ASSESSMENT OF MALNUTRITION AMONG PRESCHOOL CHILDREN IN RURAL MADHYA PRADESH, INDIA

G.R.GANGLE, PRAVEENA DHARIWAL

Abstract: Malnutrition is a major public health problem in developing countries including India. According to recent reports, Madhya Pradesh has the highest number of malnourished children in the country with 74.1 per cent of those under the age of five suffering from anaemia and 60 per cent from malnutrition. The prevalence of malnutrition among preschool children (0-5years) may differ geographically. Hence for the advancement of specific intervention strategies, local level assessment of malnutrition is very necessary. Therefore we carried out the present study to estimate the prevalence of malnutrition among less than five year (preschool) rural children and infant and young child feeding practices. This paper examines the efficacy of various anthropometric systems of nutritional status in identifying the consequent risk of mortality among the preschool children residing in the surrounding villages of Ujjain, Madhya Pradesh. We examined various indices like weight-for-age; weight-for-height; height-for-age; arm circumference-for-age; arm circumference-for-height; weight quotient; and height quotient. Cross-sectional anthropometry was performed during October 2015 to January 2016 and the mortality experience of the study children was followed potentially over 12 months. The outcome of this study indicated that severely undernourished children experienced significantly higher mortality risk. Normal, mild, and moderately malnourished children all experienced the same risk. All indicators were found to categorize mortality risk but weight/age and arm circumference/age were strongest and weight/height weakest. For each index, an entry level was noted below which mortality risk gone up sharply. The study revealed a significant association between nutritional status and different socioeconomic variables. The prevalence of underweight was significantly associated with literacy status of mother and type of house. The prevalence of wasting was significantly associated with community and type of family.

Key words: Anthropometry, Child nutritional status, Infant nutrition disorders, Madhya Pradesh.

Introduction: Undernourishment or malnutrition is extensively documented as a major health problem in developing countries. The incidence of malnourished children in India is among the highest in the world, and is nearly double that of Sub Saharan Africa with horrible consequences for mobility, mortality, productivity and economic growth [1]. Growing children in particular are most susceptible to its consequences. The occurrence of undernourishment cannot be easily estimated from the occurrence of commonly-recognized clinical syndromes. Children with mild-to-moderate malnutrition are likely to remain unpredictable because clinical criteria for their diagnosis are inaccurate and are difficult to interpret correctly. [2]

It is generally acknowledged that anthropometry is the most useful tool for assessing the nutritional status of children practically. There are many anthropometric indicators in use, such as mid-upper arm circumference (MUAC), MUAC-for-height, weight-for-age, height-for-age, weight-for-height, and body mass index of Quetlet. [3] Most of these markers need to be used along with specific reference tables, e.g. National Center for Health Statistics (NCHS) tables, for interpreting data. This might not be possible in over-crowded outpatient departments of common tertiary care hospitals. Therefore, to estimate the expected weight or height of a child rapidly, especially in emergency situations, many field workers and clinicians use formulae first introduced by Weech, using age as variable.

Each of the above indicators has advantages and disadvantages. Some have a high sensitivity, while others have a high specificity. An ideal anthropometric indicator should have a high sensitivity to detect malnutrition accurately. At the same time, its specificity should be good so that the government resources and facilities meant for malnourished population may reach only those in need of them. [4] The study was carried out to estimate the prevalence of wasting and stunting among children aged 12-60 months and to compare the commonly-used anthropometric indicators in terms of their sensitivity and specificity.

Materials and Methods: An organization based observational, descriptive study, cross sectional in design, was carried out in Pediatric Out-Patient-Department (OPD) and Immunization Clinics of Ujjain, Madhya Pradesh from October to December, 2015. 1 - 5 years children (12 to 59 months) attending the Pediatric OPD and immunization clinic during the data collection period were the study population.

This study was carried out in surrounding villages in the outskirts of the Ujjain city in Madhya Pradesh. Pre informed written consent of the parents of the study population was obtained after explaining the purpose and nature of the study and knowing their willingness to share the information. They were assured about their confidentiality and secrecy. Then data collection was conducted by exit interview of the parents of the study population followed by examining their children. Mothers were asked to give details of socio demographic profiles, immunization status and history of illness in last 6 months etc. Mothers were also requested to show immunization card to confirm vaccination status. If not available, then verbal information from the mother was collected.

Anthropometric measurements taken were weight (kg) and height (cm) by standard techniques. Weight was measured to the nearest 0.1 Kg. Height was measured against a non stretchable tape fixed to a vertical wall, with the participant standing on a firm/level surface and it was measured to the nearest 0.5 cm. The children were dressed in light underclothing and without any shoes during the measurement. Each measurement was done twice, and the mean of the two readings was recorded. The same measuring equipments were used throughout the study. Subsequently, the children were categorized on the basis of their weight for age, height for age and weight for height as per WHO [1] international growth standards 2006 generated for boys and girls aged 0 to 60 months.

General clinical examination of all the study population were carried out in natural light. In total, 115 children were examined, but only 86 were included in the study since the age of 29 children could not be known accurately. MUAC was measured to the nearest millimeter at the exact midpoint of the left arm using a narrow, flexible, and non-stretchable tape made of plastic. Weight of children was taken using a stand-on scale, the accuracy of which was established on a daily basis. Height of child was measured to the nearest millimeter using a right-angled head-plate non-stretchable tape fixed to the wall. Recumbent length was taken for children under 85 cm and standing height for children over 85 cm. All measurements were taken thrice and averaged for the final reading. Each author was dealt to take one particular measurement for the whole study to reduce inter-observer unfairness.

The classification proposed by Waterlow incorporates both the above indicators and was used for the study for presenting data [5]. The collected data and indices were compared with the NCHS tables for weight-for-height and height-for-age. The report of the World Health Organization has recommended the use of the above reference population. A value of mean −2SD was taken as the cut-off point for detection of wasting and stunting. [6], [7] The children were divided into three age groups: 12-35 months, 36-47 months, and 48-60 months. This age categorization is very important since the occurrence and distribution of slaughter and stunting differ from age to age.

The prevalence of slaying was determined using the following indicators:

- MUAC
- MUAC-for-height
- Weight-for-age indicator using the NCHS tables for weight-for-age
- Field formulae described in Nelson's Textbook of pediatrics.[8] 2x+8=reference weight (where x is age in years)

We further modified the age to include more accurate age groups, i.e. those with intervals of half year and quarter of a year. In other words:

2x+8=reference weight of child (where x is age rounded off to the nearest 6 months, e.g. 1, 1 $^{1/}{}_{2}$, 2, 2 $^{1/}{}_{2}$, etc.) and

2x+8=reference weight of child (where x is age rounded off to the nearest quarter of a year, e.g. 2 $^{1/}{}_{4}$, 2 $^{1/}{}_{2}$, 2 $^{3/}{}_{4}$, 3, etc.)

The prevalence of wasting as detected by each of the above methods was then compared with the prevalence as estimated using the NCHS tables for weight-for-height which was used as a comparison in our study. In the same way, the prevalence of stunting was calculated using Weech's formula (6x+77=reference height of child where x is age in years). [9] We also modified this as described above, and the age was rounded off to the nearest quarter of a year. This prevalence was then compared with the prevalence estimated using the NCHS tables for height-for-age. Sensitivity, specificity, predictive values, and likelihood ratios were calculated for each indicator of malnutrition comparing these with the NCHS standards.

Results:

Prevalence of malnutrition: In our study, about 71.5% of the children were malnourished (wasting, stunting, or both). Wasting had a high prevalence of 59.40.4% (Table 1). The prevalence of stunting was 34.6%. Only 33.1% were normal. The following trends in the distribution of malnutrition were observed in our study (Table 1). Significance was estimated by chi-square test. The number of children who had only stunting (9.4%) was much fewer than the number who had only wasting (29.2%). The prevalence of malnutrition was slightly prevalence of stunting (pure and mixed) in females (37.1%) was lower than that in males (36.1%).

Comparison of anthropometric indicators: The results of anthropometric indicators were summarized in Table 2, 3, and 4.

Sensitivity of MUAC: The sensitivity of Mid-Upper Arm Circumference (*MUAC)* indicators was very low, i.e. 29.2%, which denotes that almost 71.8% of the malnourished cases were missed. The specificity of the index was very good (94.8%) hence very rarely children were detected wrongly as being malnourished.

MUAC-for-height: This indicator compared the MUAC of a child with the MUAC of a reference child of same height. This method, used in field surveys, is better known as the 'quac stick' method. The sensitivity of this test was 46.2% (twice that of MUAC), and the specificity was 85.5%.

Calculation of reference weight by using Weech's formula: Results clearly indicate that the prevalence of wasting in children different with increasing age. We found higher percentage of girls having wasting (68%) than that of boys (51.2%). The occurrence of malnutrition was much higher in the lower age groups (71.1% in the age group of 12-35 months), and it decreased in the older age groups (59.1% in the age group of 36-47 months and 48.3% in the age group of 48-60 months. The prevalence of stunting in children increased significantly (χ^2=6.14, $p<0.05$) with age (24.2%, 38.1%, and 49.2% in the age group of 12-35 months, 36-47 months, and 48-60 months respectively. The application of Weech's formula offers a simple an option as the total not always is possible to refer to the standard NCHS tables. This index compares the weight of a child with that of the reference weight (as calculated by the above formula). Waterlow chooses a cut-off of 80% of the reference weight as an indicator for malnutrition. The sensitivity of the above indicator was 74%, and the specificity was 87%. The figures mentioned are indicative of the actual number in each category. Height/age tables refer to the standards prescribed by the NCHS.

Weight-for-height compared to weight-for-age (using NCHS tables): The comparison of weights of the children with reference weights obtained using NCHS weight-for-age tables yielded a sensitivity of 90% and a specificity of 78%. These values were similar to the sensitivity and specificity values obtained when Weech's formula was used for calculating the reference weight. However, the age to be used in the formula has to be accurately rounded off to the nearest quarter as demonstrated above.

Height-for-age: Heights of the children were compared with the reference NCHS heights calculated using modified Weech's formula for height (where x is age rounded off to the nearest quarter). This method yielded a sensitivity of 48.7% and a specificity of 98.5%.

Discussion: The present study reveals that the mean weights and heights of children were low in comparison to NCHS standards at all ages and for both sexes and show growth retardation. The occurrence of low weight-for-height, an indicator of malnutrition of short duration, was greater than the standard limit of WHO [7] (15%) which indicate that the severity of malnutrition in this area. Stunting or low height or-age signifies a slowing of skeletal growth and is a major indicator of long-term nutritional experience or growth impairment caused by malnutrition in the past. Stunting or long-duration malnutrition was observed in 53.0% of children and underweight (low weight-for-age) in 60.0%. Stunting as well as underweight was higher in girls than boys, although significant only in the case of underweight ($P > 0.05$), which might indicate that girls were not being given proper care as reported earlier. [10]The extent of malnutrition in these children was highest in the group aged 1–2 years, and may be endorsed to the women in rural areas following the traditional typology of infant feeding pattern. [10]

Wasting, stunting and underweight were higher in the present study than in other comparable studies. According to the National Institute of Nutrition (NIN) wasting in India was observed 26.2% and 15.4% of pre-school children. Severe wasting (below 23SD from the reference median) was higher in the present study (10.0%) than in the NIN study (1.6%). We also found that preschool children in the rural area experienced from *Protein energy malnutrition* (PEM) vitamin A and B complex deficiencies, and anaemia. PEM prevalence was higher in the present study whereas vitamin A and B complex deficiencies and anaemia have shown a declining trend, which may be due to the supply of vitamin A and iron by the state government. However, children in the present study showed higher deficits in dietary energy and protein intake compared with children in the urban areas which could be responsible for their higher prevalence of *Protein energy malnutrition* (PEM). This can be attributed to reduced harvests in this region and a poverty which further declined the availability and accessibility of nutritious food to the community. Shortage of food grains, fodder and increased labour unemployment that had direct economic consequences along with food insecurity leading to malnutrition. These findings might be due to increased poverty, lack of education and poor food intake of the inhabitants that in turn might be responsible for malnutrition. Efforts should be made to integrate measures, such as ensuring the supply of sufficient energy and protein to all age groups and especially pre-school children, into ongoing nutrition programmes in order to improve food security. Furthermore, there is a strong need to develop nutritional packages based on the locally available diet and feeding habits of pre-school children which would provide them adequate energy, protein and nutrients.

Role of Government: To address Madhya Pradesh's status as having the highest Infant Mortality Rate and fourth-highest Maternal Mortality Rate in the country, UNICEF [12] has worked with district health societies and the government in piloting the Guna Model of continuum of care. This care is backed up by the provision of 24X7 hours quality care by skilled workers at health facilities through Special New Born Care Units (SNCUs), Model Maternity Wings (MMWs), Under 5 Special Care units and 24X7 hours sub-centres in remote areas. It also includes the follow up of discharged infants from SNCUs by implementing a tracking and monitoring software and linking them to home-based newborn care.

Conclusions and Recommendations: Efforts should be made to integrate measures, such as ensuring the supply of sufficient energy and protein to all age groups and especially pre-school children, into ongoing nutrition programmes in order to improve food security. Furthermore, there is a strong need to develop nutritional packages based on the locally available diet and feeding habits of pre-school children which would provide them adequate energy, protein and nutrients. Initiatives should be planned to strengthen Routine Immunization through the introduction of the pentavalent vaccine, monitoring of cold chain and vaccine logistics and building capacity of health workers. It is advised to provide technical support to strengthen early referral and treatment of pneumonia and diarrhoea among children aged less than five years. It is essential to monitor the quality of maternal and newborn care through MMWs and accreditation of training sites for Skilled Birth Attendants (SBAs) in the next few years.

Table 1. Prevalence of malnutrition among preschool children in rural Madhya Pradesh

Group	Normal		Wasted only*		Stunted only*		Wasted and stunted	
	No.	%	No.	%	No.	%	No.	%
Total population	86	30.1	80	31.2	24	9.4	75	29.3
Females	41	27.3	40	34.2	10	8.5	35	29.9
Males	45	32.4	40	28.8	13	10.1	40	28.8
Age 12-35 months	14	22.2	31	49.2	5	7.9	13	20.6
Age 36-47 months	34	30.9	35	31.8	13	11.8	28	25.5
Age 48-60 months	29	34.9	14	16.9	6	7.2	34	41.0

* mean −2SD

Indicator	Presence (+)/absence (-) of malnutrition	Malnourished using weight/ height tables (<mean −2SD)	Normal using weight/ height tables(>mean −2SD)
Malnourishment using MUAC	+	16	10
	-	49	181
Malnourishment using MUAC/height	+	31	22
	-	34	169
Malnourishment using formula–'age x2 +8' (age rounded to nearest quarter year)	+	60	43
	-	5	148
Malnourishment using formula–'age x2+8'(age rounded to nearest half year)	+	52	42
	-	13	149
Malnourishment using formula–'age x2+8'(age in years)	+	48	25
	-	17	166
Malnourishment using weight/age	+	59	42
	-	6	149
The figures mentioned are indicative of the actual number in each category			
Weight/height tables refer to the standards prescribed by the NCHS			

References:

1. WHO.2009. World Bank Report. *Source: The World Bank (2009)*. Retrieved 2009-03-13. World Bank Report on Malnutrition in India
2. A.B. Bhake, N.T.Khaty, N.M.Limaye, S.L.Bankar, Eco-Village- A Solution To Uncontrolled Rapid Urbanization.; Engineering Sciences international Research Journal : ISSN 2320-4338 Volume 3 Issue 2 (2015), Pg 1-5

3. Elmadfa I, Weichselbaum E. European Nutrition and Health Report. 2004, vol 58, Basel, Karger Publishing, 2005.
4. Behrman RE, Kliegman RM, Jenson HB, editors. Nelson's Textbook of pediatrics. 16th ed. Philadelphia: Saunders, 2000:32-50.
5. E. Rachana, A Curtain Raiser To Multi-Antenna Receiversand Mimo Systems.; Engineering Sciences international Research Journal : ISSN 2320-4338 Volume 3 Issue 2 (2015), Pg 20-25
6. De Onis M. World Health Organization. Dept. of Nutrition for Health and Development. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. Geneva, Switzerland: World Health Organization; 2006; p312.
7. Vidyottama Kumari, Dr. Thakur C. K. Raman, G-Preregular And G-Pre-Normal Topological Spaces.; Engineering Sciences international Research Journal : ISSN 2320-4338 Volume 3 Issue 2 (2015), Pg 6-8
8. Waterlow JC, Buzina R, Keller W, Lane JM, Nichaman MZ, Tanner JM. The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. *Bull World Health Organ* 1977;55: 489-98.
9. Dr. Thakur C. K. Raman, A Perspective On πβ-Normal Topological Spaces.; Engineering Sciences international Research Journal : ISSN 2320-4338 Volume 3 Issue 2 (2015), Pg 9-11
10. Park K. Park's Textbook of preventive and social medicine. 16th ed. Jabalpur: Banarsidas Bhanot, 2000:367-72.
11. WHO, 1986.World Health Organization. Use and interpretation of anthropometric indicators of nutritional status. *Bull World Health Organ* 1986; 64:929-41.
12. Kliegman, Robert M. *Nelson textbook of pediatrics*. Saunders Elsevier, 2012.
13. Arpan Dasgupta, Dr. Madhumita Roy, Comparing Space And Power Consumption Pattern Between An Old And Modern Office Building.; Engineering Sciences international Research Journal : ISSN 2320-4338 Volume 3 Issue 2 (2015), Pg 12-19
14. Bramhabhat, K.R., Hammed, S., Naik, P.M., Parana, K.S. and Jay ram, S., 2013. Role of new anthropometric indices, validity of MUAC and Weech's formula in detecting under-nutrition among under-five children in Karnataka. *International Journal of Biomedical and Advance Research*, *3*(12), pp.896-900.
15. World Health Organization and UNICEF, 2009. WHO child growth standards and the identification of severe acute malnutrition in infants and children: joint statement by the World Health Organization and the United Nations Children's Fund.
16. http://ninindia.org
17. http://unicef.in/StateInfo/Madhya-Pradesh/Unicef-In-Action.
18. Biswajit Das, Voltage-Current Characteristics of Glow Discharge Plasma for Dc Fields; Engineering Sciences international Research Journal: ISSN 2320-4338 Volume 3 Issue 1 (2015), Pg 136

***

G.R.Gangle/ Department of Economics/ Govt.PG College/ Shujalpur/ M.P/
Praveena Dhariwal/ Department of sociology/ Govt.College/ Khachrod/