Rapid Assessment of Nutritional Status of Children in Rural Area of Maharashtra

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ABSTRACT

Introduction: Assessment of nutritional status by anthropometry is the simplest and most useful tool for assessing the nutritional status of children. Given the importance of nutrition in early life, this study was conducted among children between 12-36 months. Aim: To study the nutritional status of children between 12-36 months and factors associated with it.

Material and Methods: Settings: Catchment area of Kheda Primary Health Centre, Dhule. Design: Cross-sectional study based on 30 cluster sampling technique. Sample size: Worked out to be 210. Participants: 210 children between 12-36 months in 30 clusters. Study variables: Mid Upper arm Circumference measurement of children, gender, birth order, social categories, literacy status of parents, occupation of father, nuclear or joint family. Statistical analysis used: Chi square test of significance, descriptive analysis (mean -mode –median).

Results: Based on the Mid Upper Arm Circumference, the overall prevalence of malnutrition among children was 40%. The prevalence of severe malnutrition was 13%, with higher prevalence in females as compared to males. Statistically significant association was seen between malnutrition and gender of children, birth order, social categories (especially children belonging to Scheduled Tribes), literacy status of parents and type of family.

Conclusions: There is a need for geo-social mapping and "inclusion sensitive" microplanning, especially to ensure equitable access (in terms of support and information) to excluded social categories to reduce the magnitude of malnutrition.

Keywords: Malnutrition, mid upper arm circumference, social exclusion, Scheduled Tribes.

INTRODUCTION

A child is not a miniature form of adult. Growth is an indispensable feature of life of a child that distinguishes him from an adult. Environment experiences of the child during postnatal life determine the pace and pattern of his growth and development.[1]

Malnutrition is widely recognized as a major public health problem in the developing countries of the world including India. Based on the United Nations Children's fund (UNICEF) report, malnutrition in early childhood has serious, long term consequences because it delays motor, sensory, cognitive, social and emotional development.[2] Malnourished children are at a greater risk to grow into malnourished adults.[2] The prevalence of Undernutrition cannot be easily estimated from the prevalence of commonly recognized clinical syndromes of malnutrition such as marasmus and kwashiorkor because these constitute only proverbial tip of iceberg. Cases with mild to moderate Undernutrition are likely to remain unrecognized because clinical criteria for their diagnosis are inaccurate and difficult to interpret precisely.[3]

Child growth is commonly used to assess adequate nutrition, health and development of individual children and in comparison with other health assessment tools its measurement is a relatively inexpensive and easy to perform procedure.[4] Therefore, anthropometric examination is a mandatory tool in any research on health and nutritional condition in childhood.[5] Moreover, in community based studies, mid upper arm circumference (henceforth called as MUAC) appears to be a superior predictor of childhood mortality than many other anthropometric indicators.[4] MUAC yields a relatively reliable estimation of the body's muscle mass, the reduction of which is one of the most striking mechanisms by which the body adjusts to inadequate energy intakes.[6] Arm circumference cannot be used before the age of one year; between ages one and five years, it hardly varies.[6] Large studies in Latin America and South Asia have clearly established the reliability of arm circumference screening as an effective method of identifying malnourished children.[7]

During preschool age period, children have special nutrition needs because of their extensive growth and development.[4] Moreover, the direct effect of malnutrition is believed to operate largely in the first two or three years of life.[8]

With this background we decided to conduct a survey to rapidly assess the nutritional status of children between 12-36 months and factors associated with it by measuring the MUAC in the catchment area of Kheda Primary Health Centre of district Dhule, Maharashtra. The data collected would also benefit the district authorities to prepare a district action plan to address the problem of malnutrition in children in Dhule district.

MATERIAL AND METHODS

The survey was conducted in the catchment area of Kheda Primary Health Center, Dhule district, Maharashtra, India carried out from 23rd October to 1st November 2011. This Primary Health Center (henceforth called as PHC) caters to population of 38465 distributed among 30 hamlets (within 12 villages).

Approval of institutional ethical committee (IEC) and district health authorities were taken before conducting the survey. The survey design used in the current study is the World Health Organization 30X7 cluster survey method. This is a cluster

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sampling technique. This technique allows a small number of the target population to be sampled while providing statistically valid data that can be extrapolated to the whole target population. The 30 hamlets (within the 12 villages) under the catchment area of Primary Health Center formed the sampling frame for the cluster sampling technique. The target age group comprised of children aged 12-36 months. The random number and sampling interval were worked out to be 1117 and 1282. The determination of sample size was done as per the WHO 30X7 cluster survey – "Reference Manual" in the same way it is done to evaluate the immunization coverage.[9] For sample size determinations to assess the nutrition status, the following were determined, estimated or assumed beforehand:

- Anticipated level of prevalence of malnutrition in children – 60%;
- Desired precision of the estimate - ± 10%;
- The level of statistical confidence of the estimate (confidence level) - 0.05;
- Magnitude of differences of coverage among and within the clusters (design effect) - 2.

The total sample size was estimated (the total number of children to be surveyed) using the equation below.

$$n_{min} = DE \times \frac{z^2_{1-\alpha/2} \times p \times (1-p)}{d^2}$$

- Where p is expected prevalence, d is the desired width of CI, DE is design effect and Z is the multiplier from the normal distribution for the desired confidence level (α)
- Assuming a DE of 2 and d of 0.1, the minimum sample size worked out to 184.

Since we were going to use 30 clusters, the sample size per cluster worked out to 184/30 = 6.13. Rounded off, number of children to be surveyed in each of the 30 clusters was 7. Thus 210 children was the total sample size for 30 cluster survey. Keeping in view that, cluster is a collection of households with identifiable geographical boundaries; hamlet-wise population was obtained from PHC (cross checked with population data provided by Gram Panchayat) and taking 1117 as random number and 1282 as sampling interval 30 clusters were identified by using the standard technique.[9]

The field implementation for the survey was conducted as per a detailed plan devised beforehand. Establishing of households of the selected clusters was not going to be possible. Therefore the investigators decided that in every cluster, the geographical center of the cluster would be visited. From there, the investigators would move in a randomly chosen direction. The first house would be the house corresponding to a random number chosen beforehand. Both, the direction in which the investigator would move and the random number for choosing the first house, were generated using the computer for each cluster. After visiting the first household the second household to be visited was the one that was nearest to the first.

Interviews and Collection of Data: The investigators conducted interviews as per a pre-structured, pilot-tested interview format in households with children between 12-36 months. The MUAC of the children was measured and their socio-demographic profile was taken. Utmost care was taken at the time of measuring MUAC. The study teams were trained in taking MUAC to minimise the inter observer variations. The non-dominant upper arm was chosen for the measurement and the circumference of location in between the tip of the shoulder and the tip of the elbow (olecranon process and the acromian process)while the arm is hanging down the side of body and relaxed was considered as MUAC. Flexible measuring tape was used for measurement of MUAC. Arnold's classification[10] was used to classify malnutrition based on the MUAC. An arm circumference exceeding 13.5 cm was considered as a sign of a satisfactory nutritional status, between 12.5 cm and 13.5 cm was considered to indicate as mild-moderate malnutrition and below 12.5 cm, severe malnutrition.[6] The socio-demographic profile comprised of gender of the child, birth order, religion, social categories, father's occupation and education, mother's education, type of family (joint or nuclear).

Inclusion criteria: Children between 12-36 months with availability of responsible person for key information. All records entered were checked, cross-checked and randomly double checked for correctness.

Informed consent from all parents of the children was obtained. The parents of the children had the option to opt out of the study if they wished to. However, no parent refused to participate and thus there was 100% response.

STATISTICAL ANALYSIS

Chi square test of significance, descriptive analysis (mean-mode- median) were used to infer results with the help of SPSS 16.0 version.

RESULTS

A total of 210 children were included in the study, of which 107 (51%) were male and 103 (49%) were female children. Overall prevalence of malnutrition (MUAC ≤ 13.4 cm) in children was found to be 40% (36.4% males and 43.7% females).The prevalence of severe malnutrition (MUAC ≤ 12.4 cm) was found to be nearly 13% (7.5% males and 19.41% females). There were 10 (4.8%) children having MUAC 11.5 cm or less.

For overall prevalence of malnutrition, the sex differential was not statistically significant (P>0.05). Sex differential was though statistically significant (P<0.05) for prevalence of severe malnutrition.

Table-2 depicts MUAC distribution according to socio-demographic factors. It was observed that only 33.7% children with birth order 2 or less than 2 were malnourished. On the contrary, 60.5% children were malnourished when their birth order was 3 or higher. The difference was statistically significant. Additionally, 66% children with birth order 2 or less were found to be having satisfactory nutrition status (MUAC>13.5 CM), while, only 31.6% children with birth order 3 or higher were observed to be having satisfactory nutrition status, the difference being statistically significant (P<0.05).

Substantial differences in the status of nutrition were observed

MUAC	Number (%)
< 12.5 cm	28 (13.3)
12.5-13.4 cm	56 (26.7)
≥ 13.5 cm	126 (60)
Total	210 (100)

Table-1: Distribution of Mid Upper Arm Circumference (in cm) of sampled children.

Variables	Mid Upper Arm Circumference (in cm)		
	<12.5	12.5-13.4	≥ 13.5 cm
Total (n=210)	28 (13.3)	56 (26.7)	126 (60.0)
Sex			
Male (n=107)	8(7.47)	31(28.97)	67(62.61)
Female (n=103)	20(19.41)	25(24.27)	59(57.28)
Birth Order			
1 (n=92)	6(6.52)	24(26.08)	62(67.39)
2 (n=80)	6(7.5)	22(27.5)	52(65)
3 (n=28)	13(46.42)	4(14.28)	11(39.28)
4 (n=7)	3(42.85)	3(42.85)	1(14.28)
5 (n=3)	0	3(100)	0
Social Categories*			
SC (n=25)	7(28)	5(20)	13(52)
ST (66)	16(24.24)	25(37.87)	25(37.87)
OBC (n=98)	5(5.1)	24(24.48)	69(70.4)
Others (n=21)	0	2(9.52)	19(90.47)
Educational status of Mother			
Illiterate (n=68)	17(25)	24(35.29)	27(39.7)
Some Middle School (n=17)	5(29.41)	6(35.29)	6(35.29)
Some High School (n=96)	6(6.25)	20(20.83)	70(72.91)
Some Junior College (n=23)	0	5(21.73)	18(78.26)
Graduate (n=6)	0	1(16.6)	5(83.3)
Educational status of Father			
Illiterate (n=41)	16(39.02)	15(36.6)	10(24.4)
Some Middle School (n=20)	5(25)	4(20)	11(55)
Some High School (n=89)	6(6.74)	20(22.47)	63(70.8)
Some Junior College (n=46)	1(2.17)	13(28.26)	32(69.56)
Graduate (n=14)	0	4(28.6)	10(71.42)
Occupation of Father			
Labourer (n=123)	20(16.26)	36(29.26)	67(54.5)
Service (n=43)	3(6.97)	12(27.9)	28(65.1)
Farming (n=34)	5(14.7)	7(20.6)	22(64.7)
Business (n=10)	0	1(10)	9(90)
Type of Family			
Joint (n=155)	13(8.38)	44(28.4)	98(63.2)
Nuclear (n=55)	15(27.27)	12(21.81)	28(50.9)

* Social Categories of India - Scheduled Tribes (ST) and Scheduled Castes (SCs) are the socially depressed classes of India. OBCs are other backward classes. "Higher" social classes are classified as Others.

Table-2: Distribution of Mid Upper Arm Circumference (MUAC) by different variables.

among children belonging to Scheduled Tribe (ST) category and children belonging to higher category (others). There were higher chances of higher category children (90.4%) being well nourished as compared to children belonging to ST category (37.9) and this probability was observed to be statistically significant (P=0.029). Similarly, the prevalence of malnutrition (mild-moderate and severe) was also found to be higher (62%) among children belonging to ST social category as compared to children belonging to higher social category (9.5%) and this difference was found to be very significant statistically (P=0.0064).

Better education status of the mother had a positive impact on the nutrition status of children. The overall prevalence of satisfactory nutrition status (MUAC >13.5 cm) was high among the children (74.4%) having literate mothers (high school and above education) as compared to children (39.7%) with illiterate mothers. This difference was statistically significant (P=0.02). Children with illiterate mothers also had a higher probability of being malnourished (60.3%) as compared to children with literate mothers (high school and above education). This difference was extremely statistically significant (P=0.0032). It was revealed further that the prevalence of malnutrition among the children with literate fathers was comparatively lower (21.5%) than the illiterate fathers (75.6%) and the difference was also statistically very significant (P=.0020).

Lastly, it was observed that children belonging to nuclear family had higher prevalence of severe malnutrition (27.3%) as compared to children belonging to joint family (8.4%). The difference was considered to be statistically very significant (P=0.0068).

Table-3 gives the insight of statistical averages and measures of dispersion (standard deviation) of MUAC of sampled children by some social categories. The most striking feature is the statistical averages of MUAC of children belonging to Scheduled Tribes. The mean MUAC of these children is 13.33 cm (standard deviation-0.99), while the median is 13.25 cm. The mean and median are all below cut off point for malnutrition i.e. 13.5 cm.

Variables	Mean (cm)	Median (cm)	Standard Deviation
ST	13.33	13.25	0.99
SC	13.05	13.5	1.27
OBC	13.81	14	0.91
Others	13.9	14	0.7

Table-3: Mean Median and Standard Deviation of MUAC by different variables.

DISCUSSION

Nutrition is one of the important social determinants of health. In the last few years, state of Maharashtra has made significant progress in reducing infant mortality rate and maternal mortality rate.[8] The state also has significant economic growth. However, despite this context, the state has not been able to make much significant progress in improving the nutritional status of the population[8] which can be reflected by its Hunger index rank (The Indian state hunger index is computed by averaging the three underlying components of hunger index-the proportion of underweight children, the under-five mortality rate, and the prevalence of calorie Undernutrition in the population).[8] The Indian state Hunger index rank of Maharashtra is poor as compared to other Indian states which are not as economically well off. The global comparison of the hunger index rank also reveals that Maharashtra is behind some low income African and Asian countries such as Rwanda, Burkina Faso and Cambodia.[8] The question that needs to be answered here is, whether economic prosperity translates into adequate nutrition of the community?

Myatt et all in their review study in 2006 concluded that mid upper arm circumference is the best case detection method for severe malnutrition and that it is also simple, inexpensive and acceptable.[11] Velzeboer implicated in their study that, MUAC can be taken by minimally trained health workers with fewer and smaller errors as compared to other anthropometric measurements (weight for age and weight for height).[12] Given the situation that malnutrition is a major public health problem in India, can we train our grass root level workers (especially the Anganwadi workers) in mid upper arm circumference measurement to screen the children nutritionally? The question needs to be answered.

In the present study, the overall prevalence of malnutrition is 40%, while, the prevalence of severe malnutrition is 13%. The review of literature (ROL) indicates no such mid upper arm circumference based malnutrition study in Maharashtra. Thus, we are unable to compare our findings with similar studies in Maharashtra. In rest of India context, prevalence of overall malnutrition in the present study is higher than the earlier studies conducted at Orissa (31%)[13] and Punjab (38.5%)[14] States. This might be due to higher proportion of children belonging to Scheduled Tribes in our study. Based on National Nutrition Monitoring Bureau (NNMB) survey finding, in Maharashtra less than one third of the children in the age group of 1-3 years consume the recommended dietary allowances of proteins and calories. Moreover, the data on food consumption reveal that consumption of cereals and millets is only 69% (averagely) of what children need. They consume only half of the required quantity of pulses and legumes.[8]

More number of females were malnourished than males in our study, with statistical significance in pertinence to severe malnutrition. This could be due to gender bias particularly with respect to intra familial food distribution prevalent in Indian society. Similar finding was reported by Ahmad et al (2011).[15] Children with birth order one and two had better nutritional status than with higher birth order. This could be explained by the fact that in our study, large family norm was practiced by families belonging to Scheduled Tribes. Similar finding was reported by Harishankar et al (2004).[16] They opined in their study that, the proportion of malnourished children was significantly lower in birth order one as compared to birth order three and higher.[16] It was observed that, better educational status of parents had a positive impact on the nutritional status of children. Educated parents are more aware about their child's health and have a better chance of utilizing the health services as compared to the illiterate ones. This finding is suggestive of a strong association between parental literacy and nutritional status of children.

One of the main highlight of the study is the significant association of social category of the child and his/her nutritional status. The proportion of malnourished children was extremely high in ST children. Additionally, the mean, median and mode MUAC of children belonging to ST were all below cut off point for malnutrition i.e. 13.5 cm. We would like to suggest that study should be conducted on the dietary patterns (including the food habits and food fads) of the families belonging to ST social category to understand their consumption unit (CU). Given that Maharashtra and Dhule district have a large ST population, understanding the dietary patterns of these families will definitely have an impact on understanding the problem of malnutrition clearly, which eventually will help in addressing its problem.

CONCLUSION

The present study amply reveals that, as far as the child nutrition is concerned, the Scheduled Tribes seems to be the socially excluded groups among all the social categories. We think that there is a need for area specific, geo-social mapping and "inclusion sensitive" microplanning, especially to ensure equitable access (in terms of support and information) to excluded social categories in order to accomplish the goal of reducing malnutrition. Support may be in terms of knowledge and significance of best practices such as exclusive breastfeeding for first six months, starting nutritive semisolid at 6 months, use of locally available and inexpensive foods, child feeding practices, identification of risk of malnutrition etc. The role of Anganwadi workers (grass root health workers in India) seems to be critical in this.

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