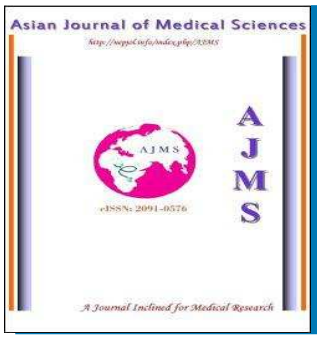

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A STUDY OF SOME PREDICTORS OF ANAEMIA IN CHILDREN ON UNDER-FIVE YEARS IN INDIA

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"Predictors of anaemia among children under-five years in India."

ABSTRACT

Background: The major nutritional problem among young children in India is anaemia that affects the ability to study and work and is significantly associated with increased morbidity and mortality.

Objectives: To analyze the prevalence of anaemia among Indian children of under-five years and to identify the significant risk factors associated with it.

Methods: Data of 35851 children from NFHS-III, India were analyzed and binary logistic regression model was fitted by using SPSS 15.0 software. Anaemia was defined as haemoglobin concentration level below 11 g/dl. HemoCue Hb 201+ analyzer was used to measure haemoglobin concentration.

Results: Overall, 69.5 percent were anaemic with the highest proportion in Bihar and the least in Goa. The age and birth order of child; religion, caste and wealth index of household; anaemia level, education, age at first birth, intake of iron supplements during pregnancy and vegetarian habit of mother showed significant influence on child anaemia.

Conclusion: Child anaemia prevails significantly in India and the findings suggest for urgent prevention and treatment measures giving importance to the different socio-economic characteristics.

Keywords: Anaemia, NFHS, O.R (Odds Ratio), CI (Confidence Interval), Binary Logistic.

INTRODUCTION

Childhood anaemia has become a major public health problem worldwide and is associated with serious consequences including poor growth, impaired motor and cognitive development, and increased morbidity and mortality.[1] Estimates suggest that 47.4% of children under five years of age are anaemic globally.[2] The most significant contributor to the onset of anaemia is iron deficiency and World Health Organization estimates that iron deficiency anaemia affects 50 percent of women and 40 percent of children in developing countries. Iron deficiency is a curse that affects the ability to study and work and is the major nutritional problem among infants and young children in India and is a leading cause of morbidity and mortality worldwide.[3,4] Studies have also shown that iron deficiency and anaemia are most prevalent among pregnant women and young children with the highest prevalence in low income countries.[5] The important determinants of anaemia most often cited in the literature are low family income and low maternal level of education, more children in the family, lack of access to healthcare services, inadequate sanitary conditions and a diet with insufficient quantities of iron.[6-9] Research in developing countries has shown that children of formally educated or literate mothers had a less risk of stunting.[10,11] Several studies have found a negative association between socioeconomic situation and anaemia prevalence.[12-14]

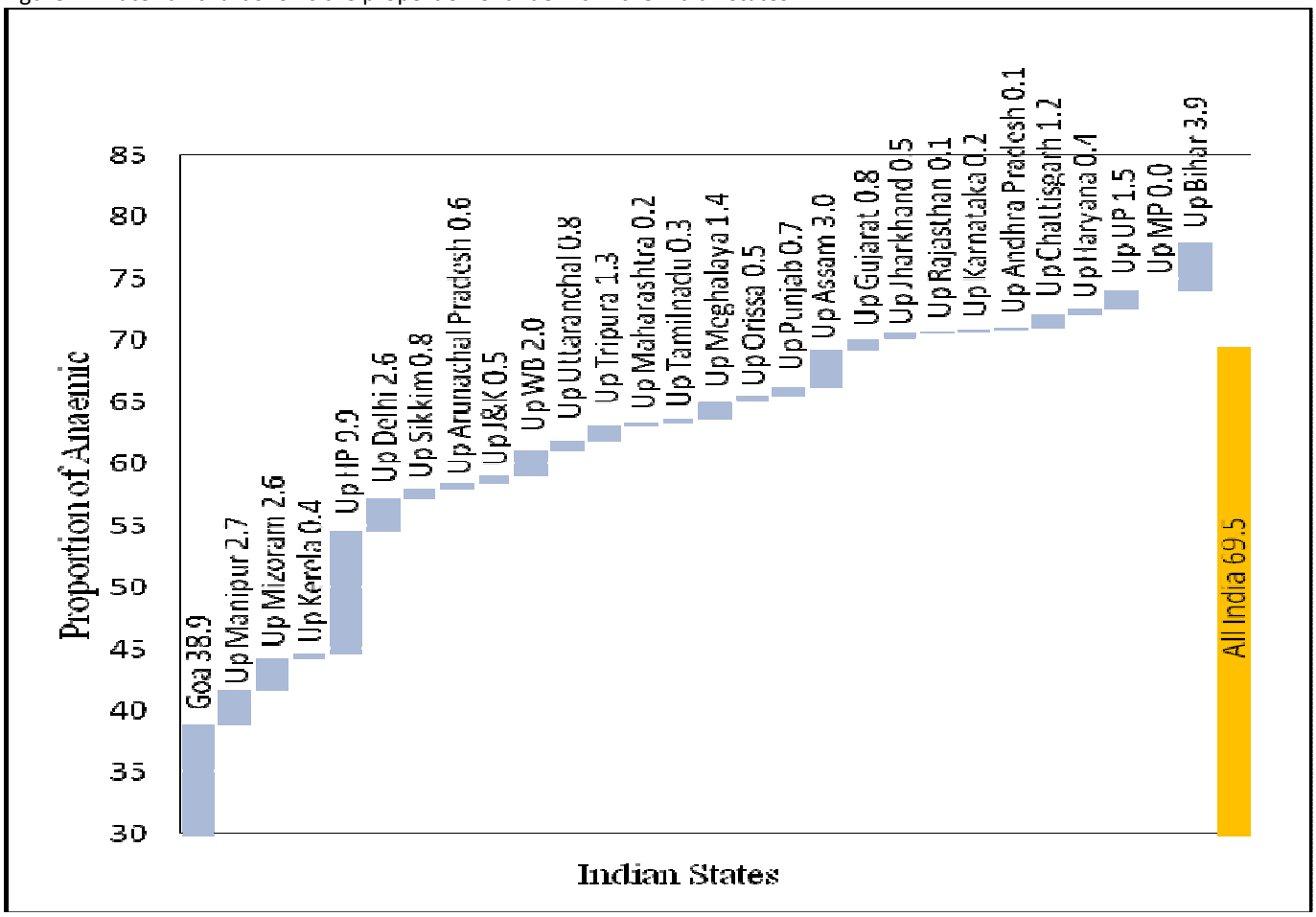
Childhood anaemia has a significant impact on life-long health and is important to identify determinants of this condition early in the child's life. If the iron requirements of a growing child are not fulfilled, learning ability, work efficiency, and immune functioning will decline and can also result in height and weight disturbances. However, early detection and subsequent preventive measures can help the child grow into a healthy adult. Keeping in mind the importance of prevention of childhood anaemia the study was designed with the objective of identifying some socioeconomic risk factors for anaemia in children of less than five years of age, in India, by means of

MATERIALS AND METHODS

The study was based on the database that was compiled in National Family Health Survey (NFHS) during 2005-06, in all the 29 States of India, under Ministry of Health and Family Welfare, Govt. of India.[15] The NFHS is a large-scale, multi-round survey conducted in a representative sample of households throughout India with features on the quality of health and family planning services, domestic violence, reproductive health, anaemia, the nutrition of women, and the status of women, HIV prevalence etc. The data of 35851 children of India, whose haemoglobin concentration was measured, of age 6-59 months, was taken and weighted analysis was performed by using SPSS 15.0 software to study the influence of some socio economic factors on anaemia. Haemoglobin concentration was measured by HemoCue Hb 201+ analyzer and a child was anaemic if concentration level fell below 11.0 g/dl. The binary logistic regression was used to fit a predictive model on anaemia and also to assess the degree of dependence of anaemia on the risk factors taken into study. In the logistic analysis backward-stepwise procedure was used, with reference category as the first category for all the predictors; and Hosmer & Lemeshow test value was used to test the goodness of fit of the model.

The response variable was a dichotomous 'anaemia level'(0 = non anaemic, 1 = anaemic) and predictors are: age of child in years (Less than 1, 1-2, 2-3, 3-4 and 4-5), birth order of child (1, 2, 3, 4 and 5 or above), place of residence (1=urban,2=rural),religion(1=Hindu, 2=Muslim, 3=Christian, 4= other), type of caste or tribe (1=SC,2=ST,3=OBC, 4=Others), wealth index(1=poorest, 2=poorer, 3=middle, 4=richer and 5=richest), mother's anaemia level (0=non-anaemic, 1=anaemic), mother's educational level(0=no education,1=primary, 2=secondary, 3=higher), father's educational level (0=no education, 1=Primary, 2=secondary, 3=higher), mother's age at first birth (1=below 18, 2=18-24 and 3=25 or above), iron supplements for mother during pregnancy (0=No, 1=Yes) and vegetarian status of mother (1= vegetarian, 2= non-vegetarian). The wealth index was constructed using household asset data. Each household asset was assigned a score generated through principal components analysis; and the resulting scores were standardized and summed up for

Figure 1: Waterfall chart shows the proportion of anaemic in the Indian states



for each household.[15] Individuals were ranked according to the score of the household in which they resided. The sample was then divided into five groups with an equal number of individuals in each. Educational level was classified on the basis of years of completion of formal education; no education referred those who never attended school; primary, secondary and higher education included individuals of 5 years, 10 years and 12 or higher years of completed schooling respectively.

The logistic regression model is:

π= Probability that a child would be anaemic for given values of predictors

$$= P(Y=1 \mid X_1=x_1, X_2=x_2, \ldots, Xp=x_p)$$

$$= \frac{e^{z(x)}}{1+e^{z(x)}},$$

where, $z(x)=\beta_0+ \beta_1x_1+ \beta_1x_1+\ldots+ \beta_px_p$ is the logit transformation of the logistic regression model.

RESULTS AND DISCUSSION

In the study 75.7% lived in rural areas and while 24.3 percent lived in urban areas (table 1). Nationwide 25.4% reported form households of poorest wealth index, 22.5% poorer, 19.9% middle, 18.2% richer and 14.0% of richest wealth index. Overall 69.5% of the children were anaemic with mean haemoglobin concentration 10.097 g/dl and standard deviation 1.565. The proportion of anaemic among rural children was more (71.6%) as

Table 1: Mean haemoglobin concentration and prevalence rates of anaemia by population subgroup

Population subgroup	N (%)	Haemoglobin (g/dl)		Prevalence rates of anaemia	
		Mean	95% CI	%	95% CI
Age (years)					
Less than 1	4196 (10.3)	9.82	9.77-9.86	80.6	78.98-82.06
1-2	9101 (22.3)	9.53	9.49-9.56	83.1	82.01-84.21
2-3	9027 (22.1)	9.90	9.87-9.93	74.6	73.89-75.05
3-4	9338 (22.8)	10.34	10.31-10.37	62.8	61.99-64.10
4-5	9222 (22.6)	10.73	10.70-10.76	53.1	52.02-54.17
Sex					
Male	21654 (53.0)	10.09	10.07-10.11	69.2	69.01-70.02
Female	19231 (47.0)	10.10	10.08-10.13	70.0	69.00-71.01
Birth order					
1	11998 (29.3)	10.24	10.21-10.27	65.1	64.10-66.11
2	11256 (27.6)	10.14	10.11-10.17	68.6	67.82-69.20
3	6762 (16.5)	10.04	9.99-10.08	71.7	70.79-75.10
4	4274 (10.5)	9.96	9.92-10.01	73.2	72.02-74.13
5 or above	6595 (16.1)	9.91	9.87-9.95	74.7	74.11-76.22
Place of residence					
Rural	30944 (75.7)	10.04	10.02-10.05	71.6	70.25-72.33
Urban	9941 (24.3)	10.29	10.26-10.32	63.1	62.16-64.28
Religion					
Hindu	32227 (78.8)	10.08	10.06-11.00	69.8	69.24-70.31
Muslim	6734 (16.5)	10.14	10.10-10.17	69.7	68.88-71.12
Christian	764 (1.9)	10.50	10.39-10.61	60.3	57.45-64.34
Others	1127 (2.8)	10.06	9.97-10.16	67.3	65.22-69.96
Caste or tribe					
SC	8515 (21.5)	9.94	9.90-9.97	72.5	69.66-73.10
ST	3858 (9.7)	9.83	9.78-9.87	77.1	76.41-78.50
OBC	16744 (42.3)	10.08	10.06-10.10	70.2	69.76-71.16
Other	10486 (26.5)	10.32	10.29-10.35	64.0	63.20-65.33
Wealth Index					
Poorest	10402 (25.4)	9.89	9.86-9.92	76.6	76.16-77.30
Poorer	9197 (22.5)	9.95	9.92-9.99	73.7	72.90-75.32
Middle	8130 (19.9)	10.08	10.04-10.11	69.4	68.38-70.41
Richer	7437 (18.2)	10.25	10.21-10.28	64.7	63.92-66.14
Richest	5718 (14.0)	10.53	10.49-10.57	56.6	55.21-58.34
All children	40885 (100.0)	10.097	10.08-10.11	69.5	68.82-70.20

compared to urban children (63.1%); and male and female were almost equally anaemic (69.2% and 70.0% respectively). Age group shows that children of 1-2 years had highest proportion of anaemic; however there was a decreasing tendency from 2 years onwards. Prevalence rates showed an increasing tendency as birth order number increased. Among different Indian States, the highest proportion of anaemic was in Bihar (77.9%) followed by UP (74.0%) and MP (74.0%), Haryana (72.5%), Chhattisgarh (72.1%) respectively; and the least was in Goa (38.9%) followed by Manipur (41.6%), Mizoram (44.2%) respectively (fig. 1). The findings of binary logistic regression using backward stepwise process (table 2) revealed that age of child, birth order, religion, type of caste or tribe, wealth index, mother's anaemia level, mother's education, intake of iron supplements for mother during pregnancy and vegetarian habits of mother were significantly (p-value≤

Table 2: Binary logistic regression model parameters for the final step

Predictors	p-value	O.R.	95% C.I. for O.R.	
			L.B.	U.B.
Age of child in years				
Less than 1*				
1-2	.004	1.159	1.049	**1.281**
2-3	<.001	.690	.624	**.762**
3-4	<.001	.370	.335	**.410**
4-5	<.001	.237	.213	**.263**
Birth order of child				
1*				
2	.002	1.110	1.046	**1.220**
3	.017	1.118	1.020	**1.225**
4	.043	1.120	1.003	**1.250**
5 or above	.043	1.122	1.004	**1.231**
Religion				
Hindu*				
Muslim	.002	1.158	1.056	**1.270**
Christian	.048	.803	.657	**1.015**
Others	.612	1.046	.879	**1.244**
Type of caste or tribe				
SC*				
ST	.005	1.195	1.056	**1.352**
OBC	.020	.909	.839	**.985**
Other	<.001	.768	.702	**.840**
Wealth Index				
Poorest*				
Poorer	.016	.893	.815	**.979**
Middle	<.001	.798	.725	**.878**
Richer	<.001	.738	.665	**.818**
Richest	<.001	.588	.523	**.662**
Mother's anaemia level				
Non-anaemic*				
Anaemic	<.001	1.663	1.571	**1.761**
Mother's education				
No education*				
Primary education	.027	.902	.823	**.988**
Secondary education	<.001	.819	.754	**.889**
Higher education	<.001	.639	.552	**.738**
Mother's age at first birth				
Below 18 years*				
18 to 24	.360	.969	.905	**1.037**
25 or above	.002	.828	.736	**.932**
Iron supplements for mother				
No*				
Yes	<.001	.864	.808	**.923**
Vegetarian status of mother				
Vegetarian*				
Non-vegetarian	<.001	.809	.756	**.865**
Constant	<.001	5.919		
*** Reference category**		***Hosmer and Lemeshow Test value for the final step :7.982 (p-value 0.435)***		
Variables removed (not significant): place of residence and father's education.				

0.05) associated with the anaemia status of children. Hosmer and Lemeshow Test value for the final step was 7.982 (p-value 0.435), i.e., the final model fitted data at an acceptable level. Estimates of parameters showed that children of 1-2 years were more likely to be anaemic (O.R. 1.159, 95% CI 1.049-1.281) than those of less than 1 year; however as age increased the risk of anaemia decreased significantly. The odds ratio showed that the level of anaemia increased as the birth order increased. Muslim children were at higher likelihood of becoming anaemic (O.R. 1.158, 95% CI 1.056-1.270); whereas Christian children were at lower likelihood (O.R. 0.803, 95% CI 0.657-1.015) as compared to Hindu children. Children of ST category were more vulnerable towards anaemia (O.R. 1.195, 95% CI 1.056-1.352) as compared to SC; where as OBC and other categories were less vulnerable. Wealth index had significant affect on developing anaemia. The estimates revealed that a child of richest category was at lower risk of anaemia (O.R. 0.558, 95% CI 0.523-0.662) than a child of poorest category. Mother's anaemia level had strong association with the child's anaemia. The findings showed that the risk of anaemia among children of anaemic mothers was 1.663 times (95% CI 1.571-1.761) of that among children of non-anaemic mothers. The risk was lower if mother took iron supplements during pregnancy (O.R. 0.864, 95% CI 0.808-0.923). The odd ratio showed that if age of mother at first birth was 25 or above, the risk of anaemia for their children was significantly less (O.R. 0.828, 95% CI 0.736-0.932). Adoption of non-veg food habit for mother reduced the risk of anaemia for children (O.R. 0.809, 95% CI 0.756-0.865).

CONCLUSION

Given the importance of severe consequences of anaemia, many countries have conducted interventions to reduce anaemia; particularly in the groups most vulnerable to its devastating effects: pregnant women and children. But the problem seems to be unchecked in India. The gravity of the findings makes it clear that there is a need of implementation of urgent prevention and treatment measures for anaemia for children giving importance to the different background characteristics, such as age, place of residence, parents' education, wealth index, ethnic group, dietary habit, etc.

REFERENCES

1. Ayoya MA, Ngnie-Teta I, Séraphin MN, Mamadoultaibou A, Boldon E, Saint-Fleur JE, Koo L, Bernard S. Prevalence and risk factors of anaemia among children 6–59 months old in Haiti. Anaemia; 2013:1-3.
2. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993–2005. Public Health Nutrition 2009; 12 (4): 444–454.
3. World Health Organisation. Malnutration: The Global Picture, Geneva World Health Organization, 2000.
4. Gupte S, Gupta RK, Gupta R. Iron deficiency Anaemia: A Diagnostic Approach in children. JK Science 2000; 2: 175 -179.
5. DeMaeyer EM. Preventing and Controlling Iron Deficiency Anaemia through Primary Health Care. A Guide for Health Administrators and Programme Planners. Geneva: World Health Organization; 1989.
6. Monteiro CA, Szarfarc SC, Mondini L. Tendência secular da anaemia na infância na cidade de São Paulo, (1984 –1996). Rev Saude Publica 2000; 34(Supl 6):62-72.
7. Lima ACVMS, Lira PIC, Romani SAM, Eickmann SH, Piscoya MD, Lima MC. Fatores determinantes dos níveis de haemoglobina em crianças aos 12 meses de vida na Zona da Mata Meridional de Pernambuco. Rev Bras Saude Matern Infant 2004; 4:35-43.
8. Neuman NA, TanakaOY, Szarfarc SC, Guimarães PR, Victora CG. Prevalência e fatores de risco para anaemia no Sul do Brasil. Rev Saude Publica. 2000; 34:56-63.
9. Osorio MM, Lira PI, Ashworth A. Factors associated with Hb concentration in children aged 6-59 months in the state of Pernambuco, Brazil. Br J Nutr 2004; 91:307-315.
10. Wamani H, Astrom AN, Peterson S, Yumwine JK, Tylleskär T: Predictors of poor anthropometric status among children under 2 years of age in Uganda. Public Health Nutr 2006; 9:320-326.
11. Chopra M. Risk factors for under-nutrition of young children in a rural area of South Africa. Public Health Nutr 2006; 6:645-652.
12. Carlo EB, Sosa EM. Iron status in non-pregnant women of child bearing age living in greater Buenos Aires. Eur. J. Clin. Nutr 1991; 45: 215-220.
13. Isah HS, Fleming AF, Ujah IAO, Ekwempu CC. Anaemia and iron status of pregnant and non-pregnant women in the Guinea savanna of Nigeria. Ann. Trop. Med. Parasitol 1985; 79: 485-493.
14. Johnson A, Latham MC, Roe DA. The prevalence and etiology of the nutritional anaemias in Guyana. Am. J. Clin. Nutr 1982; 35: 309-318.
15. MoHFW (Ministry of Health and Family Welfare), Government of India. National Family Health Survey-III (NFHS-III), 2005-2006, India 2007.

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SG & KKD: Concept and Design of the study, analysis and interpretation, manuscript preparation, critical revision of the manuscript, data collection, statistical analysis, and literature search.

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