

Assessment of Nutritional Status of Under Five Children Attending OPD at a Community Health Centre, Khorda Odisha

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Abstract:

Background: The problems of malnutrition among under five children can be us to conclude the necessity for nutritional care, surveillance, or appropriate intervention of nutritional programme in a community. The objective of present study was to assess the nutritional status of under five children attending at OPD of Balakati CHC and to evaluate the relationship of same with variables like literacy, income of parents, birth order, child sex, birth weight, and breast feeding.

Methods: A total of 206 children aged 0-5 years were included in study after implementing the exclusion criterias.

Results: Out of 206 children, majority were male children 106(51.46%). Positive correlation was observed between the nutritional status of children with educational and employment status of parents, increasing birth weight and family income. Increasing birth order has a negative influence on nutritional status of child. Breast fed babies (Exclusively breast fed for 6 months with appropriate complementary feeds thereafter) have better nutritional status.

Conclusion: Better nutritional status of children depends on early breast feeding, limiting family size, educated parents.

Keywords: Anthropometric indices, Under five children, Prevalence

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Introduction

Malnutrition among children in India is a well-known public health problem due to inadequate nutrition. According to WHO, malnutrition is defined as "pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients"[1]. Malnutrition is the biggest contributor to child mortality where 70%, 26% and 4% of malnourished children live in Asian, Africa and Latin America respectively [2]. The nutritional status of under five children is causing great concern among Social Scientists and Planners now a days because child is the Principal Victim of interaction of nutritional, social, economical and also health related factors that lead to malnutrition. On an average, a child dies every 5 seconds as a direct or indirect result of malnutrition - 700 every hour - 16,000 each day - 6 million every year [3]. Assessment of growth not only serves as a method of evaluating the health and nutritional status of children, but also it provides an alternative method of assessment of the quality of life of the entire community[4]. Death due to common childhood illness is more common in a mal-

nourished child when compared with an adequately nourished child [5]. Under five children are the most at-risk segment in any population and their nutritional status is a sensitive indicator of their health status and nutrition [6]. Malnourished children are more likely to become malnourished adults and they face increased risks of morbidity and mortality[7,8]. It is essential to pay more attention to correlate between children's nutritional status and their capability to attain the required physical growth and mental development [9].

Malnutrition among under five children has been identified as a major health and nutrition problem in India [10]. It occurs particularly in weaklings and children in the first years of life. It is not only an important cause of childhood morbidity and mortality but leads also to permanent impairment of physical and possibly of mental growth of those who survive [11,12].

The incidence of malnutrition in India in preschool age children is 1 to 2 percent[11]. The great majority of cases of malnutrition, nearly 80 percent are the Inter-

mediate ones, that is the mild and moderate cases which frequently go unrecognized. This is primarily due to an inadequate intake of food (food gap) both in quantity and quality and infections, notably diarrhea, respiratory infections, measles and intestinal worms which, increase requirements for calories, protein and other nutrients, while decreasing their absorption and utilization [13].

The nutritional status of the child can be measured by using anthropometry, a simple valuable tool and the gold standard for evaluating the nutritional status [14]. In children the three most commonly used anthropometric indices to assess their growth status are weight for height, height - for age and weight for age. By using these measurements, growth charts were made for monitoring the children's health and nutritional status. The present study was undertaken to assess the nutritional status in under 5 children, to compare the nutritional status with WHO and IAP Growth curves and to evaluate the relationship of nutritional status with variable like literacy and income of parents, order of birth, sex of the child, birth weight, breast feeding and adequacy of diet.

Materials & Methods

Study Design

Cross Sectional study

Study Population

The study included 206 children, aged 0-5 years, attending of Balakati CHC, Bhubaneswar from August - 2018 to December 2018. Mothers of all these children were interviewed and anthropometric measurements were taken for the children and their mothers who were included for analysis.

Inclusion Criteria

All the children of 0-60 months (both male and female) attending OPD of Balakati CHC Bhubaneswar.

Exclusion Criteria

- Children more than 5 years
- Children suffering from
Congenital heart disease
Enzymatic disease,
Congenital deformity
Congenital defects
Malignancy
- Whose mothers not willing to participate in the study.

Data Collection Tools

Physical instrument's and well - structured questionnaire were used for data collection.

Physical Instrument

The physical instrument used in the study included a weighing scale, a Salter Scale, retractable metal measuring tape and an infant meter. All the instruments were calibrated by the Department of Biometrics, Govt. of Odisha.

Questionnaire

Data was collected using the pre-tested semi structured questionnaire by interview technique. The parents of children of age group 0-60 months were informed about the study and each question was explained to gather the data about socio-demographic factors, environmental factors, birth history and feeding practices, recent illness, availability of health facilities and their utilization. Simultaneously height and weight of the child and mother were measured.

Steps in Data Collection

After getting approval from Department of SPM, SCB Medical College, then the study was started.

Data Collection for Study

Consent for the participation in the study was obtained from mother using questionnaire.

Anthropometric Measurements

Weight and height of all 206 children and their mothers who participated in the study were measured based on WHO recommended procedure.

Measurement of Weight

The weight of the children were measured using the conventional standard weighing scale and Salter spring balance for children aged less than two years. These scales were calibrated before commencement of data collection. These scales are widely used in epidemiological studies. With light clothing and without any footwear, children were asked to stand on the platform of weighing scale with body weight evenly distributed between both feet and weight evenly was measured to nearest 0.5 kg. Zero error was set after each measurement.

Measurement of Height

Height was measured using a retractable metal measuring tape. Children whose height has to be measured stood on the floor in an erect position without any footwear with his/her back against the wall. He/she was asked to put their feet together and move back till their heels touched the bottom of the wall and stretch upwards to the fullest extent with their arms hanging on the side. The head was held in such a way that lower rim of the orbit and auditory canal were in horizontal plane. The height appears in the read off area and

measured to nearest 0.5 cm. The supine length was measured in children <than 2 years of age using an infantometer. The child was placed on board with head positioned firmly against the fixed headboard, the knees extended by firm pressure and the feet fixed at right angles to the lower legs. Then the up right foot piece was moved to obtain firm contact with the heels and the length was measured to the nearest 0.5 cms[15].

Assessment of Nutritional Status using Anthropometry Method

The 2006 WHO Growth Standards for Pre-school Children were used for the determination of nutritional status of preschool children. Standard deviation of scores (Z-scores) for weight -for - ago, height - for - age and weight-for-height were calculated. The Z-score (SD score) is calculated as follows. The Z-score is defined as the deviation of the value observed for an individual from the median of the reference population, divided by the standard deviation (SD) of the reference population.

Z Score = (individual value - median value of reference population) / SD value of reference population.

For each of the anthropometric indicators of malnutrition a cut off point of -2 standard deviations (-2 SD) below the median of that of the WHO reference population was used. Deviation of Z-scores less than - 3 SD put children in the severe under nutrition category.

Measurement of MAC

MAC is measured by non - stretchable elastic tape. Reading below 12.5 cm indicates severe PEM, 12.5 to 13.5 cm moderate PEM and above 13.5 cm is normal. BMI is calculated by the formulae: weight (kg)/ height (m²).

24- Hour Food Recall Method

It is a retrospective assessment method in which the respondent is prompted to recall and describe all foods and beverages consumed in the proceeding 24 hours or the proceeding day. Portion size estimating aids were carried to assist the respondent to recall amounts consumed. Total Energy and Proteins in terms of calories and grams consumed was calculated for 24 h period. Percentage of Energy and Proteins consumed in comparison to recommended daily allowance (RDA) by NIN was calculated and the results were analyzed [16].

Statistical Analysis

Body Mass Index (BMI) was computed for all mothers using the following formula:

$$\text{BMI (Kg/m}^2\text{)} = \text{Weight (Kg) /Height (m}^2\text{)}$$

The variables which were found to have statistically significant association ($p < 0.05$) with Malnutrition upon univariate analysis were then subjected to multivariate logistic regression analysis. Wald statistics was then used to test the significance of the odds ratio. $P < 0.05$ was considered as statistically significant.

Institutional Ethical Committee Approval: Taken

Observation & Result

Table 1: Village wise distribution of study subject under Balakati CHC from August 2018 to December 2018

Sl.No.	Name of the Village	No. of Children
01.	Sarakana	12
02.	Brahmanasuanlo	25
03.	Bilipada	18
04.	Satyabhamapur	12
05.	Gotalgrama	14
06.	Gotalbindha	21
07.	Jhintisan	8
08.	Bhingarpur	25
09.	Satakanya	9
10.	Ranapur	33
11.	Dandilo	9
12.	Baligundi	19
Total		206

Table 2: Age and sex wise distribution of the participated in the study.

Age	Male children(N)	Female Children (N)	Total
0-6 Months	7	6	13
7-12 Months	12	11	22
1-2 years	24	18	42
2-3 years	31	30	61
3-4 years	21	32	44
4-5 years	12	12	24
Total N (%)	106 (51.46%)	100 (48.64%)	206 (100%)

Table 2: Shows A total number of 206 children were included in the study. Of them most of the children were under the age group of 2-3 years. Majority of the study subjects were male children 106 (51.46%).

Table 3: Weight for age according to IAP category

Grading	% Weight for Age	Number of Children	%
Normal	>80	101	48.8
Mild Malnutrition	71-80	69	33.5
Moderate Malnutrition	61-70	31	15.4
Severe Malnutrition	51-60	4	1.9
Very Severe Malnutrition	<50	1	0.5
Total		206	100

Table 3: Shows Majority of the children 101 (48.8%) were under normal weight. 1 (.5%) of them were suffering with very severe malnutrition.

Table 4: Weight for age according to WHO category

Grading	SD (Z Score)	Number of Children	%
Normal	+2SD to -2SD	122	59.2
Moderate Malnutrition	-2SD to -3SD	58	27.9
Severe Malnutrition	< -3SD	26	12.8
Total		206	100

Table4: Shows the nutritional status of according to weight for age as per WHO standards (2006). Most of the children 112 (59.2%) were underweight and 26 (12.8%) were under severe malnutrition.

Table 5: Distribution of children according to MAC category

Grading	MAC (cm)	Number of Children	%
Normal	13.5	131	63.7
Moderate Malnutrition	12.5 - 13.5	68	32.9
Severe Malnutrition	<12.5	7	3.4
Total		206	100

Table 5: Show the distribution of children according to MAC category. 131 (63.7%) of children are having normal MAC. About 68 (32.9%) children were under moderate and 7 (3.4%) were under severe malnutritional status.

Table 6: BMI status of children according to WHO

Grading	SD Z Score	Number of Children	%
Severe Malnutrition	< -3SD	17	8.3
Moderate Malnutrition	-3SD to -2SD	38	18.3
Normal	-2SD to 2SD	149	72.7
Over Weight	2SD to 3SD	1	0.2
Obese	>3SD	1	0.6
Total		206	100

Table 6: WHO BMI chart was taken as the criteria for assessing nutritional status. Our study shows that 149 (72.7%) as normal, 38 (18.3%) were with moderate BMI and 17 (8.3%) were in the low category. Surprisingly 1 children was overweight and 1 was obese.

Table 7: Nutritional status of the children according to parent's occupation

Grade	Occupational status of father		Occupational status of mother	
Normal	95	6	12	87
Mild malnutrition	67	2	9	60
Moderate malnutrition	30	1	3	26
Severe malnutrition	4	0	0	8
Very Severe malnutrition	1	0	0	1
Total	197	9	24	182

Table 7: Shows the nutritional status of the children according to fathers and mothers occupation. In the study about 197 fathers were employed. Of them 95 children were under normal and 4 children were with severe malnutrition. 24(11.5%) for the total mothers were employed and 182 were unemployed.

Table 8: Nutritional status of the children according to parent's educational status

Educational status of parents	Father		Mother	
	High School and above (n=97)	Primary and below (n=103)	High School and above (n=86)	Primary and below (n=120)
Malnourished	42	60	48	67
Severe malnutrition	1	1	-	-

Table 8: Shows Out of 200 children (6 fathers expired) 97 fathers have acquired high school and above qualification. 42 of 97 children (43.7%) were malnourished. But when the father's educational status was primary (103 fathers) 60 children (58%) were malnourished. Out of 5 children with very severe malnutrition, 4 were children of fathers with poor literacy. Regarding maternal education 86 mothers have obtained high school and above qualification and the prevalence of malnutrition among these literate mothers was 44.4% (48 children out of 86). But when the mother's educational status was primary or less the prevalence of malnutrition was 56% (67 out of 120 children).

Table 9: Nutritional status of the children according to family income

Grade	Family Income <Rs.2000	Family Income >Rs. 2000
Normal	65	35
Mild malnutrition	49	20
Moderate malnutrition	23	9
Severe malnutrition	3	1
Very Severe malnutrition	1	
Total	141	65

Table 9: Shows Majority of children 141 (46.2%) participated in the study were under the group of family income <2000 per month. Of them 65 were in normal status and 4 were under severe and very severe malnutrition. Most of the children 35 (54.2%) who are under the group of family income >2000 were in normal and 1 was under severe malnutrition status.

Table 10: Nutritional status of the children in relation to birth order

Grade	Birth order in %		
	1	2	3+
Normal	51.1	49.7	38
Mild malnutrition	34.1	29.7	43.6
Moderate malnutrition	12.7	17	16.9
Severe malnutrition & Very Severe malnutrition	2.1	2.9	1.4
Total % (no. of children)	100(86)	100(92)	100 (28)

Table 10: Shows 51.1% of firstborn babies and 49.8% of 2nd born babies were having normal weight, but only 38% of higher order birth (3 and above) were in the normal category. The prevalence of mild and moderate malnutrition was 61% in the higher order birth group, in contrast the prevalence of mild and moderate malnutrition was 46.8% and 47.2% respectively in the 1st and 2nd order birth group.

Table 11: Nutritional status of the children in relation to birth weight

Grade	Birth weight (kg) in %		
	<2	2-2.5	>2.5
Normal	39	40.1	54.6
Mild malnutrition	51.2	37.5	29.9

Moderate malnutrition	9.8	20.3	12.8
Severe malnutrition	0.0	2.1	1.9
Very Severe malnutrition	0.0	0.0	0.8
Total % (no. of children)	100(8)	100(74)	100 (124)

Table 11: Shows in our study when the birth weight was more than 2.5 kg. 54.6% of Children were in the normal weight category with progressive decline in the birth weight, the percentage of children in the normal weight category also declined to 39%.

Table 12: Nutritional status of the children in relation with duration of exclusive breast feeds

Grade	Duration of exclusive breast feeds in months					
	3 & less	4-6	6	7	8 & above	Total
Normal	3 (31.9)	14 (29)	56(72.3)	12(26)	6 (50)	90(46.8)
Mild malnutrition	2 (27)	25(50.4)	14(18)	24(50.6)	3(23)	68(34.9)
Moderate malnutrition	1(15.3)	10(19.5)	6(9)	10(22)	1(17)	31(15.9)
Severe malnutrition	2(19)	0	1(0.5)	1(0.4)	1(7)	3(1.7)
Very Severe malnutrition	1(6)	0	0	0	0	1(0.5)
Total % (no. of children)	9(100)	49(100)	77(100)	47(100)	11(100)	193(100)

Table 12: Shows Babies who were less than 6 months of age were excluded from the analysis for calculating duration of expressed breast milk (EBM). Out of the remaining 193, 77 babies (39.6%) have received optimum 6 months exclusive breast feeding. Only 21(27.8%) children were malnourished with ideal 6 months EBM. Only 1 children (0.5%) were severely malnourished and none were very severely malnourished. With inadequate breast feeding (EBM <3 months) the prevalence of malnutrition was 68% (6 out of 9 children), severe malnutrition was 19% and very severe malnutrition was 6%. With 19% and very severe malnutrition was 6%. With prolonged breast feeding (EBM >8 months) and delayed complementary feeding the prevalence of malnutrition was 50%, severe and very severe malnutrition was 7% and 1.7% respectively.

Discussion

The possible risk factors selected in our study associated with malnutrition are age, sex, number of family members, mother's education, father's education, mother's occupational status, father's occupational status, socio - economic status, alcohol usage by family members, mother's nutritional status, mother's age at pregnancy, place of delivery of the child, term of delivery of the child, birth order of the child, birth weight of the child, time of initiation of breast - feeding, exclusive breast - feeding, total breast - feeding, energy and protein consumption of the child, Immunization status, ICDS utilization by the child, distance of health facility, recent illness, treatment for the illness, type of house, source of drinking water and toilet usage.

Data was collected using Pre-tested semi structured questionnaire by interview technique. The mothers of children of age group -0.60 months were informed about the study and each question was explained to gather the data and simultaneously height and weight of the child and mother were measured. Anthropometric measurements of the children and mothers like height and weight were measured using standardized calibrated instruments as per WHO recommendations [17].

In our study, a total of 206 children were enrolled. Of them 106 (51.46%) were males and 100 (58.54%) were females. Male preponderance was observed in the

study. This was similar to the studies of Singh et. Al [18].

In the present study, the prevalence of malnutrition according to India Academy of Pediatrics (IAP) classification observed 105 (51.2%) children. Ghosh etc. al. in their study of urban slum children in Calcutta (1994) reported a similar value of 51% prevalence of malnutrition [19].

Using WHO growth reference (2006) the percentage of malnourished children in our study was 40.8% (84) children. Bhandari et.al. in their study using WHO standards the prevalence of underweight was noticed in 43.67% which closely correlates with our study. Other authors Sachdev et.al. in their survey of under 5 children in 1995 has reported percentage of malnourished as 61.2%. Rama Rao et.al. in their study of nutritional status of children in northeast India has reported the prevalence of underweight as 37% [20].

In this study, the nutritional status of children was also assessed using MAC as criteria and revealed 63.7% (131) children were in the normal category (MAC > 13.5cm), 68 children (32.9%) were moderately malnourished (MAC 12.5cm-13.5cm) and 7 children (3.4%) were severe malnourished (MAC < 12.5cm). Similar observation was made by Ganasekaran et. al. in their study in which 66% were normal Children, 32% were moderate malnourished and 2% were severely malnourished [21].

By using body mass index (BMI), WHO BMI chart as the criteria for assessing nutritional status, our study shows 72.7% (149 children) as normal. 18.3% (38 children) and 8.3% (17 children) were in low (<-2SD to - 3SD) and very low category (<3SD). Surprisingly 1 child was overweight and 1 was obese. Gunasekaran et al. in their study has reported 57% children were moderately under nourished and 31% as severely under nourished using BMI as criteria [21].

In our study only 9 fathers were unemployed, and we could not find any statistically significant relations between nutritional status of the child and father's employment. Rama Rao et al. observed that father's background seems to have little impact on the nutritional status of children [20]. 24 (11.5%) of the total mothers were employed. Only 3 (12.3%) children were moderately and severely malnourished. But 34 (18%) children of the (182) unemployed mothers were moderate and severely malnourished. This determines that mother unemployment had shown an impact on nutritional status of the children.

Parent's educational status also plays a very important role in the development of healthy child. In the present study (42) out of (97) children (43.7%) of whose fathers having high class and above education qualification were malnourished and 60 children (58%) out of 103 fathers with primary education status were malnourished. Ray et al. reported substantial differences in the prevalence of malnutrition among children belonging to illiterate fathers (74.76%) and literate fathers (57.28%) [22].

Mothers education was found to have strong impact on child's nutritional status. 86 mothers have obtained high school and above qualification and the prevalence of malnutrition among these literate mothers was 44.4% (48 children out of 86). Children of illiterate and poor educational status mothers were more malnourished 56% (67 out of 120 children) compared to the above. This might be due to the reason that higher educated women can take independent decisions and more aware about proper nutrition, maintenance of hygiene, and various health issues as compared to illiterate or less educated women. Earlier studies have also documented the same children health status [23,24,25].

In our series, 141 children were under the lesser income group. Of them 76 (53.7%) were malnourished and the 1 child with very severe malnutrition was also in the same income group. Similarly association of socio economic status and malnutrition was observed in the study of Bhandari et al. [26].

In this study, the prevalence of mild and moderate malnutrition was 61% in higher order birth group, in contrast the prevalence of mild and moderate malnutrition was 46.8 and 47.2% respectively in the 1st and

2nd order birth group. This might be due to the reason that children with higher birth order get lesser attention and care compared to children of first order. This observation was in accordance with the studies of Elkholy et al. [27].

In our study, it was noticed that 45.4% of children were malnourished, in relation to the birth weight less than 2.5 kg. With progressive decline in the birth weight, the percentage of children with malnutrition was also increased to 61% in comparison with overall 51.2% of our study. Rama Rao et al. in his study noticed that Babies who were small at birth, tended to have a lower nutritional status [20].

Premaraj et al. studied the relation between prevalence of under nutrition and infant feeding practices [28]. Too early introduction of milk substitutes (in the 3–5-month age group) and to late introduction of complementary feeds (in the 6-8 month age group) are associated with lower mean weight. Ghosh et al. also reported lack of introduction of semi solids and lack of EBM in the first 6 months as possible etiological factors for malnutrition [19]. The results of our study corroborate with the above statements. With prolonged breast - feeding EBM >8 months and delayed complementary feeding the prevalence of malnourished observed was 50%. The percentage of children with severe and very severe malnutrition was 7% and 1.7% respectively.

The estimates of the total number of malnourished children based on weight for age was marginally higher with IAP standard than with WHO - SD ('Z' Score) approach. The prevalence of malnutrition as per IAP was 51.2% in comparison with 40.8% malnutrition by WHO standards. Sachdev et al. reported 65.4% and 61.2% malnutrition using IAP and WHO standards respectively. IAP standard showing more malnutrition than WHO standards [29].

The estimates of moderate and severe malnutrition based on weight for age were consistently significantly higher with SD/Z score approach than with the percentage of median approach of IAP. The percentage of moderate and severe malnutrition according to IAP was 15.4% and 2.5% respectively. The percentage of moderate malnutrition and severe malnutrition according to WHO's SD score were 27.9% and 12.8% respectively. Similar observations were made by Sachdev et al. in which the percentage of severe malnutrition was 33.3% and 17.1% with WHO SD and IAP standards respectively.

Prema Ramachandran et al. also in their study reported the prevalence of moderate and severe undernutrition is lowest by IAP standards and higher with WHO standards (2006) [28].

Conclusion

The basic problem of the people is poverty. The problems of low standard of living, hunger, starvation, malnutrition, agricultural illiteracy, poor antenatal care, disease, poor sanitary and housing facilities, etc. has to be improved totally by implementation of policy that already exists.

The study shows that the prevalence of malnutrition was highest for the age group 4 to 5 years and lowest for the age group 0 to 6 months and more prevalent among female children. Educational status and employment status of parents have positive impact on nutritional status of the child. Birth weight and family income also found to have great impact on nutritional status of the children. Thus, utmost care and attention must be focused on child's nutrition with multipronged approach such as giving priority to education for slum community especially for women, creating awareness regarding benefits of early initiation of breast feeding and limiting family size.

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References

- Jelliffe DB, The assessment of nutritional status of the community, WHO monograph. 1966:53.
- Yigit EK, Tezcan S, Infant feeding practices and children's and women nutritional status. Ankara; 2004:141-155.
- Food and agriculture organization staff. The state of food insecurity in the world, 2002: Food insecurity: When people with hunger and fear starvation. Food and agriculture organization of the United Nations. 2002;6.
- World Health Organization, global database on malnutrition. Available at: <http://www.who.int/nutgrowthdb/en/>. Accessed on 3 August 2017.
- The silent emergency. State of world's children 1998. Focus on nutrition. UNICEF.
- Sachdev HPS. Assessing child malnutrition-some basic issues. Bulletin Nutrition Foundations India. 1995; 16:1-5.
- Haq MN. Age at menarche and the related issue: A pilot study on urban schoolgirls. Journal of Youth and Adolescence. 1984;13(6):559-67.
- Karim A, Chowdhury AKMA, Kabir M. Nutritional status and age at secondary sterility in rural
- Ray SK, Biswas AB, Gupta SD, Mukherjee D, Rapid assessment of nutritional status and dietary pattern in municipal area. Indian Journal of Community Medicine. 2000;25(1): 14-8.
- Makoka D. The impact of maternal education on child nutrition: evidence from Malawi, Tanzania, and Zimbabwe. Demographic and Health Surveys Working Papers no. 2013(84). Bangladesh. Journal of Biosocial Science. 1985;17(4):497-502.
- Onis MD, Frongillo EA, Blossner M. Is malnutrition declining? An analysis of changes in levels of malnutrition since 1980. Bulletin of WHO, 2000;78(10):1222-33.
- Sahu SK et al. among under-five children in India and strategies for control. Journal of Natural Science, Biology and Medicine. 2015;6(1):18-23.
- Park K. Park's Textbook of preventive and social medicine. Jabalpur, India: M/S Banarasidas Bhanot: 2013.
- Ghai OP, Paul VK, Bagga A, Nutrition, Ghai Essential Pediatrics. New Delhi, India, CBS,2009
- Kerpel-Fronius E. The main causes of death in malnutrition. Acta Paediatrica Hungarica. 1984; 25(1-2):127-30.
- Elizabeth KE. Nutrition and child development. Hyderabad, India: Paras Medical Publisher; 2004.
- Deshmukh PR, Dongre AR, Gupta SS, Garg BS. Newly developed WHO growth standards; Implications for demographic surveys and child health programs. Indian Journal of Pediatrics. 2007;74:987-90.
- Dietary guidelines of Indians – A Manual. National Institute of Nutrition, Hyderabad; 2011: 89-90.
- Physical status: The use and interpretation of anthropometry – Report of WHO expert committee, Geneva: WHO; 1995:263-308.
- Singh JP, Gupta SB, Shrotriya VP, Singh PN. Study of Nutritional Status among Under Five Children attending OPD at a Primary Care Rural Hospital, Bareilly (UP). Scholar Journal of Applied Medical Sciences. 2013;1(6): 769-73.
- Ghosh S, Shah D. Nutritional problems in urban children Indian Pediatrics-Environment Health project. Speed article series. Indian paediatrics. 2004; 41:682-96.
- G. Ramarao, L. Ladusingh and Rajkumar Pritamjit. Nutritional status of children in north-east India. Asia-pacific population Journal. 2004;19(3):39-56.
- Gunasekar S, Ganga B, Infant feeding practice in Tamil Nādu. Health and population.2000;23(1):17-27.
- Maiga EWH. The Impact of mother's education on child health and nutrition in developing countries: Evidence from a natural experiment in Burkina Faso. African centre for Economic Transformation,http://www.uneca.org/sites/default/files/page_attachments/maiga_the_impact_of_mothers_education_on_child_health_and_nutrition_in_developing_countries.pdf. Accessed on 15 Feb 2017.

25. Oyekale AS, Oyekale TO. Do mothers educational levels matter in child malnutrition and health outcomes in Gambia and Niger. UNICEF, <http://www.saga.cornell.edu/saga/educconf/oyekale.pdf>. Accessed on 10 December 2016.
26. Bhandari D, Choudhary SK. An epidemiological study of health and nutritional status of under-five children in the semi-urban community of Gujarat. *Indian Journal of Public Health*. 2006; 50(4):213-9.
27. Elkholy TA, Haassanen NHM, Rasha Demographic, socio-economic factors and physical activity affecting the nutritional status of young children under five years. *Journal of American Science*. 2011;7(10).
28. Ramachandran P. Adoption of WHO growth standards. – Issues and implications. *NFI Bulletin*. Volume 28. 2007. Available at <http://nutritionfoundationofindia.res.in/pdfs/Apr2007.pdf>. Accessed on 10 March 2017.
29. Sachdev HPS. Assessing child malnutrition: Some basic issues. *Bulletin NFI*. 1995;16(4):1-5.