

## ORIGINAL ARTICLE

# Essential determinants of Anaemia among children of Uttar Pradesh (India): Evidence from National Family Health Surveys

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## Abstract

**Background:** Using data from the National Family Health Survey, present study was planned to find out the determinants of anaemia in the state of Uttar Pradesh. **Aims & Objective:** To find out the level and determinants of trend of anaemia. Binary logistic regression was used to examine the factors affecting anaemia among children of Uttar Pradesh. **Results & Conclusion:** In Uttar Pradesh, there were about 38% of the literate mothers, 23.3% were employed and 34.5% were undernourished. Anaemia level among male were 72.6% and 73.4% among females, about 74.6% in rural areas and 69.7% in urban areas. Maternal Anaemia was present in 77.2 % of women. About 73.9% children are anemic in the Uttar Pradesh state followed by female 49.9% and male 24.3%. The prevalence of severe anaemia is the highest 3.6% in children followed by women 1.6 % and men 2.0%. Children aged 13 to 24 months are significantly (OR; 6.05, CI; 4.04-9.04) more likely to be severely anemic compared to children of 25 to 59 months.

## Keywords

Anaemia; Uttar Pradesh; NFHS; Binary logistic; Odd Ratio (OR)

## 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 fewer than five years of age are anemic 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) In India, approximately 55% of women of reproductive age and 69.5% of under-5 children are anaemic (5), and in children over 70% of anaemia is attributable to iron deficiency. (6) Iron deficiency anaemia in mothers may be associated with an increased risk of maternal mortality, preterm delivery, and low birth weight (7), where as in children with reduced cognitive development. (8) Thus, anaemia is a major public health concern in India. The Indian National Nutritional anaemia

Prophylaxis programme recommends that all children aged 6 to 59 months, and all pregnant and lactating women, should receive Iron Folic-Acid (IFA). (9) Despite this policy, the prevalence of anaemia among toddlers aged 6-36 months has risen from 74.3% in 1998-9 to 78.9% in 2005-6. The third National Family Health Study (NFHS-3) examined receipt of iron and found that only 4.7% of children in India aged 6-59 months were receiving supplementation (5) worldwide at any given moment, more individuals have iron-deficiency anaemia than any other health problem (WHO). (10) Anaemia has been a big problem in India and the National Family Health Survey (NFHS) III (11) data showed the prevalence of anaemia among children less than five years of age to be around 70%. Anaemia is a very critical health issue in Uttar Pradesh, the most populous state of the country. When we look at the data for anaemia prevalence among children under three years of age, it jumps to 79% and this is five percent more than the NFHS II (12) survey done six years prior to the NFHS III survey, which was done in 2005- 2006. The available data shows that over the passage of time, this problem is becoming more severe. As evident from NFHS-2(1998-1999) and NFHS-3(2005- 2006), the prevalence of anaemia among children aged 6-35 months in Uttar Pradesh has significantly increased from 74% to 85%. The high prevalence of anaemia in the state persists in spite of all the economic development and Government child care programmes. This calls for a detailed investigation into the trends and factors responsible for iron deficiency anaemia.

### Aim & Objective

To explore the determinants of anaemia among children of Uttar Pradesh.

### Material & Methods

Data for this study has been taken from National Family Health Survey (NFHS-3) conducted during 2005-06, conducted by the ministry of the health and family welfare, India. Study is based on secondary data. The data were compiled and coded in a MS Excel database and analysed by using the statistical software PASW 18.

The unit level information on 4556 children of Uttar Pradesh aged 6-59 months has been used in the analysis. NFHS-3 undertook direct measurement of the haemoglobin levels for children aged 6-59 months and classified anaemia as: Mild anaemia:

10.0-10.9 g/dl, Moderate anaemia: 7.0-9.9 g/dl and Severe anaemia: <7.0 g/dl. The covariates of anaemia have been examined using a multinomial logistic regression model for various categories of anaemia. Fractional polynomial method can be used for prominent covariates. To identify the variables for multivariate model; bivariate analysis was first carried out to examine the association of each possible predictor with iron-deficiency anaemia in children. The variables found significant on bivariate analysis were included in multivariate analysis. While performing multinomial logistic regression analysis, all the predictors were transformed into categorical variables and results were given for three categories of outcome variable anaemia: severe, moderate and mild with reference to no anaemia. Odds ratio, 95% confidence interval for each significant predictor has been calculated and presented. The data were compiled and coded in a MS Excel database and analysed by using the SPSS 17.0).

### Results

[Table 1](#) Prevalence of anaemia among females was 73.4% followed by male 72.6%. Maternal anaemia was found in 77.2% respectively. The prevalence of anaemia in rural area was 74.6 relatively higher than urban area 69.75. Prevalence of anaemia at size of birth order was higher in  $\geq 4$  size 74.2% which is followed by 3 size 73.3%, 2 size 72.1% and 1 size 71.4%. Approximately same prevalence of anaemia in size at birth large 76.3% and small 76.2% followed by average size at birth 71.2%. [Table 2](#) Prevalence of anaemia has been found more in children 3.6% as compared to women 1.6% and men 2.0%. Whereas prevalence of moderate anaemia has been found 45.0% in children as compared to women 13% and men 10.4%. 35.1% women have been found mild anaemia as compared to children 25.4% and men 11.9%. As compared to prevalence of any anaemia has been also found in children 73.9% with women 79.9% and men 24.3%. [Table 3](#) The prevalence of severe anaemia has been found more among 13-24 months 5.91% children as compared to 25-29 months 3.06%. Also prevalence of moderate anaemia has been found higher in 13-24 months 58.95% as compared to 6-12 months 54.38%. An undernourished stunted child has been found more severe anemic 4.80% as compared to normal stunted children 1.50. 47.97% undernourished stunted children has been found moderate anaemia 47.97% as compared to normal children 37.69%. [Table 4](#) Shows multinomial regression analysis results on

anaemia status among children (6–59 months) with their background characteristics. Child's age in months is emerging as the most dominant factor affecting severe anaemia among children. As compared to children in age group 25-59 months, children in age group 13-24 months are six times more likely to be severely anemic stunted children have five times more risk of having severe anaemia than normal children. Mothers suffering with anaemia have three times more risk of having severely anemic children than those not suffering from it. Children living in rural areas are twice more likely to be severely anemic than those living in urban areas. Here also, child's age in months is emerging as the most dominant factor affecting moderate anaemia among children. In comparison to children in age group 25-59 months, children in age group 13-24 months are about five times more likely to be moderately anemic stunted children have twice more risk of having moderate anaemia than normal children. Mothers suffering with anaemia have 1.6 times more risk of having moderately anemic children than those not suffering from it. Lastly, in comparison to normal children, those who are underweight are 1.3 times more likely to also be moderately anemic. For mild anaemia also, child's age in months is emerging as the most dominant factor. As compared to children in age group 25-59 months, children in age group 6-12 months are twice more likely to be mildly anemic. Children belonging to families in the lowest wealth quintile have two times more risk of suffering with mild anaemia than those belonging to the highest wealth quintile. A decline in odds ratio is observed with the rise in household wealth. Stunted children have 1.4 times more risk of having mild anaemia than normal children. Mothers suffering with anaemia have 1.3 times more risk of having mildly anaemic children than those not suffering from it

## Discussion

This study was an attempt to give an overview of anemic condition of 6-59 month(s) age old children in a state of Uttar Pradesh and examine the determinants of anemia. The entire exercise has been carried out using the NFHS-3 data. The study reveals that in the state of Uttar Pradesh 73.4% of (6-59) months old children are anemic. Based on different categories of anemia, it is seen that severely anemic children are 3.6%, whereas moderately and mildly anemic children make up

45.0% and 25.4%, respectively. The percentage of anemic children is very high in the age interval of (13-24) months and then it decreases with the age. Age is a biological factor that cannot be controlled. There are many studies that show a nonlinear relation of anemia with age. Prevalence of anemia is very high in the age interval of 6 to 24 months. (13) After 6 months of age, the children are introduced to solid foods and it is evident that from the 6th to 12th month, iron requirement increases with body weight as the infant's weight is tripled by the end of first year of life. For this, sufficient amount of iron is required from food<sup>14</sup>. It is seen that rural children (OR; 1.78, CI 1.12-2.82) are more risk of anemic as compare to the urban children. This may be because of the low availability of iron-rich food in the rural areas especially among poor families. Also, the percentages of poor families are more in the rural areas. In conformity to our finding, several other studies 28-31 carried out on childhood anemia indicated that children living in rural areas were at greater risk of anemia compared to their urban counterparts. While some studies (15-19) reported that there was no association between gender and anemia, others as well as our results showed that male children were at greater risk of anemia than female children (16-20). It is seen that the Muslim children 4.26% are more anemic compared with Hindu children 3.45. Mother's level of education may be considered an important factor for the occurrence of anemia. An increase in the level of education decreases getting the risk of anemia. The literacy factor shows that children of literate mothers were comparatively at lesser risk of severe anemia than children of non-literate mothers but they too were at higher risk of moderate and mild anemia. This confirms the findings of National Family Health Survey-3, which revealed that more than half of the children were anemic even when their mothers had 12 or more years of schooling or were in the highest wealth quintile. The fertility of mother was found to have significant effect on anemia the outcome of our study suggests that socioeconomic factors also influence childhood anemia. From the above discussions, while looking at the determinates associated with anemia; it was found that cause of anemia is multifactorial. Because of the multiple correlates of anemia, multiple strategies may be necessary to combat the problem. However, it is clear that illiteracy, maternal anemia, and low wealth index are the main causes of anemia among

children in state of Uttar Pradesh. The same scenario is seen in the study of Kailali district of Nepal where it was shown that anemic condition of 6- to 23-month-old children can be improved through an integration of improvement of overall socioeconomic condition, including maternal education. (22) This article is among the few that studied socioeconomic determinants of childhood anemia using national level data in India and strongly advocates education of parents and standard of living as the most important factors toward amelioration of anemia. Although Health and nutrition programs exist in rural areas so the emphasis should be given in proper implementation especially for the age-group of 6 to 59 months. Mother's education must be enhanced. This increases the awareness to the causes of anemia of their children.

### Conclusion

This paper evaluated the existing information of childhood anemia in a state of Uttar Pradesh and summarized the available information to present the extent of occurrence of anemia among children aged 6-59 month(s). Results from multivariate logistic regression analysis shows that Children's age, maternal anemia and place of residence of children are most dominant factors affecting all three stages of anaemia among children, followed by child's and mothers nutritional characteristics of the risk of anemia in the target population. Keeping in view the modifiable factors, the main focus of the policy makers may be on child's nutritional status and mother's education .

### Recommendation

As a result, the implication of the problem necessitates additional comprehensive strategy for sustainable long-term approaches, along with short-term measures for immediate prevention and control of anemia. Our study recommends that the high prevalence of mild and moderate anemia demands due emphasis so as to tackle the overall prevalence of anemia among children aged 6 -59 month(s). Children should be periodically screened, and appropriate measures should be taken for detection and preclusion.

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**Tables**

**TABLE 1 PREVALENCE OF ANAEMIA WITH DIFFERENT CHARACTERISTICS**

Gender (%)	Maternal Anaemia (%)	Residence (%)	Birth Order (%)	Size at Birth (%)
<b>Male (72.6)</b>	Present (77.2)	Urban (69.7)	1 (71.4) 2 (72.1)	Small (76.2)
<b>Female (73.4)</b>	Absent (67.8)	Rural (74.6)	3 (73.3) ≥4 (74.2)	Average (71.2) Large (76.3)

**TABLE 2 PREVALENCE OF ANAEMIA IN CHILDREN AGE, WOMEN AND MEN BY STATE OF UTTAR PRADESH**

Anaemia Levels	Severe (%) <7.0 g/dl	Moderate (%) 7.0-9.9 g/dl	Mild (%) 10.0-10.9 g/dl	Any Anaemia (%) <11.0 g/dl
<b>Children (6-59) M</b>	3.6	45.0	25.4	73.9
<b>Women (15-49) Y</b>	1.6	13.2	35.1	49.9
<b>Men (15-49) Y</b>	2.0	10.4	11.9	24.3

**TABLE 3 PREVALENCE AND ASSOCIATED FACTORS OF ANAEMIA AMONG CHILDREN BY THEIR BACKGROUND CHARACTERISTICS**

S. N.	Variables	Anaemia levels				Total	%	χ <sup>2</sup> value
		Severe <7.0 g/dl	Moderate 7.0-9.9 g/dl	Mild 10.0-10.9 g/dl	No			
<b>Child's age(months)* (N=4556)</b>								
1	6-12	11(2.29)	261(54.38)	136(28.33)	72(15.00)	480	10.54	262.21
2	13-24	61(5.91)	609(58.95)	222(21.49)	141(13.65)	1033	22.67	
3	25-59	93(3.06)	1142(37.53)	788(25.90)	1020(33.52)	3043	66.79	
<b>Stunting* (N=4361)</b>								
4	Undernourished	123(4.80)	1229(47.97)	633(24.71)	577(22.52)	2562	58.75	115.05
5	Normal	27(1.50)	678(37.69)	474(26.35)	620(34.46)	1799	41.25	
<b>Underweight* (N=4361)</b>								
6	Undernourished	80(4.42)	891(49.17)	454(25.06)	810(31.78)	1812	41.55	71.61
7	Normal	70(2.75)	1016(39.86)	653(25.62)	387(21.36)	2549	58.45	
<b>Wasting* (N=4361)</b>								
8	Undernourished	20(3.87)	247(47.78)	149(28.82)	101(19.54)	517	11.86	18.62
9	Normal	130(3.38)	1660(43.18)	958(24.92)	1096(28.51)	3844	88.14	
<b>Mother's nutritional status(BMI)* (N=4504)</b>								
10	≤ 18.49	62(3.99)	731(47.04)	388(24.97)	373(24.00)	1554	34.5	262.21
11	18.50-24.99	90(3.57)	1096(43.47)	634(25.15)	701(27.81)	2521	55.97	
12	≥ 25.00	10(2.33)	161(37.53)	110(25.64)	148(34.50)	429	9.53	
<b>Mother's anemic status* (N=4487)</b>								
13	Anemic	114(4.72)	1147(47.48)	604(25.00)	551(22.81)	2416	53.84	65.09
14	Normal	50(2.41)	835(40.32)	520(25.11)	666(32.16)	2071	46.16	
<b>Size at birth* (N=4553)</b>								
15	Small	49(5.72)	395(46.09)	209(24.39)	204(23.80)	857	18.82	27.65

16	Average	89(2.90)	1321(43.00)	781(25.42)	881(26.68)	3072	67.47	
17	Large	27(4.33)	293(46.96)	156(25.00)	148(23.72)	624	13.71	
<b>Residence* (N=4556)</b>								
18	Urban	74(4.85)	610(40.00)	379(24.85)	462(30.30)	1525	33.47	27.51
19	Rural	91(3.00)	1402(46.26)	767(25.31)	771(25.44)	3031	66.53	
<b>Religion (N=4547)</b>								
20	Hindu	119(3.45)	1493(43.31)	878(25.47)	957(27.76)	3447	75.81	11.75
21	Muslim	46(4.26)	507(46.99)	264(24.47)	262(24.28)	1079	23.73	
22	Others	0(0)	9(42.86)	3(14.29)	9(42.86)	21	0.46	
<b>Type of Caste/tribe (N=4553)</b>								
23	SC	47(4.23)	490(44.10)	288(25.92)	286(25.74)	1111	24.4	9.95
24	ST	3(6.25)	22(45.83)	14(29.17)	9(18.75)	48	1.05	
25	OBC	82(3.62)	1001(44.17)	578(25.51)	605(26.70)	2266	49.77	
26	None	33(2.93)	496(43.97)	266(23.58)	333(29.52)	1128	24.78	
<b>Birth Order (N=4556)</b>								
27	1	35(3.42)	435(42.48)	261(25.49)	293(28.61)	1024	22.48	9.68
28	2	32(3.09)	453(43.68)	263(25.36)	289(27.87)	1037	22.76	
29	3	39(5.10)	337(44.05)	185(24.18)	204(26.67)	765	16.79	
30	≥4	59(3.41)	787(45.49)	437(25.26)	447(25.84)	1730	37.97	
<b>Wealth Index* (N= 4556)</b>								
31	Poorest	25(2.43)	492(47.77)	284(27.57)	229(22.23)	1030	22.61	58.16
32	Poorer	40(3.79)	483(45.78)	272(25.78)	260(24.64)	1055	23.16	
33	Middle	40(4.54)	408(46.26)	204(23.13)	230(26.08)	882	19.36	
34	Richer	30(3.68)	347(42.52)	196(24.02)	243(29.78)	816	17.91	
35	Richest	30(3.88)	282(36.48)	190(24.58)	271(35.06)	773	16.97	
<b>Mother's Educational status* ( N=4556)</b>								
36	No education	103(3.71)	1298(46.71)	682(24.54)	696(25.04)	2779	61	41.46
37	<5 Years	5(3.47)	69(47.92)	34(23.61)	36(25.00)	144	3.16	
38	5-7 Years	22(5.15)	177(41.45)	113(26.46)	115(26.93)	427	9.37	
39	8-9 Years	15(3.13)	200(41.67)	130(27.08)	135(28.13)	480	10.54	
40	10-11 Years	8(3.35)	86(35.98)	59(24.69)	86(35.98)	239	5.25	
41	≥ 12 Years	12(2.46)	182(37.37)	128(26.28)	165(33.88)	487	10.69	

**TABLE 4 MULTINOMIAL REGRESSION ANALYSIS RESULTS ON ANAEMIA STATUS AMONG CHILDREN BY THEIR BACKGROUND CHARACTERISTICS**

Anemic status	Severe <7.0 g/dl			Moderate 7.0-9.9 g/dl			Mild 10.0-10.9 g/dl		
	β	Exp (β)	95 % CI for Exp (β)	β	Exp (β)	95 % CI for Exp (β)	β	Exp (β)	95 % CI for Exp (β)
<b>Child's age in months (Ref.Cat: 25-59)</b>									
13-24	1.8	6.05	4.04-9.04	1.5	4.47	3.60-5.55	1.03	2.2	1.72-2.81
<b>Stunting (Ref. Cat: No)</b>									
Yes	1.58	4.83	2.95-7.93	0.6	1.82	1.50-2.20	0.66	1.93	1.29-2.91
<b>Maternal Anaemia (Ref. Cat: No)</b>									
Yes	1.02	2.77	1.89-4.05	0.46	1.59	1.36-1.85	0.36	1.43	1.16-1.76
<b>Place of residence (Ref. Cat: Urban)</b>									
Rural	0.58	1.78	1.12-2.82	0.25	1.29	1.05-1.57	0.29	1.33	1.12-1.58
Intercept	-4.4			-0.62			-0.72		