



ORIGINAL RESEARCH PAPER

Pediatrics

ASSESSMENT OF FACTORS RESPONSIBLE FOR MALNUTRITION IN CHILDREN UNDER 5 YEARS OF AGE: A PROSPECTIVE STUDY IN DHULE.

KEY WORDS: Severe Acute Malnutrition, Moderate Acute Malnutrition, Predisposing factors.

DR. Neelam R Shah*

(M.D PEDIATRICS) Associate Professor of Pediatrics Shri Bhausaheb Hire Govt. Medical College, Dhule. *Corresponding Author

Dr. Amit V. Rathod

Junior Resident 2, Dept of Pediatrics Shri Bhausaheb Hire Govt. Medical College, Dhule.

Dr. Yogita V. Bhansali

Junior Resident 1, Dept of Pediatrics Shri Bhausaheb Hire Govt. Medical College, Dhule

ABSTRACT

OBJECTIVE: Assess the prevalence and factor responsible for malnutrition in 1000 children aged between 6 to 59 months attending Pediatric OPD of SBH GMC DHULE.

METHOD: A prospective study was conducted in Pediatric OPD of SBH GMC, Dhule enrolling 1000 children from 6 to 59 month. Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) was diagnosed as per WHO growth standards. All the details regarding children and their family were entered in excel sheet and results were analysed. Prevalence of malnutrition in these children was analysed and various Sociodemographic factors, Nutritional factors and Environmental factors responsible for malnutrition in these children were also evaluated.

RESULTS: Among 1000 children SAM was present in 117 children (11.7%) and MAM was observed in 209 children (20.9%). Thus a total of 326 children (32.6%) were malnourished in this study. Acute malnutrition was observed more in males (34%) as compared to females (30%). Hindu children (35%) were more malnourished as compare to Muslim children (30%). In children less than 1 year age SAM (25%) was observed more than MAM (11%). Malnutrition was significantly more observed in children with low birth weight (43%), < 3 year interval between two pregnancies (33%), >2 children in family (41%), Illiterate mothers (53%), in children belonging to lower socioeconomic class (40%), those living in kutchha house (37%), and in those practicing open air defecation (40%). The association of malnutrition with delayed introduction of complementary feeds (44%) was also statistically significant. In this study the statistically significant correlation of malnutrition with age, sex, bottle feeding, breast feeding, immunization and place of birth could not be established.

CONCLUSION: Prevalence of malnutrition is very high in remote places. This can be significantly decreased by some simple measures like improving parental education, small family norms, proper spacing of pregnancies, educating mothers about health care, hygiene measures, feeding habits, immunization and seeking treatment at right time.

INTRODUCTION

Malnutrition is one of the leading cause of morbidity and mortality under 5 years of age in developing countries. [1] India being one of these countries, malnutrition is an important public health problem. Children's death constitute more than 34% of total deaths in India. [2] Seven out of ten of these deaths are due to respiratory infections, diarrhoea and Malnutrition. [3] Protein energy malnutrition is a major contributory factor in majority of these childhood morbidities and mortalities. At present 65% of children under five are under- weight which includes 47% moderate and 18% severe cases of malnutrition. [4]

Sociodemographic factors like neglect of a girl child, large family size, lack of child spacing, home delivery, and incomplete immunization have an adverse effect on child survival and development. Nutritional factors like improper breast feeding practices during first year of life, bottle feeding and delayed introduction of complementary feeds influence the growth and development of children [5]. Environmental factors like maternal education, socioeconomic status, sanitation and standard of living also influence the growth and development of children.

Severe acute malnutrition is defined as very low weight-for-height/length (Z-score below -3SD of the median WHO child growth standards), and/or a Mid Upper Arm Circumference (MUAC) < 11.5 cm and/or by the presence of bilateral edema. Moderate acute malnutrition is defined as weight-for-height/length between -3SD and -2SD Z-score of WHO child growth standards and/or MUAC between 11.5 cm and 12.5 cm. [6] The objective of present study is to assess the prevalence and predisposing factors responsible for Severe acute malnutrition and Moderate acute malnutrition among children of DHULE.

Materials and methods

A prospective study conducted for three months (July 17 to September 17) enrolling 1000 cases. The study was conducted in

Pediatric out patient department (OPD) of Shri Bhausaheb Hire Government Medical College (SBHGMC), Dhule, a tertiary health care centre in Maharashtra. All children from 6 months to 59 months of age attending Pediatric OPD of SBHGMC, Dhule were enrolled in this study. Ethical approval was obtained. After receiving informed consent, the demographic and clinical details were noted.

A semi constructed interviewer-administered questionnaire was used to obtain information on (a) Socio-demographic Factors- age, sex, religion, birth weight, place of birth, immunization, no of siblings in family and spacing between pregnancies. (b) Infant feeding practices -age of exclusive breast feeding, age of introducing complementary feeds and bottle feeding. (c) Environmental factors -maternal education, per capita income, type of house and defecation practices. Children were examined and their anthropometric details were measured. Weight for height/length, MUAC and edema were noted in all children. All the details regarding children and their family were entered in excel sheet and results were analysed. Statistical analysis was done. The results were obtained in percentages and proportions and then Chi square test was applied. The p value was taken as significant when less than 0.05. Thereafter the prevalence and predisposing factors for malnutrition was calculated.

RESULTS

A total of 1000 children aged from 6 months to 59 months were enrolled for this study. Among 1000 children, Severe Acute Malnutrition (SAM) was observed in 117 children (11.7%) and Moderate Acute Malnutrition (MAM) was observed in 209 children (20.9%). Thus a total of 326 children (32.6%) were malnourished in this study.

Various Socio demographic, Nutritional and Environmental factors responsible for malnutrition were analyzed. As off 15 variable factors responsible for malnutrition were analyzed.

TABLE 1 Age wise distribution of malnutrition

	Total Children	Sam	Mam	Total Children With Malnutrition
< 1 year	114	29 (25%)	13 (11%)	42 (36%)
1 -3 year	586	63 (11%)	127 (22%)	190 (33%)
3-5 year	300	25 (8%)	69 (23%)	94 (31%)

Malnutrition was more commonly noticed in the age group of 6 months to 12 months i.e.36% followed by the age group of 1 to 3 years i.e. 33%. SAM was more noticed in children less than 1 year of age while MAM was more noticed in children above 1 year of age .

TABLE 2 Sex wise distribution of malnutrition

	Total Children	Sam	Mam	Total Children With Malnutrition
MALE	523	74 (14%)	106 (20%)	180 (34%)
FEMALE	477	43 (9%)	103 (21%)	146 (30%)

Males (34%) were more malnourished as compared to females (30%) . Incidence of SAM was more in males (14%) as compared to females (9%) while incidence of MAM was almost same in both sexes.

Table 3 Religion

	Total Children	Sam	Mam	Total Children With Malnutrition
HINDU	509	69 (13%)	113 (22%)	182 (35%)
MUSLIM	491	48 (10%)	96 (20%)	144 (30%)

Hindu children (35%) were more malnourished as compare to Muslim children(30%). Incidence of SAM as well as MAM was more in Hindus as compared to Muslims.

Table 4 Birth Weight

	Total Children	Sam	Mam	Total Children With Malnutrition
< 2.5 kg	216	40 (18.5%)	53 (24.5%)	93 (43%)
>2.5 kg	784	77 (10%)	156 (19%)	233 (29%)

Incidence of SAM as well as MAM was more common in children whose birth weight < 2.5 kg (43%) as compared to those whose birth weight >2.5 kg (29%).

Table 5 Place Of Birth

	Total Children	Sam	Mam	Total Children With Malnutrition
HOSPITAL	684	78 (11.4%)	134 (20%)	212 (31%)
HOME	316	39 (12%)	75 (24%)	114 (36%)

Malnutrition was slightly more in home delivered children (36%) as compared to those who were delivered in hospital (31%) .

Table 6 Immunization Status

	Total Children	Sam	Mam	Total Children With Malnutrition
UNIMMUNISED	03	01 (33%)	01 (33%)	02 (66%)
PARTIALLY IMMUNISED	211	29 (14%)	43 (20%)	72 (34%)
FULLY IMMUNISED	786	87 (11%)	165 (21%)	252 (32%)

Malnutrition was maximum among children who were unimmunized (66%) followed by those who were partially immunized (34%) as compared to those who were fully immunized (32%).

Table 7 No. Of Siblings In Family

	Total Children	Sam	Mam	Total Children With Malnutrition
<2	843	93 (11%)	168 (20%)	261 (31%)
>2	157	24 (15%)	41 (26%)	65 (41%)

Incidence of SAM as well as MAM was definitely more in families having more than 2 siblings (41%) as compared to families having 2 or less than 2 siblings (31%).

Table 8 Spacing Between Pregnancies

	Total Children	Sam	Mam	Total Children With Malnutrition
SPACING <3 years	571	69 (12%)	122 (21%)	191 (33%)
SPACING >3 years	197	14 (7%)	37 (18%)	51 (25%)

Among 1000 children, 232 were single sibling in family hence only 768 children were considered for time interval between two successive pregnancies . So in these children in whom interval between two pregnancies was less than 3 years were more malnourished (33%) as compared to those in whom the birth spacing was more than 3 years (25%).

Table 9 Exclusive Breast Feeding

	Total Children	Sam	Mam	Total Children With Malnutrition
< 6 MONTH	157	23 (15%)	33 (21%)	56 (36%)
AT LEAST FOR 6 MONTH	843	94 (11%)	176 (21%)	270 (32%)

Incidence of SAM was more among children who were not given exclusive breast feeding for 6 months (15%) as compared to those who were given exclusive BF for 6 months (11%) . Children who were completely devoid of breast milk were more malnourished (38%) as compared to those were offered breast milk (32%).

Table 10 Age Of Introduction Of Complementary Feeds

	Total Children	Sam	Mam	Total Children With Malnutrition
INTRODUCED AT 6 MONTHS	825	94 (11%)	154 (19%)	248 (30%)
INTRODUCED AT 9 MONTHS	175	23 (13%)	55 (31%)	78 (44%)

Malnutrition was more observed in children in whom complementary food was introduced after 9 months of age (44%) as compared to those in whom it was introduce at 6 month of age (30%) . Particularly the incidence of MAM was more in children in whom there was a delay in introduction of complementary feeds .

Table 11 Bottle Feeding

	Total Children	Sam	Mam	Total children with malnutrition
BOTTLE FEEDING GIVEN	125	17 (14%)	24 (19%)	41 (33%)
BOTTLE FEEDING NOT GIVEN	875	100 (11%)	185 (21%)	285 (33%)

Among bottle fed children , incidence of SAM (14%) was more as compared to those who were not given bottle feeding (11%) .

TABLE 12 MATERNAL EDUCATION

	Total Children	Sam	Mam	Total Children With Malnutrition
ILLITERATE	150	36 (24%)	43 (29%)	79 (53%)
1 st -5 th STD	134	13 (10%)	26 (19%)	39 (29%)
5 th – 10 th STD	529	47 (9%)	110 (10%)	157 (29%)
>10 th STD	181	21 (11%)	30 (16%)	51 (27%)

When we consider maternal education , it was observed that incidence of malnutrition was definitely more among siblings of illiterate mothers (53%) and lowest among siblings of mothers with higher secondary education (27%).

Table 13 Socio Economic Status

	Total Children	Sam	Mam	Total Children With Malnutrition
UPPER CLASS	25	01 (4%)	02 (8%)	03 (12%)
UPPER MIDDLE	49	04 (8%)	10 (20%)	14 (28%)
MIDDLE	125	09 (7%)	19 (15%)	28 (22%)
LOWER MIDDLE	523	62 (12%)	107 (20%)	169 (32%)
LOWER	278	41 (15%)	71 (25%)	112 (40%)

Socio economic status was assessed by Revised Modified B.G.Prasad classification . Malnourished children were observed maximally in lower class (40%) followed by lower middle class (32%) and least in upper class (12%) .

Table 14 Type Of House

	Total Children	Sam	Mam	Total Children With Malnutrition
KUTCHHA	770	113 (15%)	170 (22%)	283 (37%)
PUCCA	230	04 (2%)	38 (16%)	42 (18%)

Incidence of malnutrition was more common in children living in Kutchha house (37%) as compared to those living in Pucca house (18%).

Table 15 Mode Of Defecation

	Total Children	Sam	Mam	Total children with malnutrition
CLOSED	670	70 (10.4%)	122 (18.2%)	192 (28.6%)
OPEN AIR	330	47 (14.2%)	87 (26.3%)	134 (40.5%)

Among children practicing open air defecation , the incidence of SAM and MAM (40.5%) was more than those practicing closed defecation (28.6%).

TABLE 16 Demographic, Nutritional and Environmental Characteristics and their significance with Malnutrition

Predisposing Factors		Malnutrition	No.of Children	%	Total	%
Age	<1 Yr	SAM	29	25 %	42	36 %
		MAM	13	11 %		
	1-3 Yr	SAM	63	11 %	190	33 %
		MAM	12	22 %		
	3-5 Yr	SAM	25	8 %	94	31 %
		MAM	69	23 %		
Sex Of Child	Male	SAM	74	14%	180	34%
		MAM	106	20%		
	Female	SAM	43	9 %	146	30 %
		MAM	103	21 %		
Religion	Hindu	SAM	69	13 %	182	35 %
		MAM	113	22 %		
	Muslim	SAM	48	10 %	144	30 %
		MAM	96	20 %		
Birth Weight	LBW	SAM	40	18.5 %	93	43 %
		MAM	53	2 4.5 %		
	NBW	SAM	77	10 %	233	29 %
		MAM	156	19 %		
Place Of Birth	Hospital	SAM	78	11 %	212	31 %
		MAM	134	20 %		
	Home	SAM	39	12 %	114	36 %
		MAM	75	24 %		
Immunization	Fully immunized	SAM	87	11 %	252	32 %
		MAM	165	21 %		
	Partially immunized	SAM	29	14 %	72	34 %
		MAM	43	20 %		
	Not immunized	SAM	01	33 %	02	66 %
		MAM	01	33 %		
No. Of Children In Family	≤ 2	SAM	93	11 %	261	31 %
		MAM	168	20 %		
	> 2	SAM	24	15 %	65	41 %
		MAM	41	26 %		
Spacing Between Two Pregnancies	< 3 years	SAM	69	12 %	191	33 %
		MAM	122	21 %		
	> 3 years	SAM	14	7 %	51	25 %
		MAM	37	18 %		
Breast Feeding	Not given at all	SAM	04	14 %	11	38 %
		MAM	07	24 %		

	Given	SAM	113	11 %	315	32 %
		MAM	202	21 %		
Exclusive Breast Feeding	< 6 months	SAM	23	15 %	56	36 %
		MAM	33	21 %		
	For 6 months	SAM	94	11 %	270	32 %
		MAM	176	21 %		
Introduction Of Complementary Feeds	6 – 9 months	SAM	94	11 %	248	30 %
		MAM	154	19 %		
	After 9 months	SAM	23	13 %	78	44 %
		MAM	55	31 %		
Bottle Feeds	Given	SAM	17	14 %	41	33 %
		MAM	24	19 %		
	Not given	SAM	100	11 %	285	33 %
		MAM	185	21 %		
Mother's Education	Illiterate & Primary school	SAM	49	17 %	118	42 %
		MAM	69	24 %		
	Middle school & above	SAM	68	10 %	208	29 %
		MAM	140	20 %		
Socioeconomic Status	Lower Class	SAM	103	13 %	281	35 %
		MAM	178	22 %		
	Middle & Upper class	SAM	14	7 %	45	23 %
		MAM	31	16 %		
Type Of House	Kutchha	SAM	113	15 %	283	37 %
		MAM	170	32 %		
	Pucca	SAM	04	1.8 %	42	18 %
		MAM	38	16 %		
Defecation Practices	Closed	SAM	70	10 %	192	28.6 %
		MAM	122	18 %		
	Open	SAM	47	14 %	134	40 %
		MAM	87	26 %		

TABLE 17 P Value of Predisposing factors .

		Present	%	Absent	%	Chi	P
Age Wise distribution	<1 Yr	42	12.88	72	10.68	1.16	0.5590 not significant
	1 – 3 Yr	190	58.28	396	58.75		
	3 – 5 Yr	94	28.83	206	30.56		
Sex	Male	180	55.21	343	50.89	1.64	0.1990 not significant
	Female	146	44.79	331	49.11		
Religion	Hindu	182	55.83	327	48.52	4.7	0.0301 significant
	Muslim	144	44.17	347	51.48		
Birth Wt	LBW	93	28.53	123	18.25	13.7	0.0002 significant
	NBW	233	71.47	551	81.75		
Place of birth	Hospital	212	65.03	472	70.03	2.54	0.1100 not significant
	Home	114	34.97	202	29.97		
Immunization	Fully	252	77.30	534	79.23	1.911	0.3840 not significant
	Partially	72	22.09	139	20.62		
	No	2	0.61	1	0.15		
No. of Children in Family	≤2	261	80.06	582	86.35	6.56	0.0100 significant
	>2	65	19.94	92	13.65		
Spacing between two Pregnancies	<3 Yrs	191	58.59	380	56.38	3.887	0.0400 significant
	≥3Yrs	51	15.64	146	21.66		
BF	6 months	270	82.82	573	85.01	0.798	0.3710 not significant
	<6months	56	17.18	101	14.99		
Introduction of complementary feeds	6-9months	248	76.07	577	85.61	13.83	0.0002 significant
	After 9 months	78	23.93	97	14.39		
Bottle feeding	Given	41	12.58	84	12.46	0.0026	0.9500 not significant
	Not Given	285	87.42	590	87.54		
Mother Education	Illiterate & Primary	118	36.20	166	24.63	13.81	0.0002 significant
	Middle school and above	208	63.80	502	74.48		
Socioeconomic Status	Lower	281	86.20	520	77.15	11.27	0.0007 significant
	Middle and Upper	45	13.80	154	22.85		

Type of house	Pucca	42	12.88	188	27.89	27.6	0.0001 significant
	Kutcha	283	86.81	487	72.26		
Defecation Practice	Closed	192	58.90	478	70.92	14.36	0.0001 significant
	Open	134	41.10	196	29.08		

Above table shows statistically significant correlation of malnutrition with religion ,low birth weight , large family, improper spacing of pregnancies, delayed introduction of complementary feeds , maternal education, socioeconomic status and unhygienic living conditions.

82.3 % of children had upper respiratory tract infections and second commonest was acute gastroenteritis in 9.6 % of children.Congenital Heart Disorders was present in 0.5 % of children.

DISCUSSION

Under nutrition contributes to nearly 45% of all deaths in children under 5 years old globally . Low and middle income countries are worst affected .[7]. World bank data indicates that India has one of the worlds highest demographic children suffering from malnutrition . In India ,SAM affects approximately 8.1 million children with 0.6 million deaths per year.[8]

Among 1000 study children , severe acute malnutrition was observed in 117 children (11.7%) and moderate acute malnutrition was observed in 209 children (20.9%). Thus told prevalence of malnutrition in this study was 32.6%.

In this study , more than one third of the malnourished children (36%) were in the age group of 6 month to 12 months (**Table I**) . Since this coincides with the period of introduction of complementary feeds, may well be that inappropriate complementary feeding practices may have been a major contributor to this finding. A similar pattern was found in a study in Enugu , Nigeria.[9].

As reported in previous studies [10,11,12,] our study found that boys were more likely to suffer from under nutrition than girls (**Table II**) . This could be due to increased nutrition needs among boys or the influences of early childhood diseases in boys [11] or may be in India female children were less in number to seek the medical advice when compared to male children.

Across most health indicators, the situation of the scheduled castes, scheduled tribes and Muslims is significantly worse than that of others [13]. Contrary to that , in present study, Hindu children were more malnourished compare to Muslims (**Table III**)

Low birth weight is associated with malnutrition in this study (**Table IV**). Similar findings have been reported by other studies . [14,15].

Place of birth was observed to be associated with under nutrition which is similar to the findings of other studies [16]. Though statistically not significant , home

delivered children were more malnourished as compared to those delivered in hospitals (**Table V**)

In present study, prevalence of malnutrition was found to be higher in children who were not immunized. (**Table VI**) In a study done in Calcutta, West Bengal, a significantly higher (p.c. 0.05) prevalence of malnutrition was observed among partially immunized (81.25%) and non immunized (88.23%) in comparison to fully immunized children (62.07%) [17,18].

Our results are supported by previous studies where living with many siblings has been associated with the nutritional status of children [19,20]. The possible explanation for such a relationship may be understood through the dilutional effect factor.This effect is apparently due to the presence of more siblings in the household , which affects the intra – household food allocation. This holds true in present study where incidence of malnutrition is significantly high in families having more than two siblings. (**Table**

VII)

Mothers who adequately space their pregnancies are able to provide their children with the necessary nutrition for growth and development and strong immune system , thereby reducing the likelihood of childhood under nutrition [21]. This is true in present study also where improper spacing was significantly associated with higher incidence of malnutrition (**Table VIII**)

Timely introduction of complementary feeding in children aged 6-8 months was associated with higher weight for age z-score and lower probability of SAM and MAM (**Table X**). Same is true for exclusive breast feeding for 6 months of age, though the estimated effects were of borderline significance . (**Table IX**) These results were comparable with previous studies. [22,23]

Bottle feeding is more observed in the severely malnourished group (**Table XI**). Bottle feeding is discouraged at any age. It is associated with increased risk of diarrheal disease. A study in Ethiopia also shows that bottle feeding increases the prevalence of malnutrition. [24,18] It has been well documented that mothers education has a direct impact on the nutritional status of the children [25,26]. These findings are similar to the results of present study where significantly more than half (53%) the children of illiterate mothers as compared to children of literate mothers were malnourished (**Table XII**). It is well known that literate mothers adopt many improved and hygienic behaviors

16 related to child health care, feeding and eating practices which results in healthy nutritional status of the children. [27].

Inverse relation has been observed between income and prevalence of malnutrition (**Table XIII**).Children from socioeconomic class 4 and 5 were significantly malnourished . Similar finding were observed by Gupta et al.[28]

The influence of socioeconomic and environmental conditions on physical growth has been widely studied and is incontrovertible. The presence of sanitary water in the home is an indirect indicator of hygiene and general care, since they forestall the occurrence of repeated infections [15]. The observation in this study that not having a toilet poses a greater risk of malnutrition has also been made by other authors [29,30] (**Table XIV, XV**)

CONCLUSION

In conclusion, prevalence of malnutrition among under five children in remote place like Dhule is high. There is statistically significant correlation of malnutrition with several predisposing factors like low birth weight, large family size, improper spacing of pregnancies , improper infant and young child feeding practices, maternal illiteracy and unhygienic living practices (**Table XVII**). Treatment services are estimated to reach less than 15% of undernourished children. Health care providers can play a crucial role in identifying under nutrition in children and ensuring appropriate care and referral.Prevalence of malnutrition can be significantly decreased by some simple measures like improving parental education , small family norms, proper spacing of pregnancies, and educating mothers about health care, hygiene measures, feeding habits, immunization and seeking treatment at right time.

REFERENCES

1. World Health Organization .World health report .Geneva .The organization ; 2002
2. K.E.Elizabeth Triple burden of malnutrition . 4 th ed. Nutrition and child development. (Hyderabad: Paras Medical Publisher, 2010)
3. PARK textbook of Preventive and Social Medicine , K.Park , 18th edition , Publisher: M/ S Banarsidas Bhanot, Pg 423.
4. Progress for children. A report card on Nutrition . UNICEF ;Times of India , May 2006
5. WHO global strategy for infant and young child feeding WHA 55/15 , April 2002
6. WHO , UNICEF . WHO child growth standards and the identification of severe acute malnutrition of infants and children . A joint statement by WHO and UNICEF ,

- World Health Organization ; 2009
7. WHO –Child Health Epidemiology Reference group report- Causes of Under Five Deaths in India (2012).
8. Nelson-Essentials of Pediatrics. 1st South Asia Edition .Karen j. Marcdante ,Robert M. Kliegman ,page92.
9. Ubesie AC, Ibeziako NS, Ndiokwelu CI, Uzoka CM, Nwafor CA. Under- five protein energy malnutrition admitted at the University of Nigeria Teaching Hospital, Enugu; A 10 year retrospective review. *Nutr J.*2012;11-43.doi:10.1186/1475-2891-11-43.
10. Bisai S, Mallick C, Prevalence of undernutrition among Kora-Mudi children aged 2-13 yrs in Paschim Medinipur District , West –Bengal, India. *World J..Pediatric* 2011;7(1);31-6
11. Sharma B, Mitra M , Chakrabarty S , Bharati P . Nutritional status of Preschool children of Raj Gond -a tribal population in Madhya Pradesh , India .*Malays J Nutr* 2006; 12:147-55
12. A Mittal, J Singh, SK Ahluwalia Effect of Maternal Factors on Nutritional status of 1-5 years old Children in Urban Slum Population. *Indian Journal of Community Medicine* 2007. 32(4):264-267
13. Nidhi Sadana Sabharwal. *Economic and Political weekly* vol XLVI , No 50, Dec 10 , 2011
14. Black RE, Allen LH , Bhutta ZA, Caulfield LE , Ezzati M, et al .Maternal and Child under nutrition ,Global and Regional exposures and Health consequences .*Lancet* 2008;371(9608):243-60
15. Motta MEFA, da Silva GAP , Araujo OC , Lira PI , Lima MC. (2005). Does Birth Weight affect nutritional status at the end of first year of life? *J. Pediatric* 2005 ;81(5):377 -82
16. Meshram II, Laxmalah A, Gal Reddy CH , Ravindranath M , et al (2011). Prevalence of under nutrition and its correlates among under 3 years old children in rural areas of Andhra Pradesh , India. *Ann .Hum Biology* 38:93-101
17. Ray S K , Biswas A B , Gupta S D , Mukharjee D , Kumar S, Biswas B et al . Rapid assessment of Nutritional status and Dietary patterns in a municipal area . *Indian Journal of Community Medicine.*2000.Vol 25 (1):14-18.
18. K.Mishra ,P Kumar, S,Basu,K.Rai , S. Aneja. Risk factors for Severe Acute Malnutrition in children below 5 years of age in India. A case –control study.*Indian J.Pediatr*,81,2014:762-5.
19. Kumar A. and Ram F. Influence of family structure on child health ; evidence from India. *J. Bio –Social Sci* 2013;45 (5):577-99
20. Heer D . Effects of sibling number on child outcomes. *Ann Rev Sociology* 1985;11(85):27-67
21. James. N . Gribble , Nancy Murray and Elaine . P . Menotti. Reconsidering Childhood Under nutrition : Can Birth spacing make a difference ?An Analysis of 2002 – 2003 . *Salvader National Family Health Survey . Maternal and Child Nutrition* 5.No.1 (2008)
22. Dirga Kumar Lamichhane, Jong Han Leem, Hwan Cheal Kim J, Young Lee. Association of infant and young child feeding practices with under nutrition : evidence from the Nepal Demographic and Health Survey. *Pediatrics And international Child health* 2016;Volume 36:Issue 4
23. Kumar D, Goel NK , Mittal PC, Mishra P. Influence of Infant feeding practices on nutritional status of under five children. *Indian. J. Pediatr*, 2006;73(5):417-421
24. Solomon Amsalu , Zemene Tigabu. Risk factors for severe acute malnutrition in children under the age of five . A case control study. *Ethopia. J. Health Dev.* 2008 ;22(1):21-25.
25. International Institute for Population Science (IIPS) and Macro- International, National Family Health Survey (NFHS-3), 2005-06: India Mumbai: IIPS ;2007.
26. Prasot RM , Verma SK, Kashyap S, Kanaujiya MK. An Epidemiological study of PEM among 1-6 years children in rural Lucknow, Uttar Pradesh ,India, *JOSRJ Dental Med Science* 2014; 13(3):10-4
27. Joshi HS , Gupta R, Joshi MC, Mahajan V. Determinants of nutritional status of school children .A cross sectional study in the western region of Nepal. *National J Integrated Res Med* 2011;2(1);10-5
28. Gupta et al. Epidemiology correlates of PEM in preschool children *Indian Journal of PSM*, 1992;23(1):27-3119.
29. Checkley W, Gliman RH , Black RE , Epstein LD , Cabrera L , Sterling CR ,et al. Effect of water and sanitation on childhood health in a poor Peruvian peri-urban community .*Lancet* 2004 ; 363:112-18
30. Onyango AW , Esrey SA , Kramer MS . Continued breast feeding and child growth in the second year of life: A prospective cohort study in western Kenya. *Lancet* 1999;354:2041-5.