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Original Research Article

A Study of Association of Nutritional and Socio-Demographic Factors with Anemia in Children Between 1 year to 5 years of Age

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Abstract: The objective of this study is to analyze the association of nutritional and socio-demographic factors with anemia in children between 1 year to 5 years of age. A Cross-sectional, observational study was performed in department of pediatrics from April 2013 – April 2014 in Santosh hospital Ghaziabad, U.P. 300 children between 1 to 5 years of age who full fill inclusion criteria were enrolled. Method- Proforma was primarily focused to obtain the dietary intake of calories, proteins & iron, co-morbidities, Anthropometry and Socio-demographic data. Predictor variable- Socio-demographic factors (age, sex, type of family & socioeconomic status) dietary (age of start of complementary feeding, dietary intake of calories, proteins & iron) and h/o co-morbidities (worms in stool & pica), anthropometry data (wasting & stunting). Outcome variable- Anemia, diagnosed at hemoglobin level of less than 11gm/dl (WHO). Statistics - Odds ratio with confidence interval. The p value of less than 0.05 was considered significant. Prevalence of anemia was found to be 78% with 17% mild, 58% moderate and 3% severe anemia. Anemia was significantly seen with following dietary habits- vegetarian diet (P<0.001), low intake of calories (P<0.001) and iron deficient diet (P<0.001). Anemia was significantly associated with malnutrition (100% of moderately wasted and stunted children were anemic. Association was found with SES and co morbidities like Pica & h/o worm infestation. High prevalence of anemia (78%) along with presence of poor dietary intake of calories and iron in majority of subjects point towards the importance of proper dietary advice to combat nutritional anemia.
Keywords: anemia, Anthropometry, nutrition.

INTRODUCTION:

Age group 1-5 years is a critical period for growth and development. India has the highest prevalence of iron deficiency anemia in children aged 1 to 5 years. Poor dietary habits are quite prevalent and important modifiable predictor of nutritional anemia. India is home to more than a third of the world's undernourished children with under-nutrition level remaining around 45 percent for children below 3 years [1].

Anemia is attributed to dietary inadequacy due to, illiteracy, ignorance regarding nutritional value of available cheap food, cultural taboos, superstition, large families & poor purchasing power etc 2−4. Globally Iron deficiency is the most common form of malnutrition, being most prevalent and severe in young children (6months-5 years) [5]. In India also, Iron deficiency anemia (IDA) is the commonest nutrient deficiency with prevalence of about 75% in children under the age of 5 years [6].

Hemoglobin is necessary for transporting oxygen from the lungs to other tissues and organs of the body. Anemia in young children is a serious concern because it can result in impaired cognitive performance, behavioral and motor development, coordination, language development, and scholastic achievement, as well as increased morbidity from infectious diseases. One of the most vulnerable groups is children age 6 months – 5 years [7, 8]. In India, the overall prevalence of anemia in toddlers as per NFHS-3 [7] is 6-8 months – 79.7%, 9-11 months – 81.7%, 12-17

months – 84.5 %, 18-23 months – 81.6%, 24-35 months – 74.6%, 36-47 months – 63%, 48-69 months – 53%.

The prevalence is highest (78%) in Bihar and lowest in southern states (Kerala 45%). In Uttar Pradesh the prevalence is 74% in children of 6-59 months of age[7]. Some studies also have shown that severe iron deficiency causes neurological impairment and this impairment may be irreversible [6, 9, 10, 11].

MATERIAL AND METHODS

Study design: observational analytical cross-sectional study. **P**lace of study & sample frame: children in the age group of 1 year to 5 years presenting at the pediatric Out Patient Department (OPD), Santosh medical college and hospital, Ghaziabad, U.P. for a routine checkup, immunization or in well baby clinic. Period of study: April 2013 to April 2014[12 months]. Sample size: It was calculated using Kish and Leslie formula minimum sample size calculated was 296. A total of 300 eligible consecutive cases during study period were enrolled and screened.

Inclusion Criteria:

1. Children between the age group of 1 year to 5 years attending pediatric out patient department.
2. Children free from any acute or chronic illness.
3. Parents willing to give consent and to undergo Hb(hemoglobin) level estimation of their children.

Exclusion criteria:

1. hemolytic anemia
2. children with any bleeding disorders.
3. children on iron supplements
4. any pre-term or IUGR baby (by documentation or reliable history)

Method:

Informed consent was taken in all the consecutive cases during study period who satisfied the inclusion criteria and were willing to participate in the study were enrolled. Proforma was primarily focused to obtain the dietary intake of calories, proteins & iron, co-morbidities, anthropometry and socio-demographic data. Predictor variable- socio-demographic factors (age, sex, type of family & socioeconomic status) dietary (age of start of complementary feeding, dietary intake of calories, proteins & iron) and h/o co-morbidities (worms in stool & pica), anthropometry data (wasting & stunting). Outcome variable- anemia, diagnosed at hemoglobin level of less than 11gm/dl (WHO).

Statistics - odds ratio with confidence interval. The p value of less than 0.05 was considered significant.

OBSERVATION AND RESULT

This is an analytical study with intention to detect any association between socio-demographic, dietary habits, anthropometric and comorbidities with anemia in preschool children aged between 1 to 5 years. Results are described as Odd‘s ratio with 95% confidence interval and corresponding level of significance was described by p value.

Magnitude of Anemia:

Out of 300 cases studied, 233(78%) were anemic. Majority 175(58%) were moderately anemic. Mild anemia was present in 50(17%) while severe anemia was seen in only 8 (3%) children (Figure 1). The mean hemoglobin level of anemic children was 9.12±0.96 gm/dl while the non-anemic group had mean hemoglobin of 11.72±0.37 gm/dl and this difference was statistically significant (Table 1).

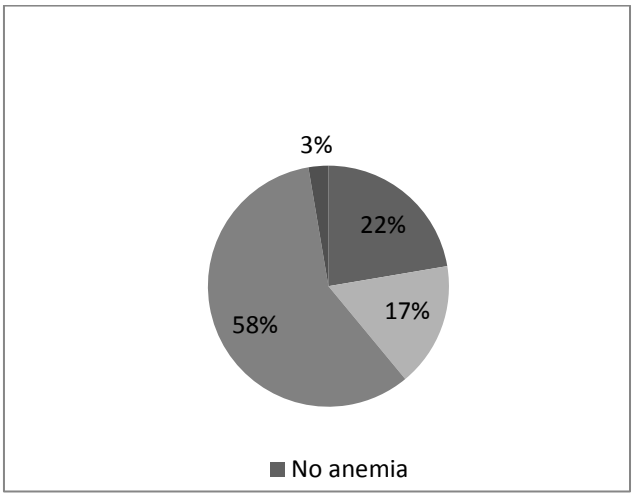

Fig-1. Severity of anemia

Table–1.Mean levels of Anemic and non anemic children.

Investigation	Non anemic		Anemic		p-value (t-test)
	Mean	±sd	Mean	±sd	
Hb gm%	11.72	0.37	9.12	0.96	0.000

Anemia in relation to Morphological Types:

88.8% of anemic children had Microcytic hypochromic (MCHC) anemia. Macrocytic normochromic (MNC) anemia was found in 6% of anemic children, whereas, 4.72% were having Dimorphic (DM) picture & only 0.4% were having Normocytic normochromic (NNC) picture (Figure 2).

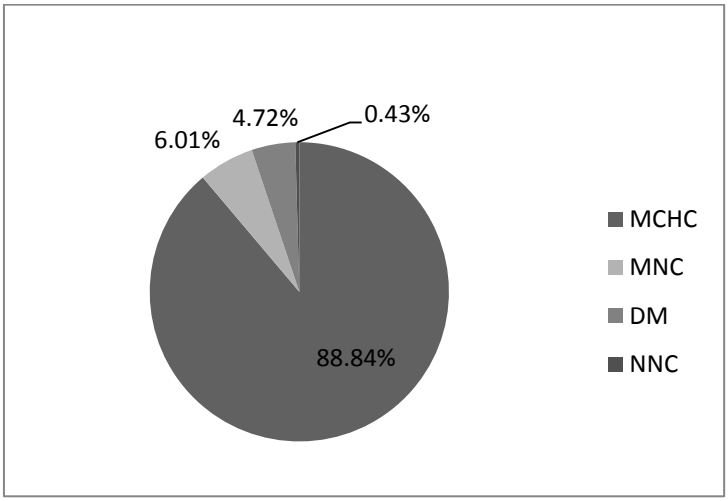

Fig-2. Anemia in relation to morphological types

Table-2. Spectrum of Iron, Vitamin B_{12} and folate status in anemic and non anemic children.

Investigation	Non anemic		Anemic		p-value(t-test)
	Mean	±sd	Mean	±sd	
S.Iron(µg/dl)	39.02	8.25	20.90	2.34	0.000
S.Ferritin(ng/ml)	30.83	6.18	7.71	5.35	0.000
S.VitaminB_{12}(pg/ml)	-	-	95.28	50.48	-
S.Folate(nmol/ml)	-	-	7.57	2.46	-
Hb (gm%)	11.72	0.37	9.12	0.96	0.000

Table-2. Shows-

- Mean serum Iron levels of non anemic children were 39.02 µg/dl ± 8.25, which were although in normal range (22-184 µg/dl) but were on lower side of normal value.
- The mean serum iron levels of anemic children were almost half of (20.90±2.34) of non anemic children.
- Mean serum ferritin level of anemic children were almost one fourth (7.71±5.35) of normal children (30.83±6.18), much below the normal range of serum ferritin (10-60 ng/dl).
- The levels of B12 and folate indicated that B12 deficiency was major culprit for macrocytic anemia. The anemic children in whom B12 estimation was done revealed mean value of 95.28±50.48 µg/ml, almost half of the normal value (180-500) while levels of folate (7.57±2.46) were within normal range (5.7-13.3nmol/ml).

SOCIODEMOGRAPHIC:

1. Age: The prevalence of anemia ranged from 58% to 92% & was highest (92%) among children aged 12-24 months (Fig-3).

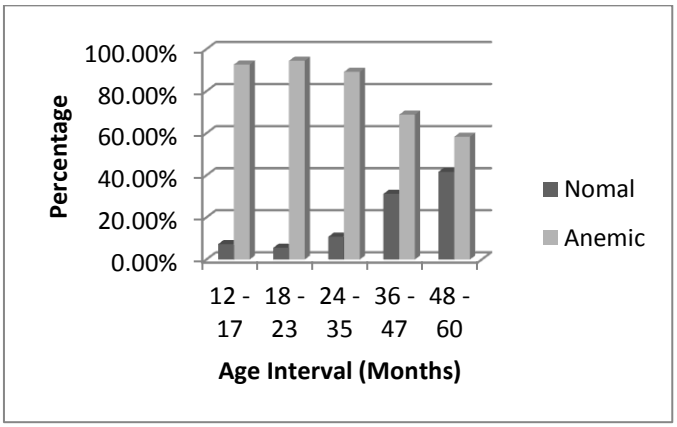

Fig-3. Anemia in relation to age

2. Sex: Contrary to expectation there was insignificant difference in prevalence of anemia between boys & girls (Male=78.33%; Females=76.67%) (Fig-4). Odd's ratio and p value were insignificant.

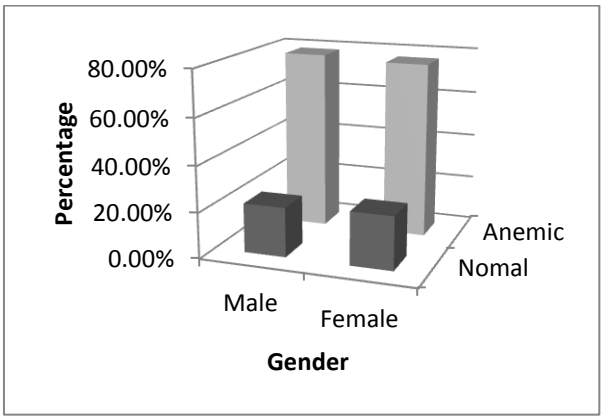

Fig-4. Anemia in relation to sex

3. Type of family: Prevalence of anemia was commoner in nuclear families (82.11%) than joint families (57.41%)(Fig-5).

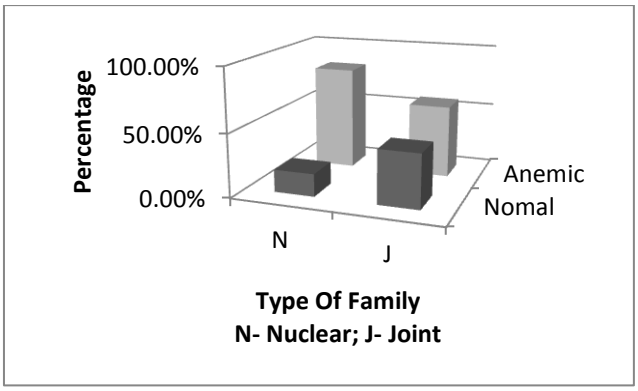

Fig-5. Anemia in relation to type of family

Table−3. Shows number (n) of normal and anemic cases in joint and nuclear families in studied cases.

TOF	Normal		Anemic		p-value	Odds Ratio	TOTAL	
	n	%	n	%			n	%
N(nuclear)	44	17.89%	202	82.11%	0.000	3.406	246	82.00%
J(joint)	23	42.59%	31	57.41%			54	18.00%
TOTAL	67	22%	233	78%			300	100%

4. Socio-economic status (SES. As expected prevalence of anemia was higher in SES Class IV (95.74%) & III (72.73%). Anemia was relatively low in class II (36.84%) (Fig−6). In the study population approximately (94%) children belong to middle and lower class (grade IV & III), 6.33% children belonged to SES grade II. None of the subject belonged to grade me & V (Table 4).

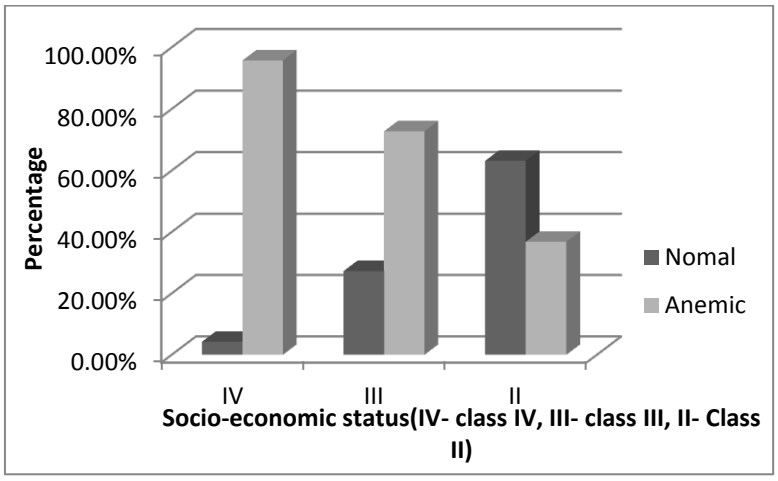

Fig-6. Anemia in relation to socio-economic status

Table−4. Shows prevalence of anemia in socioeconomic status (n- number of cases)

Socio economic status	Normal		Anemic		p-value	Odds Ratio	TOTAL	
	n	%	n	%			n	%
IV	4	4.26%	90	95.74%	0.000	9.913	94	31.33%
III	51	27.27%	136	72.73%	0.004	0.440	187	62.33%
II	12	63.16%	7	36.84%	0.000	0.142	19	6.33%
TOTAL	67	22%	233	78%			300	100%

DIET:

1. Daily intake of calories, proteins & iron as per RDA:

Statistical analysis showed strong association of anemia & inadequate calories intake. Of all anemic children, nearly 97% were having inadequate daily calories intake as per RDA while surprisingly only 4.72% were having inadequate protein intake. Iron intake was low in 92% of anemic children. (Figure 7) Inadequate calorie intake was present in 97% of anemic children. This predictor has very strong association with anemia (p-value of < 0.001). It was surprising observation that only 4.72% of anemic children were having inadequate protein intake and the association of this predictor with anemia was insignificant. The daily intake of iron was inadequate in 92% of anemic children. This observation explains the high prevalence of MHCH anemia and low levels of serum Iron and serum ferritin in anemic children. This association was very significant (p value <0.001) (Table 5).

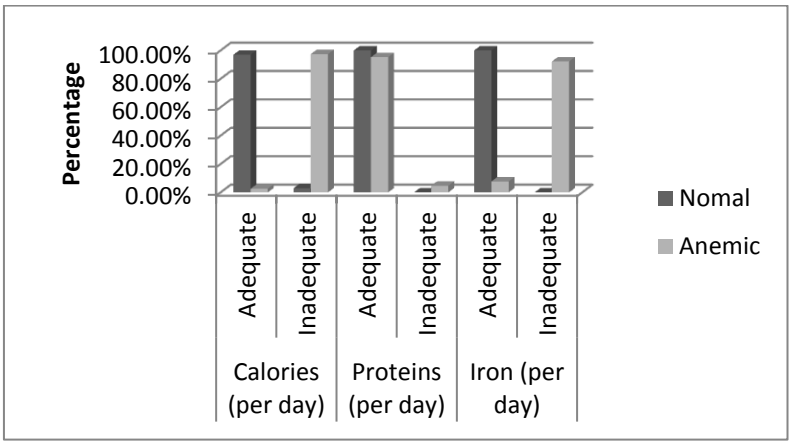

Fig-7. Anemia in relation to Calories, protiens & iron intake in diet

Table−5. Dietary intake of Calories, protein and iron per day in studied cases

Dietary details		Normal		Anemic		p-value	Odds Ratio
		N	%	n	%		
Calories (per day)	Adequate	65	97.01%	6	2.58%	0.000	0.001
	Inadequate	2	2.99%	227	97.42%	0.000	
Proteins (per day)	Adequate	67	100.00%	222	95.28%	0.035	0.000
	Inadequate	0	0.00%	11	4.72%	0.035	
Iron (per day)	Adequate	67	100.00%	18	7.73%	0.000	0.000
	Inadequate	0	0.00%	215	92.27%	0.000	

2.Vegetarian/Non-Vegetarian:

- Only one fifth (55 of 233) of the studied children were non vegetarian. (Figure 8)
- As expected, more (81.63%) of the vegetarian children were anemic as compared to non-vegetarian (60%) children who were anemic (Table 6).

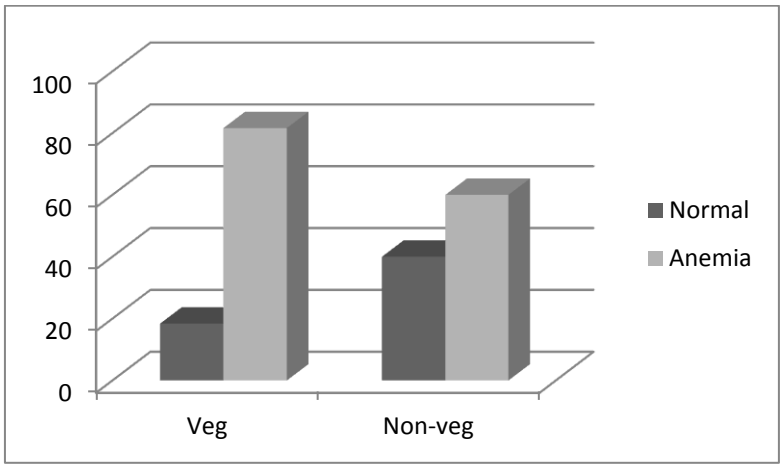

Fig-8. Anemia in relation to Vegitarian(Veg) and Non-vegetarian(Non-veg)

Table-6. Shows number (N) & percentage (%) of chidren normal and anemic in relation to vegetarian (veg) and non-vegetarian (non-veg) diet.

Dietary details		Normal		Anemic		p-value	Odds Ratio
		N	%	n	%		
Diet	Veg	45	18.37%	200	81.63%	0.000	2.963
	Non-veg	22	40.00%	33	60.00%	0.000	

3. Complimentary feeding:

Complementary feeding was started timely in 147(49%) children while it was delayed beyond 6 months in 153(51%) children (figure 9). Yet the prevalence of anemia was higher (91.50%) in later group (63.30%)(Figure 5 & Table 7).

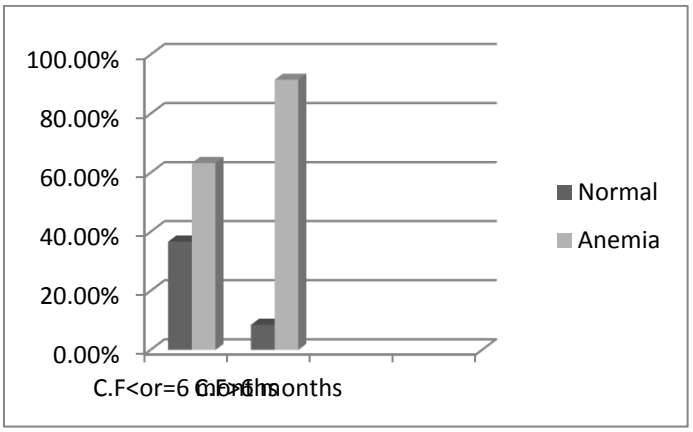

Fig-9. anemia in relation to time of attar of complimentary feeding(C.F)

Table-7. Shows number (n) & percentage (%) of normal and anemic children in relation to time of start of complimentary feeding (C.F).

Dietary details	Normal		Anemic		p-value	Odds Ratio
	n	%	n	%		
C.F < or = 6 month	54	36.7%	93	63.3%	0.000	0.160
C.F > 6 months	13	8.5%	140	91.5%	0.000	

ANTHROPOMETRY:

1. Wasting(weight for height):

Overall wasted children were 57.30%, of which only 4% were severely wasted.

Almost all of the wasted children had anemia.

And 42% children were not wasted yet nearly half (49%) of them were anemic.(figure 10 & table 8)

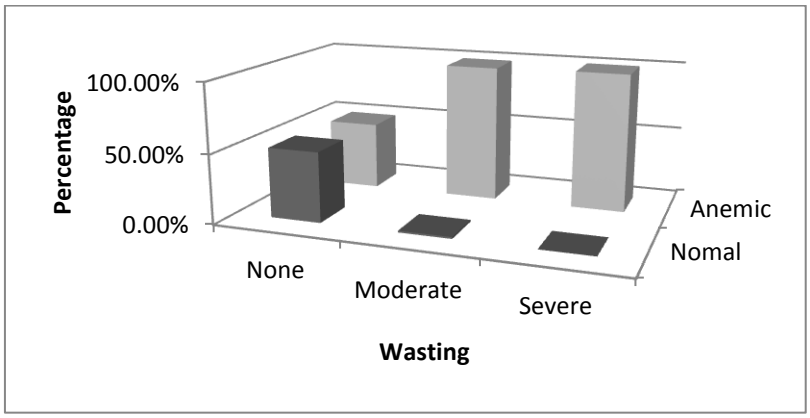

Fig-10. anemia in relation to wasting

Table-8. Shows number (N) & percentage (%) of normal and anemic in wasted (moderate and severe) cases

Wasting	Normal		Anemic		p-value	Odds Ratio	TOTAL	
	N	%	n	%			n	%
None	65	50.78%	63	49.22%	0.000	0.011	128	42.67%
Moderate	2	1.25%	158	98.75%	0.000	-	160	53.33%
Severe	0	0.00%	12	100.00%	0.029	-	12	4.00%
TOTAL	67	22%	233	78%			300	100%

2. Stunting (height for age):

Overall stunted children were 19(5.67%), of which only 8(2.67%) were severely wasted whereas 281(93.67%) children were not stunted. All of the stunted children had anemia, also in non stunted children prevalence of anemia was found to be 76.16 %.(Figure 11 & Table 9)

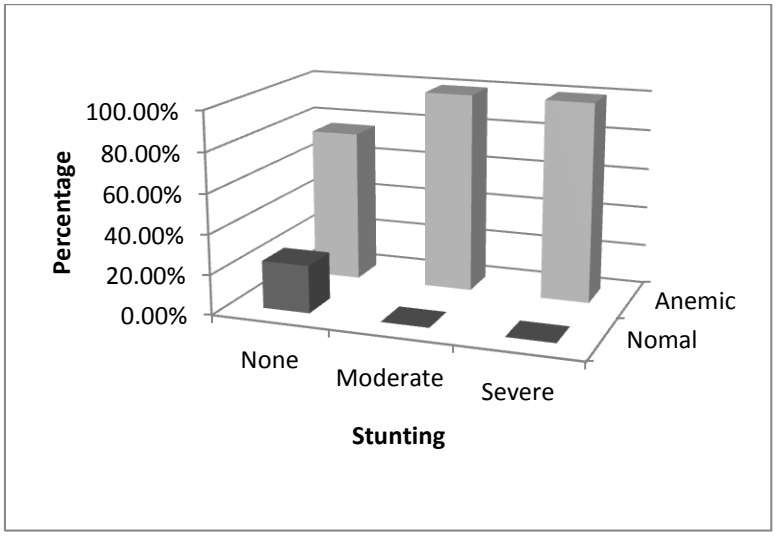

Fig-11. Anemia in relation to stunting

Table-9. Shows number (n) & percentage (%) of normal and anemic childern in stunted cases

Stunting	Normal		Anemic		p-value	Odds Ratio	TOTAL	
	n	%	n	%			n	%
None	67	23.84%	214	76.16%	0.008	0.000	281	93.67%
Moderate	0	0.00%	11	100.00%	0.035	-	11	3.67%
Severe	0	0.00%	8	100.00%	0.062	-	8	2.67%
TOTAL	67	22%	233	78%			300	100%

COMORBIDITIES:

Anemia in relation to co- morbidities:

Overall prevalence of worms infestation was 8% of which majority (87.50%) was anemic.

Overall prevalence of pica was only 16% but 91% of these children were anemic. (Figure 12 & Table 10)

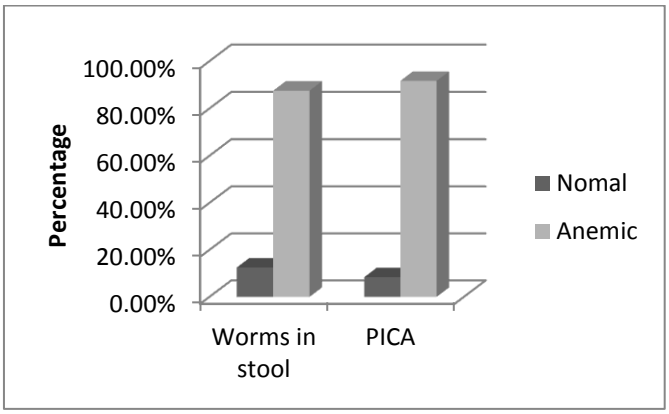

Fig-12. Anemia in relation to comorbidities (PICA & worms in stool)

Table-10. Shows number (n) & percentage (%) of normal and anemic cases in relation to children with history of PICA and worms in stool.

Comorbidities	Normal		Anemic		p-value	TOTAL	
	n	%	n	%		n	%
Worms in stool	3	12.50%	21	87.50%	0.114	24	33.33%
PICA	4	8.33%	44	91.67%	0.006	48	66.67%
TOTAL	7	10%	65	90%		72	100.00%

DISCUSSION

Strong association was found between studied predictors (especially low intake of calories, and iron) and outcome (anemia).So,

NULL HYPOTHESIS WAS REJECTED.

Prevalence of anemia in this study was higher than the NFHS – 3[7] figures in U.P. (78% vs 74%).

Prevalence of Anemia:

In the present study the prevalence of anemia was found to be 78%.

This indicated that it is a public health problem of high magnitude as per WHO guidelines [8].

Findings of the present study are in accordance with Rehema *et al* [12] (77.2%).

Magnitude of Anemia:

In present study, the prevalence of severe anemia was 3%, moderate anemia 58% and mild anemia 17%.

These findings are in concordance with the observations of Deshmukh *et al* [13] in 2009. They

conducted research in rural Wardha and reported prevalence was 27.1%, 51.3% & 1.3% of children were Mild, Moderate & Severe anemic respectively. There are studies reporting high prevalence of severe anemia. Prevalence of 7.8% was reported in a study by Kapur *et al* [14] in urban slums ICDS project in Delhi, 2002.

Socio-demographic Predictors:

1. AGE: In the present study, the prevalence of anemia was highest among the subjects aged between 12-24 months (90%).
   It was observed that prevalence of anemia was decreasing with increasing age (58% in age group 48-59 months).
   This variation in anemia can be explained by delayed complimentary feeding.

2. TYPE OF FAMILY: In the present study, anemia was more common in children belonging to nuclear families (82.1%) in comparison to ones belonging to joint families (57.4%). This association was statistically significant.
   This observation is in contrast with the results by Deshmukh *et a*l [13] who showed no major difference in prevalence of anemia between nuclear and joint family.

3. SES: In the present study, the prevalence of anemia was high among children belonging to lower socio-economic group (95.7% & 72.7% in class IV & III respectively) as compared to subjects belonging to higher socio-economic groups (36.84% in class II).
   This inverse relationship was statistically significant also. It is easy to explain due to differences in availability of quality & quantity of food & standard of living.

Dietary:

1. Daily intake of calories, protein, iron as per RDA :
   The energy intake (calories) by RDA was found to be significantly low in anemic children i.e. nearly 97.4% of children who were anemic were found to be taking low calories per day in their diet as per RDA. Also, 92.27% of the anemic children were found to be deficient in iron intake per day as per RDA. Whereas only 4.7% of the anemic children were deficient in protein intake per day as per RDA. In a study by Deeksha Kapur *et al* [14] found that around 56% and 45% of children who were anemic were deficient in energy and iron intake respectively as per dietary guidelines for Indians.

2. Complementary feeding :
   In the present study we found that 40% of the anemic children received exclusive breastfeeding till or before 6 months of age. A significant increase in anemic percentage was noted in children who were exclusively breastfed for more than 6 months of age i.e. of total anemic children 60% were exclusively breastfed for more than 6 months. In a study by Sultan Ali N *et al* [10], who found that late weaning, more than 6 months was the most important predictor of Iron deficiency anemia in 1-2 years of age.

Anthropometry:

This study found that anemic children i.e. 78% of which 67.8% & 5.2% were moderately & severely wasted respectively. Also, 4.7% & 3.4% anemic children were moderately & severely stunted respectively.

A similar data was obtained from Deshmukh *et al* [13] & Suparna Ghosh *et al* [15].

Co-morbidities:

In the present study, children who had history of PICA were found to be significantly anemic (91.7%). And only 8.3% were non-anemic. Similarly, children who had history of worms in stool were found to be significantly anemic (87.5%) whereas only 12.5% were non-anemic. This study shows a high association between anemia and history of PICA & Worms in stool. In a study by Dr. William G. *et al* [16] in 1989 stated that 88% of the anemic subjects had history of PICA as Pagophagia. These data are in correlation to the present study.

Anemia in relation to Morphological Types and Spectrum of Iron, Vitamin B_{12} and folate status:

In the present study, of all total anemic children, 88.8% were found to have microcytic hypochromic picture, 6% macrocytic normochromic picture and 4.72% were having dimorphic/ mixed picture also we found that serum ferritin and serum iron levels were low in all anemic children who had microcytic hypochromic picture, and in cases of dimorphic picture also. In cases of macrocytic normochromic picture and in dimorphic picture serum iron & ferritin levels were in normal range, whereas either Vit B_{12} or folate levels were lower than the normal range. These data were comparable to data by N. M. Hanumante *et al* [6] who

found 90% of anemic children had low levels of serum ferritin & serum Iron. In a study by Sant-Rayn Pasricha *et al* [17] and Deeksha Kapur *et al* [14] similar results were found.

CONCLUSION:

High prevalence of anemia (78%) along with presence of poor dietary intake of calories and iron in majority of subjects point towards the importance of proper dietary advice to combat nutritional anemia.

REFERENCES

1. National guidelines on infant and young child feeding. Indian Pediatr 2010; 47: 995-1004.
2. Ramesh Chellan, Lopamudra Paul. Prevalence Iron-Deficiency Anaemia in India: Results from a Large Nationwide Survey. Journal of population and Social studies 2010; 19(1): 59-80.
3. ACC/SCN: Fourth Report on the World Nutrition Situation. Geneva, ACC/SCN in collaboration with IFPRI, 2000.
4. Lorena W. Tengco, Pura Rayco-Solon et *al*. Determinants of Anemia among Preschool Children in the Philippines. Journal of the American College of Nutrition 2008; 27(2): 229-243.
5. Stoltzfus RJ, Dreyfuss ML. Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia. INACG/WHO/UNICEF. ILSI Press, International Life Science Institute, Washington, USA, 1998.
6. Hanumante NM, Kanvinde S, Sanwalka NJ, Vaidya MV, Khadilkar AV. Iron deficiency anemia in an urban slum. The Indian Journal of Pediatrics. 2008 Apr 1; 75(4):355-7.
7. National Family Health Survey-3 (NFHS) - India 2005-06.
8. Maureen M. Black. Integrated strategies needed to prevent iron deficiency and to promote early child development. Journal of Trace Elements in Medicine and Biology 2012; 26: 120–123.
9. Olney DK, Pollitt E, Kariger PK, Khalfan SS, Ali NS, Tielsch JM, Sazawal S, Black R, Allen LH, Stoltzfus RJ. Combined iron and folic acid supplementation with or without zinc reduces time to walking unassisted among Zanzibari infants 5-to 11-mo old. The Journal of nutrition. 2006 Sep 1; 136(9):2427-34.
10. Sultan Ali N, Zuberi RW. Late weaning - The most significant risk factor in the development of iron deficiency anemia at 1-2 years of age. J. Ayub Med Coll Abbottabad 2003; 15(2): 3-7.
11. Tomas Walter, Isidora De Andraca, Patricia Chadud MT. Iron deficiency anemia - adverse effect on infant psychomotor development. Pediatrics 1989; 84(1): 7-17.
12. Kabyemera R, Masalu N, Rambau P, Kamugisha E, Kidenya B, De Rossi A, Petrara MR, Mwizamuholya D. Relationship between Non-Hodgkin's lymphoma and blood levels of Epstein - Barr virus in children in north-western Tanzania: a case control study. BMC pediatrics. 2013 Jan 7; 13(1):4.
13. Deshmukh PR, Dongre AR, Sinha N, Garg BS. Acute childhood morbidities in rural Wardha: some epidemiological correlates and health care seeking.
14. Kapur D, Agarwal KN, Sharma S. Iron status of children aged 9-36 months in an urban slum, ICDS project in Delhi. Indian Pediatr 2002; 39:136-144.
15. Suparna Ghosh, Anita Singh. Dimensions of nutritional vulnerability: Assessment of women and children in Sahariya tribal community of Madhya Pradesh in India. Indian J of Public Health. 2013; 57(4):260-267.
16. Rector WG. Pica. Journal of general internal medicine. 1989 Nov 1; 4(6):512-3.
17. Pasricha SR, Black J, Muthayya S, Shet A, Bhat V, Nagaraj S, Prashanth NS, Sudarshan H, Biggs BA, Shet AS. Determinants of anemia among young children in rural India. Pediatrics. 2010 Jul 1; 126(1):e140-9.