review of literature.

Mpwapwa school age children are more stunted (42.7% vs 29.0%) but less underweight (39.3% vs 72%) compared to Sri Lankan school age children[6]. This suggests different aetiologies of malnutrition in the two areas with children in Mpwapwa experiencing more of chronic as opposed to acute malnutrition observed in the Sri Lankan children. However, contrary to our expectations we did not observe an increasing trend in the prevalence of stunting by age in the Mpwapwa school age children.

The prevalence of underweight among school children established in this study (39.3%) is lower than that found among school children in Tanga[9] i.e. 54.1%. A possible explanation for this observation could be the difference in the age range of the children studied and the different environmental settings. As in the Tanga study[9], both girls and boys tended to be underweight in all age groups, however data from this study does not depict an increasing trend of underweight with age as established among Tanga school children.

Most of the respondents were in their adolescence, a period that is characterized by rapid somatic growth and development that can be limited by factors such as prolonged undernutrition persisting from early childhood, infection and chronic disease[3,10]. So far, it has not been established that adolescents can catch-up on incomplete childhood growth. The high prevalence of malnutrition observed in this study is a matter of concern as these children may not be able to attain their maximal growth potential during adolescence. Short stature and low body mass during adolescence may be associated with delayed

development of secondary sexual characteristics; decreased lean body mass and reduced working capacity as well as adverse reproduction outcomes for girls in the future[3]. Poor nutrition status has also been shown to affect learning capabilities of children by impairing their ability to concentrate and learn, and may also affect school attendance due to poor health and nutrition related illnesses[3,10.] Malnutrition during the school years could therefore impact negatively on future adult life by altering academic and occupational prospects of the children who are affected.

Conclusion and Recommendations

The magnitude of chronic protein energy malnutrition among school age children in Mpwapwa district was found to be very high. There is need for further studies to assess prevailing disease patterns, household food security, household food consumption patterns, as well as to examine possible factors which will explain why school going children are more affected than out of school children.

Acknowledgements

The authors acknowledge contributions from the late Dr. F. Kawau who came up with the original idea of the study and for data collection. Due to his untimely death he could not see this work through its completion. Thanks are due to the School Age Health Research Initiative in Tanzania for supporting the research activity and to Mpwapwa residents for agreeing to participate in the study.

References

1. **Tatala S, Svanberg U and Mduma B. Low Dietary Iron Availability Is a Major Cause of Anaemia: A nutrition survey in the Lindi District of Tanzania. Am J Clin Nutr 1998; 68:171-8.**
2. **Meakins RH, Harland PSEG and Carswell F. A Preliminary Survey Of Malnutrition And Helminthiasis Among School Children In One Mountain And One Lowland Ujamaa Village In Northern Tanzania. Transactions Of The Royal Society Of Tropical Medicine And Hygiene 1981; 75 (5).**
3. **WHO Physical Status: The Use And Interpretation Of Anthropometry. Technical Report Series No. 854. Geneva, WHO, 1995; pp 263-308.**
4. **WHO World Health Report. Geneva, WHO, 1999; pp 84-87.**
5. **Beasley NM, Hall A, Tomkins AM, Donnelly C, Ntimbwa P, Kivuga J, Kihamia CM, Lorri W and Bundy DA. The Health Of Enrolled and Non Enrolled Children Of School Age, Tanga Tanzania. Acta Trop. 2000; 76(3): 223-9.**
6. **Fernando SD, Paranavitane SR, Rajakaruna J, Weerasinghe S, De Silva D and Wickremasinghe AR. The health and nutrition status of school children in two rural communities in Sri Lanka. Tropical Medicine and International Health 2000; 5(6): 450-452.**
7. **Tee Es, Khor SC, Ooi HE, Young SI, Zakiyah O and Zulkafli H. Regional Study Of Nutritional Status Of Urban Primary School children.3. Kuala Lumpur. Food Nutr bull. 2002; 23(1):41-7.**
8. **Kohi TW and Charles T. Needs Assessment Of Children In Five Districts: Mafia, Kyela, Manyoni, Magu and Geita. A Report Submitted To UNICEF Dar-Es-Salaam, 2000.**
9. **Kihamia C, Mwanri L, Issae W, Magingo J, Mwaikemwa A, Hall A and Brooker S. Ushirikiano Wa Kumuendeleza Mtoto Tanzania, UKUMTA, The Tanzania Partnership For Child Development. Health And Education Of The School Child In Tanga Region. UKUMTA 1997; Report Series No. 8.**
10. **Allen L and Gillespie S. What works? A review of the efficacy and effectiveness of nutrition interventions. United Nations Administrative Committee On Coordination, Sub Committee On Nutrition And Asian Development Bank, Manila, 2001.**