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Prevalence of anemia and factors associated with anemia among children of age 6-59 months in Maharashtra: Evidence from NFHS-5

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Abstract

Childhood anemia is a significant health concern with multifaceted risk factors that necessitate targeted interventions. This study aimed to examine the prevalence of anemia among children aged 6-59 months in Maharashtra, India, and explore its associated factors. Using data from the National Family Health Survey-5 (NFHS-5), the prevalence of anemia for the children of age 6-59 months were found to be high, with an overall rate of 74% among children in the state. Comparisons with the earlier NFHS-4 survey revealed an increase in anemia prevalence, indicating a growing burden over time. Factors such as maternal anemia, place of residence, maternal age, specific castes, and lower wealth index were significantly associated with higher odds of anemia among children. Interestingly, variables like maternal education and number of household members showed no significant associations. These findings underscore the need for targeted interventions to address anemia's prevalence and associated factors, providing valuable insights for policy-makers and program implementers to improve child health and nutrition outcomes in Maharashtra.

Keywords: Childhood anemia, schistosomiasis, hookworm disease, Hemolytic anaemia

Introduction

Anaemia is a common problem in children. A child who has anaemia doesn't have enough red blood cells or hemoglobin. There are many types of anaemia such as Iron deficiency anaemia, Megaloblastic anaemia, Hemolytic anaemia, Sickle cell anaemia, Cooley's anaemia (Thalassemia), Aplastic anaemia. Iron deficiency anaemia is more prevalent in developing countries than in developed countries, affecting around 36% of the population. Factors such as malaria, hookworm disease, and schistosomiasis also contribute to the prevalence. In Africa, Asia, and some Pacific islands, congenital haemolytic diseases like sickle-cell anaemia and thalassemia may also impact the population. Approximately 700-800 million people worldwide are affected by iron deficiency anaemia, but this estimate is conservative and likely higher. Iron deficiency anaemia is a gradual decline in haemoglobin levels, affecting health and physical endurance, even if individuals do not meet the criteria for being classified as anaemic (World Health Organization, 1989) [13]. Anaemia prevalence in young children continues to remain over 70% in most parts of India and Asia despite a policy being in place and a program that has been initiated for a long time. The irreparable damage that anaemia in childhood can cause particularly to the development of a young child on one hand and the knowledge and mechanism available for its control on the other, makes this silent morbidity completely unacceptable in modern times where we strive for millennium development Goal 4 (Prakash V Kotecha, 2011) [10].

Maternal anaemia and communities with a significant proportion of women affected by anaemia have negative implications for childhood anaemia that extend beyond the pregnancy period. One plausible explanation is that mothers experiencing anaemia are more likely to reside in impoverished households or communities, which serve as indicators of socioeconomic disadvantage.

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As a result, these mothers may encounter difficulties in affording and supplying nutritious food for both themselves and their children, leading to anaemia caused by insufficient consumption of iron and other nutrient-rich foods. (Ngwira A *et al.*, 2015) [7]. Additionally, low levels of essential minerals such as iron, zinc and folate as well as vitamin A and B12 in the breast milk of the anaemic mother could also affect the Hb level of the breastfeeding child (Wang J *et al.*, 2015) [4].

Malnutrition is highly prevalent among children below the age of five in all states of India, especially in those states with poor demographic and socioeconomic indicators. Approximately 66.9% of children under the age of 5 exhibited signs of anaemia. (NNMB, 2003) [6]. Iron deficiency anaemia (IDA) is a common issue in this population, caused by various factors such as insufficient dietary intake of iron (less than 20 mg/day) and folic acid (less than 70 mg/day), as well as chronic blood loss due to infections like malaria and hookworm infestations (GS Toteja *et al.*, 2004) [12]. In a study examining the socioeconomic and demographic factors contributing to anaemia among Indian children aged 6-59 months, it was discovered that the prevalence of anaemia exhibited an ascending trend up to the age of two years, followed by a subsequent decline (Goswami *et al.*, 2015) [2]. After studying the trend in prevalence of anaemia and low BMI among pregnant women from Eastern Maharashtra and evaluate if low BMI and anaemia affect pregnancy outcomes, it is found out that maternal anaemia is associated with enhanced risk of stillbirth, neonatal deaths and LBW. The risks are increased if anaemia and underweight were present simultaneously (Archana Patel *et al.*, 2018) [1].

The study examined the occurrence, seriousness, and factors that contribute to iron deficiency anaemia (IDA) in young children (Aged 6-59 months) who come from well-off families in Kerala. The findings revealed a significant prevalence of IDA in these seemingly healthy children, suggesting that the rates among the overall population are likely to be even higher. This research emphasizes the importance of conducting additional intervention trials focused on providing iron-rich or iron-fortified foods, or administering iron supplementation, particularly for children under the age of two (Jijo Joseph John *et al.*, 2018) [5]. As per the National Family Health Survey (NFHS-5) conducted in the period of 2019-2020, the prevalence of anaemia among children below the age of five in India stands at 67.1%. In contrast, the preceding National Family Health Survey (NFHS-4) conducted during 2015-2016 reported a higher occurrence of anaemia among children under five in India, at 58.6%. Upon analyzing the situation in Maharashtra, the NFHS-5 Survey uncovered a rise in the incidence of anaemia among children aged 6-59 months, in contrast to the findings from the NFHS-4 survey.

These figures indicate an escalation in anaemia prevalence among children across both India during the transition from NFHS-4 to NFHS-5. This points to a growing burden of anaemia among young children over time, signifying an ongoing challenge in public health. It underscores the imperative for well-devised interventions and strategies to effectively address anaemia, thereby enhancing child health and nutritional outcomes within the nation. This study is essential to identify the prevalence of anaemia among

children of age 6-59 months in Maharashtra and also assess the factors influencing.

Objectives: The specific objectives of this study are to:

1. To assess the prevalence of anaemia among children of age 6-59 months in Maharashtra
2. Explore the factors associated with anaemia among children of age 6-59 months Maharashtra.

Methods

National Family Health Survey-5 dataset of the year 2020-21 for Maharashtra state is used for this study. WHO classification of anemia is was taken for this study such as, Haemoglobin level is below 7 g/dl, it causes Severe Anaemia, Haemoglobin level is between 7-9.9 g/dl, it causes Moderate anaemia. Haemoglobin level is between 10-10.9 g/dl, it indicates that there is Mild Anaemia and if Haemoglobin level is above 11 g/dl it indicates that there is no anaemia. Level of anaemia is taken a dependent variable for this study. Independent variables used in this study to understand the extend and differentials in the level of anaemia among children aged 6-59 months are age of mother, place of Residence, Religion, Caste, Number of Household members, Educational Attainment of mother, Wealth Index, Number of Living Children, Duration of Breastfeeding, intake of Iron tablets by mother during pregnancy and Anaemia level of mother. Bivariate as well as Multivariate methods were applied to identify the factors affecting Anaemia and independent predictors of anaemia. Chi Square test and Odds ratio with 95% CI were used to test for the significance of each of the potential risk factor of anaemia level in children of age 6-59 months. Multivariate logistic regression is used to find independent predictors of presence of anaemia in children of age 6-59 months. $p < 0.05$ was considered the threshold for statistical significance. Statistical analyses were performed by using a statistical software package SPSS, version 20.0.

Result

Background characteristics of infants and their mother were presented in Table 1. For family background, it was observed that nearly 70% of the families resided in rural areas. Approximately three-fourths of the families were from Hindu religion, and around 81% of the families belonged to the SC category. More than 40% of the families had the Richer/Richest Wealth Index. From the background characteristics of mothers, it was noted that roughly 60% of mothers were in the age group of 25-34. Approximately 62% of the mothers had incomplete secondary education, while only 17.1% had higher education qualifications. Over 60% of the mothers had more than two living children.

During pregnancy, 87% of the mothers had been administered iron tablets, and only 34% of the mothers had anaemia. In relation to the background characteristics of children, it was found that about 50% of them were still breastfeeding.

Anaemia level of children of age 6-59 month is presented in Figure 1. It had been observed that among the 6091 children aged 0-59 months, 41.7% of them had Mild anaemia, 28.9% had Moderate Anaemia, 26.4% showed no signs of Anaemia, and only 3% were diagnosed with Severe Anaemia.

Table 1: Percentage distribution of the sample according to background characteristics of child and parent

Background characteristics		Count	Percent
Age of mother	15-24	2603	34.3
	25-34	4486	59.2
	35-49	494	6.5
Place of residence	Urban	2328	30.7
	Rural	5255	69.3
Religion	Hindu	6061	79.9
	Muslim	980	12.9
	Buddhist / Neo-Buddhist	453	6.0
Caste	Other	89	1.2
	SC	6117	80.9
	ST	1000	13.2
Number of household members	Others	443	5.9
	1-5	3294	43.4
	6-10	3737	49.3
Educational attainment of mother	> 10	552	7.3
	No education	537	7.1
	Incomplete primary	634	8.4
	Incomplete secondary	4704	62.0
	Complete secondary	413	5.4
Wealth index	Higher	1295	17.1
	Poorest	833	11.0
	Poorer	1469	19.4
	Middle	1925	25.4
	Richer	2025	26.7
Number of living children	Richest	1331	17.6
	1	2812	37.3
	2	3196	42.4
Duration of breastfeeding	> 2	1530	20.3
	Never breastfed	440	5.8
	< 12 months	913	12.1
	> =12 months	2457	32.7
During pregnancy, given or bought iron tablets/syrup	Still breastfeeding	3714	49.4
	No	934	12.7
Maternal Anaemia	Yes	6433	87.3
	Yes	2540	33.5
	No	5043	66.5

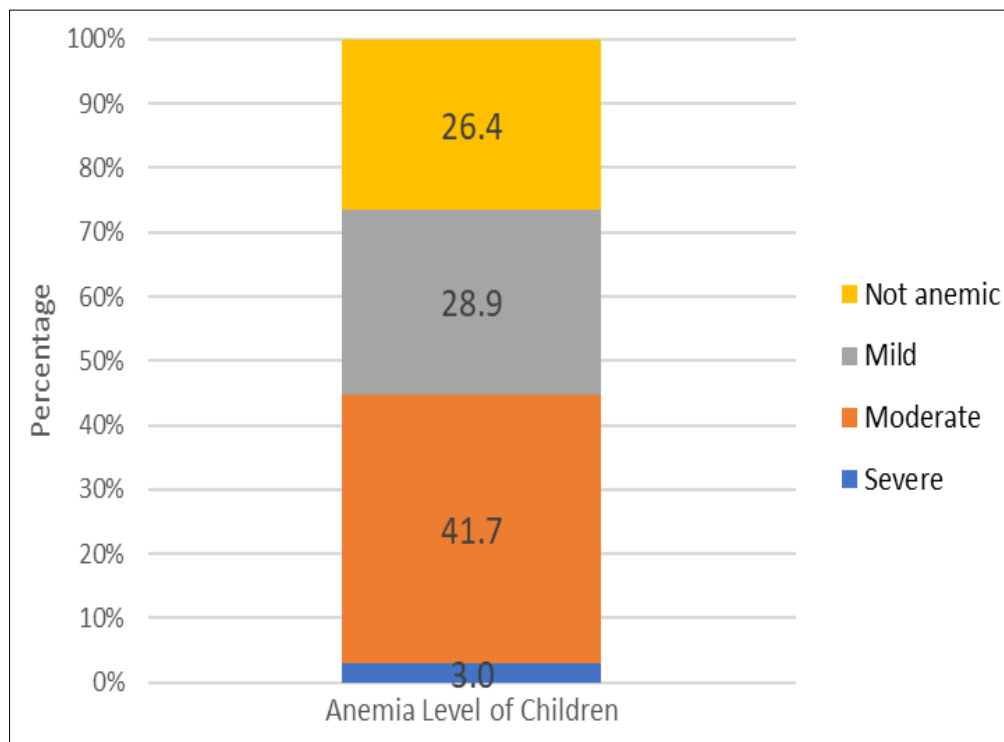


Fig 1: Percentage distribution of the sample according to Anaemia leve

Overall prevalence of anaemia among children in the age of 6-59 month in Maharashtra is 73.6%, 95% confidence interval indicated that the prevalence of anaemia in children would be within the range of 72.5% - 74.7%.

Test for association on selected independent factors with the Anaemia level of children is presented in Table 2. It was observed that factors such as age of mother, place of residence, caste, wealth index, duration of breastfeeding, and maternal anaemia, showed significant association with anaemia level of children. It had been observed that 74.7% of children from rural areas had anaemia, and they had 1.20 times higher odds of experiencing anaemia compared to children from urban places. Among children born in the ST category, 79.8% were found to have anaemia, and they had

1.794 times higher odds of having anaemia compared to children from other castes. Children from the poorest Wealth Index had the highest number of anaemia cases, accounting for 81.3% of the cases, and they had 1.728 times higher odds of having anaemia compared to children from a richer wealth index. For mothers aged 15-24, 79% of them had children with anaemia, and these children had 2.066 times higher odds of experiencing anaemia compared to mothers in the age group greater than 34. 80.4% of the children were born to mothers who exhibited anaemia, and they had 1.725 times higher odds of having anaemia when compared with children born to mothers who don't have anaemia. 81.4% of the children who were still breastfeeding showed a higher prevalence of anaemia compared to other children

Table 2: Association of presence of anaemia among children with selected variables

		Yes		No		p	Odds (95% CI)
		Count	Percent	Count	Percent		
Age of mother	15-24	1520	79	403	21	p<0.01	2.06(1.645-2.595)
	25-34	2692	71.8	1055	28.2		1.39 (1.131-1.728)
	>34	272	64.6	149	35.4		1
Place of residence	Urban	1305	71.1	531	28.9	p<0.01	1
	Rural	3179	74.7	1076	25.3		1.20(1.06-1.36)
Caste	SC	3607	72.9	1339	27.1	p<0.01	1.22 (0.962-1.555)
	ST	636	79.8	161	20.2		1.79 (1.344-2.396)
	Others	229	68.8	104	31.2		1
Religion	Hindu	3624	73.7	1292	26.3	0.497	1.40(0.78-2.53)
	Muslims	536	72	208	28		1
	Buddhist / Neo-Buddhist	269	74.3	93	25.7		1.47(1.22-1.76)
	Others	55	79.7	14	20.3		0.82(0.64-1.04)
Household members	1-5	1982	72.9	737	27.1	0.517	1
	6-10	2198	74.2	764	25.8		1.07(0.95-1.20)
	More than 10	304	74.1	106	25.9		1.07(0.84-1.35)
Educational attainment of Mother	No education	328	75.6	106	24.4	0.193	1
	Incomplete primary	385	76.5	118	23.5		1.05(0.78-1.42)
	Incomplete secondary	2782	73.3	1012	26.7		0.89(0.71-1.12)
	Complete secondary	266	75.8	85	24.2		1.01(0.73-1.06)
	Higher	723	71.7	286	28.3		0.82(0.63-1.06)
Wealth index	Poorest	535	81.3	123	18.7	p<0.01	1.72 (1.397-2.138)
	Poorer	908	76	286	24		1.26 (1.078-1.476)
	Middle	1103	72	428	28		1.02 (0.891-1.177)
	Richer	1938	71.6	770	28.4		1
Number of Living Children	1	1624	74.4	559	25.6	0.473	1.10(0.94-1.29)
	2	1945	73.5	701	26.5		1.05(0.91-1.22)
	>2	915	72.5	347	27.5		1
Duration of Breastfeeding	Never Breastfed	193	69.2	86	30.8	p<0.01	1
	< 12 months	538	69.8	233	30.2		1.03(0.77-1.39)
	> = 12 months	1507	66.2	771	33.8		0.87(0.67-1.14)
	Still Breastfeeding	2226	81.4	510	18.6		1.95(1.48-2.55)
During pregnancy, given or bought iron tablets/syrup	No	531	72.6	200	27.4	0.495	1
	Yes	3853	73.8	1366	26.2		1.06(0.89-1.26)
Maternal Anaemia	Yes	1600	80.4	391	19.6	p<0.01	1.73 (1.516-1.964)
	No	2884	70.3	1216	29.7		1

The background characteristics such as Religion, Number of Household members, educational attainment of mother, Number of Living Children and During pregnancy, given or

bought iron tablets/syrup are not significantly associated with level of anaemia in children.

Table 3: Independent predictors of presence of anaemia in children of age 6-59 month

		B	S.E	P	Odd's Ratio (95% CI)
Age of Mother (> 34)	15-24	0.537	0.121	0.000	1.712 (1.350-2.171)
	25-34	0.301	0.112	0.007	1.351 (1.085-1.682)
Place of residence (Rural)	Urban	0.029	0.070	0.678	1.030 (0.897-1.182)
Caste (Others)	SC	0.172	0.126	0.173	1.188 (0.927-1.521)
	ST	0.346	0.156	0.026	1.414 (1.042-1.918)
Wealth index (Richer/Richest)	Poorest	0.382	0.120	0.001	1.466 (1.159-1.855)
	Poorer	0.124	0.087	0.153	1.133 (0.955-1.343)

	Middle	-0.036	0.076	0.635	0.965 (0.832-1.119)
Duration of Breastfeeding (Never Breastfed)	< 12 months	0.076	0.154	0.619	1.079 (0.799-1.459)
	> = 12 months	-0.094	0.139	0.501	0.911 (0.693-1.196)
	Still Breastfeeding	0.640	0.141	0.000	1.896 (1.440-2.497)
Maternal Anaemia (No)	Yes	0.528	0.068	0.000	1.695 (1.485-1.935)

Nagelkerke R Square = 0.066

Multiple Logistic Regression was used to find out independent predictors for presence of anaemia in children of age 0-59 months and the result is presented in Table 3. The presence of anaemia among children is taken as the dependent variable and variables which were found significant association with presence Anaemia among children in Bivariate analysis were taken as independent variables. Independent variables taken for the study are Age of Mother, Place of residence, Caste, Wealth Index, Duration of Breastfeeding and Maternal Anaemia. Multiple Logistic Regression with Enter method was used for analysis. It was observed that age group of mothers, caste, wealth index, duration of breast feeding and maternal anaemia are significant independent predictors of presence of anaemia in children. It was observed that children born to women of age group 15-24 had 1.712 higher odd times of having anaemia compared to women of age group greater than 34, and children born to women of age group 25-34 had 1.351 higher odd times of having anaemia compared to women of age group greater than 34. Families of ST category had 1.414 times higher odds of having anaemia in children compared to families of other caste. Similarly, families having Poorest wealth index had 1.466 times higher odds of having anaemia in children compared to families having Richer/Richest wealth index. Children who are still breastfeeding had 1.896 times higher odds of having anaemia compared to children who never breastfed. Mothers who had anaemia had 1.695 odd times higher of having anaemia in children compared to mothers who don't have anaemia.

Discussion

The identification of risk factors plays a crucial role in the formulation and implementation of programs aimed at eliminating childhood anaemia, especially in populations where its occurrence is notably elevated. Research findings highlight a significant prevalence of anaemia among children in Maharashtra, with an overall rate of nearly 74%. Examination of data from the NHFS-4 survey revealed an anaemia prevalence rate of only 53.8% among children. Consequently, it can be deduced that there has been a rise in the proportion of anaemia cases among children aged 6-59 months. This result proves that necessary actions should be taken to reduce the prevalence of anaemia in children, given the observed upward trend over the years. According to the All India NFHS-5 survey, approximately 67% of children were found to have anaemia. It had been observed that the highest prevalence of anaemia was recorded in Ladakh, at around 93%, while the lowest was in Kerala, at approximately 39%. Additionally, Maharashtra stands out as one of the states with the highest prevalence of anaemia, surpassing other states in this regard.

Through the bivariate analysis it was found that presence of anaemia is significantly associated with age of mother, place of residence, caste, wealth index, duration of breastfeeding and maternal anaemia and variables such as number of household members, educational attainment of mother, number of living children and intake of iron tablets during pregnancy were not associated with presence of anaemia.

N Sinha, *et al.* it had been observed that caste, socio-economic status, nutritional status of mother, education of mother are statistically significant with anaemia level of children. Similar finding was observed in the present study. Wealth Index is found associated with level of anaemia in this present study, whereas Sanku Dey *et al.*, had been observed a contradictory finding that household living standard is not associated with level of anaemia.

The study's findings reveal a pervasive health issue of anaemia throughout the state of Maharashtra. The observations highlight the influence of diverse familial backgrounds, maternal aspects, and infant factors on the levels of anaemia in children. These insights offer valuable guidance for policy-makers, program planners, and implementers striving to address and mitigate childhood anaemia within the context of Maharashtra.

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