IMPACT OF SOCIO-ECONOMIC FACTOR ON CHILD DEVELOPMENT AMONG URBAN POOR - A STUDY IN BANGALORE, INDIA

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Abstract

The study has been undertaken to document the nutritional status of school going children among Bangalore's Urban Poor and to document the factors influencing it. The three anthropometric measures namely wasting, stunting and underweight is used to understand the level of malnutrition in children. The main focus of the study is to document the nutrition status of children from poor urban households through the anthropometric measures, to analyse the socio economic factors like gender and income and their impact on nutritional status. The data was collected from a sample of households drawn from Bangalore's slums and was drawn using cluster sampling. Moderate levels of stunting is seen in majority of households and also across both gender, slightly higher with the female children and it was found predominant in small and large families across all categories of caste. The Gomez index measuring nutrition based on weight for age found small percentage of children with mild form of malnutrition across income and gender groups. Gomez analysis also found that with increase in family size the level of malnutrition, which is strengthened through the logistic regression. Wasting was also found at moderate levels in more than fifty percent of the households. logistic regression was used to analyse the factors influencing economic development revealed that the age of the child and family size were deterrent factors affect nutrition levels.

Keywords: Nutrition, Children, Slums,Households, Income

Introduction

Nutrition is measured in terms of the availability of energy to the human cells in relation to its requirements. If this energy and nutrition

measured in terms of calorie is insufficient it leads to underdevelopment of the child. Nutrition plays a vital role, as inadequate nutrition during childhood may lead to malnutrition, growth retardation, reduced work capacity and poor mental as well as social development (Awasthi and Kumar 1999). Under-nourishment not only retards physical development but also hampers the learning and cognitive process, leading to sluggish educational, social and economic development. The high incidence of low birth weight compounded with inadequate care and restricted access to health services translates into high rates of child malnutrition and threatens the process of healthy development, culminating in a high infant mortality rate (IMR). Malnutrition is often related to high morbidity among children which is related to their socio-economic status. There are various studies done by researchers to find the cause of this grave problem and suggest suitable policy measures. Since malnutrition affects the various physical and mental ability of the child it is important to understand the cause so that suitable remedial measures can be provided.

The study of Onus (2006, NFHS-3), estimated that 1/3rd of children worldwide are moderately or severely undernourished being a major cause of child death. Baron (2010), states malnutrition in India as 'Asian Enigma' where progress in childhood malnutrition seems to have sunken into an apparent under nutrition trap, lagging far behind the other Asian countries characterized by similar levels of economic development. Deaton (2008) observed that in spite of India's rapid economic growth, there has been a sustained decline in per capita calorie consumption during the last twenty-five years. Further he observed that Anthropometric indicators for both adults and children, in India are among the worst in the world. He traced to poor households with large size families which led to low purchasing power and consumption. According to National Family Health Survey (NFHS-3 2005-2006) and UNICEF Reports (2000), 46% of preschool children and 30% of adults in India suffer from moderate and severe grades of protein-calorie malnutrition. A study by Griffith (2002), in South Africa revealed childhood malnutrition is the result of low income of Households. Rayappa's (2012), study based on the several rounds of National Family Health surveys, found that malnutrition levels in India decreased moderately between NFHS-2 and NFHS-3. In poorer households, it is seen that the female child is neglected and appears more malnourished than her other siblings. According to studies by United Nations 1998, there existed widespread discrimination against the girl child in terms of feedings but no concrete reasons was found as to why this was done. The NFHS-2 and 3 also revealed the same results.

There are various factors both social and economic which affect child nutrition which manifest itself as poor development. The review states

elaborate studies on malnutrition in the tribal areas, in rural areas as well as in urban areas in the various states of India. The present study is undertaken to document the level of child development among school going children of Bangalore's urban poor and the socio Economic factors having a bearing on the level of child development

The specific objectives of the study are:

1. To document the development of children from poor urban households through the anthropometric index
2. To analyze the socio economic factors like gender, income, family size, food expenditure, caste and their impact on nutritional status of children

Methodology

This study has been carried out in Bangalore city which has been purposively selected as it is one of the fastest growing cities in the Country. The study is based on a primary survey conducted in the poorer households having school going children. Data was collected during June to October 2012. Data was collected using a pretested questionnaire which was designed keeping the objectives of the study in mind. The questionnaire elicited information on the following broad parameters such as the Socio Economic parameters of the household, the educational status, Income, height and weight of children and their food intake.

Sample: A sample comprising 1000 households were selected randomly using cluster sampling method. First a list of slums situated in Bangalore city, was collected from the Slum Board. Out of the total of 276 notified slums in Bangalore city, 45 slums were selected randomly. From each of the selected slums a sample of 25 households were selected randomly.

Nutritional status of children: Several commonly used anthropometric measures were computed for studying the degree of malnutrition. Anthropometric indicators are useful both at an individual and at a population level. At an individual level, anthropometric indicators can be used to assess compromised health or nutrition well being. This information can be valuable for screening children for interventions and for assessing the response to interventions. At the population level, anthropometry can be used to assess the nutrition status within a country, region, community or socioeconomic group, and to study both the determinants and consequences of malnutrition. This form of monitoring is valuable for both the design and targeting of health and nutrition interventions.

The three most commonly used internationally recommended anthropometric indicators namely **stunting** (low height-for-age), **underweigh**t (low weight-for-age) and **wasting** (low weight-for-height)

(WHO 1995) were used to analyse the extent of malnutrition. The anthropometric measures used in the study are presented in the table below

Classification	Definition	Formulae	Grading	
Gomez	Weight below % median WFA	WFA= Weight (Kg)/Age(Years)	Mild (grade 1) Moderate (grade 2) Severe (grade 3)	75%–90% WFA 60%–74% WFA <60% WFA
WHO (wasting)	z-scores (SD) below median WFH	WFH= Weight (Kg)/Height(cm)	Moderate Severe	-3%</= z-score < -2 z-score < -3
WHO (stunting)	z-scores (SD) below median HFA	HFA= Height(cm)/ Age (years)	Moderate Severe	-3%</= z-score < -2 z-score < -3

Source: Behrman, J.R. and A.B. Deolalikar-1988

Note: z score of a variable, x, is calculated as $z = \frac{X - \bar{X}}{SD(X)}$ and median is the middle value, where the values are arranged in ascending order.

Logistic regression

Logistic regression is an approach to prediction, like Ordinary Least Squares (OLS) regression. But logistic regression helps in predicting a dichotomous outcome, like being normal in development parameters or otherwise. This situation poses problems of estimation using Ordinary Least Squares (OLS) that the error variances (residuals) are normally distributed. Instead, they are more likely to follow a logistic distribution. Another difference between OLS and logistic regression is that there is no $\mathbf{R^2}$ to gauge the variance accounted for in the overall model. Instead, a chi-square test is used to indicate how well the logistic regression model fits the data. Because the dependent variable is not a continuous one, the goal of logistic regression is a bit different, because we are predicting the likelihood that Y is equal to 1 (rather than 0) given certain values of the independent variables. That is, if X and Y have a positive linear relationship, the probability that a person will have a score of Y = 1 will increase as values of X increase.

The factors influence are family income, gender, size of dependents and caste are taken as independent variables to analyse if the level of development is affected by these factors. The family is classified as High when income lies above Mean +½SD > Rs 11000/-, medium, when income lies between Rs 7555and Rs 10999 per month and low when income lies below (Mean -½SD, i.e., < Rs 5000/ per month. The total no of sample amounted to 986 as few questionnaires had blanks. The no of dependents are classified as large when the no of dependents are greater than six members,

medium when the dependents size lies between five and six members and small when the dependents are between two to four.

Results and Discussion

Malnutrition levels based on the anthropometric indices were tested for the data obtained from field survey through a questionnaire. The socio-economic profile of the respondents which profiles the family income, the size of population based on gender is presented in Table 1.

Table No: 1 Households based on Income and Gender

Income Group	High (%) > Rs 11000/-.	Medium (%) Rs_ 7555 per month to Rs10999/	Low (%) below Rs 5000	Grand total
Female	58(11.4)	360(70.59)	92(18.04)	510(100)
Male	70(14.7)	316(66.39)	90(18.91)	476(100)
Grand Total	128(12.98)	676(68.56)	182(18.46)	986(100)

Source: Primary Data Survey

A sizeable percentage of children both male and female were from the households which were in the middle income range followed closely by children from low income households. Only 12% of children were found to be from high income families, with an income above Rs 11000. The female children were predominantly from the middle and low income groups with only eleven percent from the high income. The same pattern was found with the male children, with a slight high Percentage (14.7%) belonging to the high income families.

The Nutritional status of the children has been assessed in terms of Stunting, Wasting and Stunting

Stunting is seen as a failure to reach linear growth and is prevalent in children with long-term insufficient nutrient intake and frequent infections. It is said to be chronic when the value falls below 2 standard deviations of the median score. Low height-for-age is referred to as stunting and occurs when the Z-score is below the median –less 2SD (WHO 2007). Severe stunting has not been seen in any of the households. It is moderate in 49.79 percent of the households and is more prevalent among the medium (52.35%) and low (48.86) income groups. It is also found in the high income household, as these are poor households, and high income households are also relatively poor. Thus stunting is found in all the categories of households. When it comes to stunting based on gender, it was found that stunting is marginally higher among females. The prevalence of stunting is found amongst one-third of the world's children (WHO 2004, UNICEF 2007), which reflects that 33 percent of the world's children are moderately stunted and 17 percent severely stunted (UNICEF 2007).

Table No.2 Stunting among households based on Family Income, Gender, Family size, &Caste

Income	**Moderate**	**Normal**	**Grand Total**
High	37.39(46)	62.60(77)	100.00%
Medium	52.35(344)	47.64(313)	100.00%
Low	48.86(86)	51.13(90)	100.00%
Grand Total	**49.79(476)**	**50.20(480)**	**100.00%**
Gender	**Moderate**	**Normal**	**Grand Total**
Female	50.60(252)	49.4(246)	100(498)
Male	48.91(224)	51.09(234)	100(458)
Grand Total	**49.79(476)**	**50.21(480)**	**100(956)**
Family size	**Moderate**	**Normal**	**Grand Total**
Large	16.67%	83.33%	100.00%
Medium	45.68%	54.32%	100.00%
Small	50.46%	49.54%	100.00%
Grand Total	49.84%	50.16%	100.00%
Caste	**Moderate**	**Normal**	**Grand Total**
Minorities	44.19%	55.81%	100.00%
others	75.00%	25.00%	100.00%
SC	52.05%	47.95%	100.00%
ST	45.00%	55.00%	100.00%
Grand Total	**50.70%**	**49.30%**	**100.00%**

Source: Primary Data Survey

Fifty percent of the households (table 2) had children who possessed normal height for age; an alarming 50% were found with moderate stunting. It is seen that the medium (52%) and low income (49%) households had a sizeable percentage of children who were stunted. In the high income households 37% were stunted and 62% were normal. Income of households have a major role in determining the adequate food intake of the family. As revealed by Nagati (2003) Under-nutrition is a condition caused by a lack of food good nutritional value combined with interaction from infections. Further analysis of stunting among gender revealed that nearly fifty percent of children were moderately stunted. It was also found that female children had a slightly higher percentage (51%) of stiltedness than the male children (48.9%).

The no of dependents in a household play a major role in the affecting the distribution of nutritious food. The larger the size of the family the expenditure on nutritious food tends to decrease. In the table2, moderate level of stunting is found to be prevalent in the small (50.46%)and medium size families(49.5%) than the large size, which goes to show that malnutrition does exist in households irrespective of the family size.

A sizeable percentage of SC, ST and minorities were affected by stunting across caste. The above analysis indicates that the household of the selected communities are also adversely affected by malnutrition.

Under weight

Under weight reflects the body mass relative to chronological age influenced by the weight for age of the child. The analysis of Gomez which is one of the popular measure in the 1960s and 70s to find malnutrition using the proportion of weight to chronological age of the child.

Table No: 3 Gomez analysis of under weight

Income	**Normal**	**Moderate**	**Mild**	**Severe**	**Grand total**
High	57.58(92)	12.12(10)	29.09(21)	-	100(123)
Low	85.51(138)	0.97(4)	11.59(30)	1.98(4)	100(176)
Medium	74.32(476)	4.11(32)	21.23(145)	0.34(4)	100(657)
Grand Total	73.85(706)	4.81(46)	20.50(196)	0.84(8)	100(956)
Gender	**Normal**	**Moderate**	**Mild**	**Severe**	**Grand total**
female	69.28%	4.82%	24.90%	1.00%	100.00%
male	78.82%	4.80%	15.72%	0.66%	100.00%
Grand Total	73.85%	4.81%	20.50%	0.84%	100.00%
Family Size	**Normal**	**Moderate**	**Mild**	**Severe**	**Grand total**
Large	50.00%	0.00%	50.00%	0.00%	100.00%
Medium	21.95%	4.88%	73.17%	0.00%	100.00%
Small	20.16%	4.84%	74.08%	0.92%	100.00%
Grand Total	20.50%	4.81%	73.85%	0.84%	100.00%
Caste	**Normal**	**Moderate**	**Mild**	**Severe**	**Grand total**
minorities	19.38%	6.98%	72.87%	0.78%	100.00%
others	25.00%	0.00%	75.00%	0.00%	100.00%
SC	20.47%	4.41%	74.17%	0.94%	100.00%
ST	15.00%	15.00%	70.00%	0.00%	100.00%
Grand Total	20.18%	5.08%	73.86%	0.89%	100.00%

Source: Primary Data Survey

It was found that three fourth of the sample households were of a normal weight and 20% of them facing mild underweight (Table-3). An analysis across income groups shows that the low income category had no underweight problem closely followed by the medium income group which had a sizeable percentage, followed by high income groups with 50% of them having a normal weight. It was also found that the high income groups had 12% moderate and 29% facing mild malnutrition. A very small percentage of severe malnutrition was found in the low income which was expected. The study of Deaton 2008, also found that the level of nutrition

improved with increase in real income and wages which is also reflected in the present study.

Comparing underweight among gender (Table -3), it was found that a vast majority of the male children were possessing normal weight. Though a sizeable majority of female were having normal weight, their number was less compared to the boys. One fourth of female children were also found to have mild underweight and a small percentage (5%) was moderately underweight.

Wasting

Low weight-for-height, known as wasting, is reflected by thinness of the body and weight loss associated with acute starvation, is classified as moderate level of malnutrition when the Z-score is below the median by -2SD. Low weight-for-height by a percentile lower than -3SD is regarded as severe wasting (UNICEF 2007; WHO 2004).

Table No: 4 Wasting across Income groups

Income	**Moderate**	**Normal**	**Grand total**
Low	32.43%(72)	67.57%(150)	100%(222)
Medium	55.07%(326)	44.93%(266)	100%(592)
High	53.22%(91)	46.78%(70)	100%(171)
Grand Total	49.64(489)	50.36%(496)	100%(985)
Gender	**Moderate**	**Normal**	**Grand total**
Female	38.46%	61.54%	100.00%
Male	49.74%	50.26%	100.00%
Grand Total	49.59%	50.41%	100.00%
Family size	**Moderate**	**Normal**	**Grand Total**
Large	37.50%	62.50%	100.00%
Medium	45.98%	54.02%	100.00%
Small	50.17%	49.83%	100.00%
Grand Total	49.70%	50.30%	100.00%
Caste	**Moderate**	**Normal**	**Grand Total**
Minorities	47.73%	52.27%	100.00%
others	100.00%	0.00%	100.00%
SC	51.14%	48.86%	100.00%
ST	50.00%	50.00%	100.00%
Grand Total	50.80%	49.20%	100.00%

Source: Primary Data Survey

The study by UNICEF 2007, WHO 2004 also states that wasting is a result of acute starvation and disease which leads to severe malnutrition. According to UNICEF 2006, around 11% of the child population suffers from wasting. Wasting which measures weight by height (Table-4) shows that the households in the sample area equally falling into the normal rate of nutrition and another equal number into moderate malnutrition. Vast majority of the medium income households face moderate level of wasting, which indicates that z score of the median states a condition of above 75% level of malnutrition, followed very closely by, the high income groups and medium income groups. This clearly indicates that vast majority of children do face a moderate level of malnutrition

Analyzing wasting based on family size it is seen that the small families are gravely been affected (50%) followed by the medium and large size families. This goes to indicate that a majority of households irrespective of dependents face malnutrition in the form of a severe weight loss.

Factors influencing malnutrition

In this study logistic regression has been used to study the influence of selected socio-economic factors on the development of the child. The variables considered were the child's age, Family size, Total Earnings, Caste, Exp on Medicine, Food Expenditure, and expenditure on quality food like non-veg and quality foods like fruits and vegetables. The dependent variable was given a value of 1 if the child was not normal based on the parameter under study or zero if it was normal. The results are presented in the tables below.

The factors influencing the outcome of child development which is not categorized as normal children based on the Gomez measure is studied using logistic regression. The interesting thing about logistic regression is that the estimates of the regression presented in column 3 in the table do not have any direct interpretation. Instead the antilog of these coefficients are interpreted as the odds ratio and is presented in the last column of the table as Exp(Est). Child age and family size are significant variables affecting child development according to the Gomez measure. The odds ratios are 0.75 and 0.78. This implies that as the age or family size increases by one unit, the chance of the child being underdeveloped is less. Among the caste groups, the minorities' are taken as base in the analysis it shows the only children from minority households have a greater odds of being underdeveloped. All the other caste groups are doing better than the minorities. The Other groups consisting of the forward group children have no problem. Surprisingly income and total food expenditure are not important indicators of child development. Therefore child development awareness programmes have to be conducted in areas where the poor reside, so that the development of the children can be enhanced.

Table No: 5 Logistic regression of factors influencing child development (Gomez)

Analysis of Maximum Likelihood Estimates							
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept		1	-12.8516	186.2	0.0048	0.9450	0.000
child age		1	0.0523	0.0190	7.5653	0.0060	1.054
Family size		1	-0.1882	0.0489	14.8196	0.0001	0.828
Per capital		1	0.000042	0.000079	0.2813	0.5958	1.000
Caste	Minorities	1	11.3589	186.2	0.0037	0.9514	85723.38
Caste	Others	1	11.3429	186.2	0.0037	0.9514	84366.93
Caste	SC	1	11.5835	186.2	0.0039	0.9504	107316.8
Caste	ST	1	-0.2634	292.5	0.0000	0.9993	0.768
Exp Medical		1	5.921E-6	0.000074	0.0063	0.9366	1.000
Food Expend		1	0.000720	0.000167	18.6131	<.0001	1.001
Non-Veg		1	0.000226	0.000233	0.9407	0.3321	1.000

Source: Primary Data Survey

The model has a correct prediction as indicated by the coefficient of concordance of 80.7 which indicated that the model can correctly predict the children as normal or underdeveloped in 81% of the cases and the wrong prediction is on 19%. Yet another measure of the predictive power of the model is the c statistic which ranges from 0 to unity. In this case it is 0.81 indicating a good predictive power of the model.

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	63.5	Somers' D	0.274
Percent Discordant	36.0	Gamma	0.276
Percent Tied	0.5	Tau-a	0.113
Pairs	196244	c	0.637

The logistic regression estimated to study the factors influencing development of the child according to Gomez, also indicated a good fit of the model with a coefficient of concordance of 63.4 and a c statistic of 0.64.

Here also income and food expenditure did not significantly affect the child development. The important problem was associated with the caste. Minorities, SC had other has higher odds of underdevelopment according to the Gomez measure.

Development of the child as measured by method stunting and wasting is presented in Table 6. The model yielded a good fit to the data with a percentage of concordance of 90 percent. The c statistics was also high at 0.9. The significant variables in this model are child age, expenditure on medicines, food expenditure and family size. Though the coefficients of caste are high, it was only the coefficient of SC household which was significant. This goes to show that children from these household demonstrated problems of Wasting. The effects of the other significant

variables were neutral except for child age and family size which contributed to normalcy in children with respect to WHO wasting.

Table 6: Logistic regression of factors influencing child development WHO (wasting & stunting)

Analysis of Maximum Likelihood Estimates							
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept		1	7.3217	1.1732	38.9454	<.0001	1512.737
child age		1	-0.5719	0.0359	253.5394	<.0001	0.564
fly size		1	-0.2181	0.0577	14.3008	0.0002	0.804
Total Earnings		1	-0.00004	0.000026	2.0369	0.1535	1.000
Caste	Min	1	1.1070	0.9434	1.3768	0.2406	3.025
Caste	Others	1	13.1841	518.1	0.0006	0.9797	531866.3
Caste	SC	1	1.5548	0.9365	2.7562	0.0969	4.734
Caste	ST	1	0.2136	1.3832	0.0238	0.8773	1.238
Medical Expenditure		1	-0.00022	0.000090	5.8320	0.0157	1.000
Food Expenditure		1	-0.00045	0.000200	5.0160	0.0251	1.000
NonVeg		1	-0.00005	0.000356	0.0200	0.8875	1.000

Source: Primary Data Survey

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	90.4	Somers' D	0.809
Percent Discordant	9.5	Gamma	0.810
Percent Tied	0.1	Tau-a	0.405
Pairs	237636	c	0.904

Summary and policy implications

The study has been undertaken to analyse the nutritional status of school children among the poor in Bangalore city. A large number of sample households were from the middle and low income groups, with family incomes of Rs. 11,000 per month. Fifty percent of households were found with moderate levels of stunting. This was also found to be predominant with the middle and low income groups and female headed households. Though the levels of malnutrition are only moderate, it indicates a range of 75 to 90% levels of malnutrition. Comparing underweight, though ¾ of possessed normal weight, a sizeable percentage of mild and moderate levels of underweight did exist and it was once again found prevalent with the female children. Wasting was also seen on a moderate level in more than half the population. Households equally fall into the normal rate of malnutrition and another equal number falling into moderate malnutrition. Vast majority of the medium income households face moderate level of wasting, followed

very closely by, the high income groups and low income groups. Malnutrition measured through the anthropometric indices, indicates that moderate to mild forms of malnutrition did exist in sizeable number of households. The analysis of family as variable affecting nutrition was found to be positive Family size did play a role leading to mild form of stunting, underweight and wasting. Caste has also been a significant factor in affecting malnutrition in a sizeable percentage of households.

The results of moderate levels of malnutrition prevailing in its different forms is far less compared to the All India nutrition percentage which stands at an alarming rate of 48% according NFHS survey 2005. Understanding of the basic food groups and the daily requirements and sources there will help in making the right choices. Poor quality and quantity of food are underlying factors which contribute to malnutrition. Awareness on the ill effects of malnutrition should be highlighted at schools on a regular interval to understand the need for a healthy nutrition. Mid-day meals provided by schools can be made more nutritious. Medical camps by NGOs and state Government in schools and in populated urban areas have to be set up to bring about awareness on a healthy lifestyle and to provide information to cure various diseases. Insufficient health services are an underlying factor contributing to malnutrition. By encouraging good eating habits, a healthier body is developed and the child can grow optimally, steps should be taken at the macro levels to educate and bring awareness regarding nutritious food, what they consist of and how they have to consume.

References:

Awasthi N, Kumar AP (1999) Nutritional status of hill primary school children. Indian Journal of Nutrition Dietetics, pp 453-459.

Barun Kanjilal, Papiya Guha Mazumdar,Moumita Mukherjee, M Hafizur Rahman (2010) Nutritional status of children in India: household socio-economic condition as the contextual determinant-International Journal for Equity in Health , pp 9-19

Behrman, J.R. and A.B. Deolalikar, Health and Nutrition, in Handbook of development economics.

Bhattacharya AK (2000) Assessment of growth and nutritional status in Indian population. Indian Journal Anthropol Sociology, Vol 49, pp 69–102.

Bose K, Biswas S, Bisai S, Ganguli S, Khatun A,Mukhopadhyay A, Bhadra M (2007) Stunting, underweight and wasting among Integrated Child Development Services (ICDS) scheme children aged 3-5 Yearsof Chapra, Nadia District, West Bengal, India. Maternal Child Nutrition, Vol, 3(3) pp, 216–21.

De Onis, M., Onyango, A.W., Borghi, E., Farza, C., Yang, H. 2006. Comparison of the World Health Organization (WHO) child Growth

Standards and the National Center for Health Statistics/WHO international growth reference: implications for the child health programmes. Public Health Nutrition, Vol.9 (7): pp.942-947.
Deaton (2008) Nutrition in India- Facts and Interpretations Subal Das and Kaushik Bose 2011-Assessment of Nutritional Status by Anthropometric Indices.
Griffith P, Mathews, and A Hinde 2002" Gender, Family and the Nutritional status of Children in three culturally contrasting states of India", Social Science and Medicine No 55, pp.755-790
Lee RD, Nieman DC 2003. Nutritional Assessment. New York: McGraw Hill.
Santal Tribal Children- Journal of Life Sciences, 3(2): 81-85.
Nagati, K., Mansour, B. Alouane, L. (2003) Multiple approaches to Micronutrient Deficiency in Developing Countries. In Elmadfa, I., Anklam, E., König, J.S. 2003. Modern Aspects of Nutrition, 2003. New York: Karger. Pp. 282.
National Family Health Survey II (1998-99), International Institute of Population Services, Mumbai,
Census of India, (2001) Sample Registration Bulletin, Registrar General GOI, April, pp.1-6
Prabir Kumar Manna, Debasis De, Tushar Kanti Bera, Kausik Chatterjeeand Debidas Ghosh,Anthropometric Assessment of Physical Growth and Nutritional Status among School Children of North Bengal, Anthropologist, 13(4): 299-305 (2011)
Rayappa (2012) Nutritional status of school children in districts of Karnataka – Journal of man and Development.
United Nations Children's Fund, 2010.The State of the World's Children 2000. New York, United Nations Children's Fund Press
World Health Organization, 1995. Physical Status: The Use and Interpretation of Anthropometry: Technical Report Series no. 854. Geneva
World Health Organization, 2006, "The WHO Child Growth Standards, Geneva: WHO Press
World Health Organization 2004. WHO global database on child growth and malnutrition. Geneva: WHO Press
World Health Organization (WHO). 2002. World Health Report, Geneva, WHO Press
G.N., Ukoha, A.I., Nwachukwa, N., Agha, N.C. (2007). Studies of the Predisposing Factors of Protein Energy Malnutrition amongst Pregnant Women in a Nigerian Community. Online Journal of Health an Allied Sciences (OJHAS), 6(3); Jul-Sep 2007.

World Health Organization (WHO). 2004. WHO global database on child growth and malnutrition. World Health Organization/Programme of Nutrition, Geneva

World Health Organization (WHO). 2005. Interventions on diet and physical activity: what works? Geneva, World Health Organization Press

Steyn, N.P., Lambert, E.V., Parker, W., Mchiza, Z., De Villiers, A. (2009). A review of school nutrition interventions globally as an evidence base for the development of the Health Kick programme in the Western Cape, South Africa. South African Journal of Clinical Nutrition (SAJCN), 22(3):145-152.

World Health Organization (WHO). 2007. 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, World Health Organization Press

United Nations Childrens Fund (UNICEF). 2006. Progress for Children: A Report Card on Nutrition, Number 4, May 2006. New York. United Nations Childrens Fund Pres

United Nations Childrens Fund (UNICEF). 2007 A Progress for Children: A world fit for children statistical review, New York. United Nations Childrens Fund Press.