Original Article

Prevalence of anaemia among rural pre-school children of Maharashtra, India

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Abstract

Background: Anaemia continues to be a severe public health nutritional problem in India affecting all physiological groups, even after the National Nutritional Anaemia Prophylaxis Programme has been in operation for more than three decades.

Objective: To assess the prevalence of anaemia among rural pre-school (1-5-years) children of Maharashtra.

Methods: A community based cross-sectional study was carried by National Nutrition Monitoring Bureau (NNMB) covering a total of 404 (Boys-243; Girls-161) pre-school children. Information of socio-demographic particulars was obtained and the finger prick blood samples were collected for the estimation of haemoglobin levels by cyanmethmoglobin method.

Results: The result shows that 59.2 % (CI: 54.4-64.0) of the rural pre-school children of Maharashtra were anaemic, and the prevalence was significantly ($p<0.001$) higher (76.5% with CI: 68.1-84.9) among 1-3-year children as compared to 53.6% in 4-5-year- children. Stepwise Logistic regression analysis also revealed that the risk of anaemia in 1-3-year-age group was three times higher (OR= 2.8; 95% CI: 1.6-4.7).

Conclusion: Anaemia was severe public health nutritional problem (>40%) among rural pre-school children of Maharashtra. Therefore, appropriate intervention measures such as supplementary iron & folic acid, periodic deworming and health & nutrition education should be strengthened. The community needs to be encouraged to diversify their diets by consuming iron rich foods.

Keywords: Anaemia, Pre-school children, Maharashtra, Micronutrients.

Introduction

Micronutrient deficiencies of Iron, vitamin 'A', and Iodine are the major public health nutritional problems world-wide, especially in developing countries[1]. As reported by the World Bank[2], the combined economic cost of iron deficiency anemia (IDA), vitamin 'A' deficiency (VAD) and iodine deficiency disorders (IDD) contribute to as much as 5% of gross domestic product of developing countries. Micronutrient deficiencies continue to be of public health significance in India[3], and it costs 0.8% to 2.4% of the gross domestic product of India[4]. Iron deficiency anaemia is the most frequently occurring nutritional disorder worldwide[5] and is affecting almost all physiological groups; of them pre-school children, pregnant women and lactating mothers are most vulnerable[6]. About 60-70% of children below 6 years of age were suffering from various degrees of anaemia[7]. Similarly, as per for NFHS-2[8] survey 74% of children of 6 – 35 months were anaemic. Iron deficiency in young children can impair their physical growth and cognitive functions such as learning memory and attention process[9-11], and adversely increase the childhood morbidity and mortality[12].Anaemia continues to be a severe public health nutritional problem in India[7, 8], even after the National Nutritional Anaemia Prophylaxis Programme[13] has been in operation for more than 30years.

Studies on the prevalence of anaemia among rural pre-school children (1-5 years), with representative sample for many States are not readily available. Such studies would be useful for the State Governments for the planning and development of health and nutrition intervention programmes aimed at target segments of the population, especially pre-school children, for the control and prevention of anaemia. Keeping in view of the magnitude of the problem, National Nutrition Monitoring Bureau (NNMB) has carried out a survey in rural areas of Maharashtra with the objective to study the prevalence of anaemia among pre-school children, covering a representative sample for the State.

Material & methods

Sampling design

A population based cross-sectional study adopting multi stage stratified random sampling procedure was carried out in rural area of Maharashtra during 2003. The villages covered by National Sample Survey Organisation[14], for its 54th round of consumer expenditure survey formed the sampling frame. The NSSO divided the State into different Strata based on agro-climatic variables. Each district or part of the district with a population of 1.8 million was considered as one stratum. If the districts had more than 1.8 million population, they were divided into two or more strata depending on their population size. Thus, each state was divided into several strata. Of them a total of 16 strata were selected randomly from the State, and a sub-sample of 80 villages @ 5 villages per stratum was selected randomly from 16 strata.

Sample size

Assuming the prevalence of anaemia in pre-school children as 70% [7], and considering the 95% confidence interval

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(CI), 90% power and relative precision of 10%, a sample size covered due to some constraints during the survey.

Selection of subjects

The sample size to be covered from each of the selected village was determined on the basis of proportion to population size (PPS) method. For this purpose, each selected village was divided into five geographical areas based on natural groups of houses or streets. Households (HHs) belonging to SC/ST community, who generally live as a group, constituted one of the five areas. All HHs in each geographical area were enumerated, and all the pre-school children in each geographical area were allotted serial numbers. The required number of pre-school children to be covered in each geographical area was determined on the basis of (PPS) total sample to be covered from the village and the total number of pre-school children in a given area. In each geographical area, the first HH having pre-school child was selected randomly and HHs were surveyed continuously till the required number of pre-school children covered.

Ethical Clearance

The study was approved by the scientific advisory committee (SAC) of Indian Council of Medical Research (ICMR). Ethical clearance was obtained from National Institute of Nutrition's ethical review board. Written informed consent was obtained from the parents.

Data collection

The information of household (HHs) socio- demographic particulars were collected, and finger prick blood samples were collected to estimate hemoglobin levels. Knowledge and practice of mothers of alternate pre-school child covered for estimation of hemoglobin on anaemia and receipt & consumption of iron and folic acid (IFA) tablets was also collected.

Blood sample collection and standardization

Finger prick blood sample of 20µL was collected using fixed volume Finn pipette. Hemoglobin was estimated by cyanmethaemoglobin method using colorimeter[15].WHO[16], cut-off value of <11g/dL of haemoglobin was considered as anaemia in pre-school children of 1- 5 years. Trained medical officer, nutritionist and sociolworker of NNMB, Maharashtra State unit, collected the data. All the investigators were trained in estimation of haemoglobin.

Statistical Analysis:

The data was analyzed by using Statistical Package for Social Sciences; windows version 15.0[17]. The mean heamoglobin values with 95% CI were calculated according to age and gender and these mean values were compared by 't' test. The percent prevalence of anaemia by age and sex was analyzed. Chi-square ($\chi 2$) test was performed to study the association between the prevalence of anaemia and different socio-demographic variables. To identify the best set of socio-demographic variables, those are associated with the prevalence of anaemia, the multivariate analysis i.e. step-wise logistic regression was performed.

Results

Prevalence of Anaemia

The mean and 95% CI of haemoglobin values among the pre-school children by age and gender are presented in Table 1. The mean haemoglobin level among the children of 1-5 years was 10.4 g/dL (CI: 10.2-10.6), with 9.6 g/dL (9.3-9.9) in 1-3 year and 10.6 g/dL (10.4-10.8) in 4-5 year-age group. The mean haemoglobin values are significantly ($p<0.01$) different between different age groups, however no gender differentials were observed.

Prevalence of anaemia among rural pre-school children by age group and gender is presented in Table 2. The overall prevalence of anaemia was about 59% (CI: 54.3-63.9), and relatively a higher (63%) proportion of girls were anaemic compared to boys (57%). The prevalence of anaemia was decreased with increase in age where significantly ($p<0.01$) a higher proportion (90.9%) of 1+ year- children were anaemic compared to the children of 4+ years (48.1%).

Anaemia vs. Socio-economic variables:

Association between the prevalence of anaemia and different socio-demographic variables is presented in Table 3. The prevalence of anaemia was significantly higher in 1-3-year age group compared to children of 4-5-year age group. Though, statistically not significant, the prevalence of anaemia was relatively higher (72.5%) among the children of scheduled tribe compared to the children of other communities. In general, no significant ($p>0.05$) differences were observed in the prevalence of anaemia with respect to father's occupation, literacy status of mother and presence of sanitary latrine. Stepwise logistic regression analysis revealed that the age group of children was significantly correlated with the high prevalence of anaemia, where the risk anaemia in 1-3-year-age group was three times higher (OR= 2.8; 95% CI: 1.6-4.7) compared to 4-5 year-age group.

Supplementation of Iron and Folic Acid (IFA) tablets:

Only, 12% of the pre-school children reportedly received IFA tablets. However, the proportion of children who received ≥90 IFA tablets was very low (3.5%). Majority of mothers (44%) of pre-school children stated that the reason for partial or non-receipt of IFA tablets was that the IFA tablets were not offered by the health worker, followed by not aware of the programme and not received the next supply (12% each) and fear of side effects. The proportion of women who received health and nutrition education regarding signs and symptoms, consequences, prevention and control of anaemia was only 15%.

Table: 1
Mean values of (%) of Haemoglobin by age group and gender

Age group (Yr)	n	Mean	95% CI*	P Value
1-3	98	9.6	9.3-9.9	0.000
3-5	306	10.6	10.4-10.8	
Pooled	404	10.4	10.2-10.6	
Gender				
Boys	243	10.4	10.2-10.7	0.204
Girls	161	10.2	9.9-10.5	

*CI: Confidence Interval

Table: 2
Prevalence (%) of anaemia among rural pre-school children by age group and gender

Age (yrs)	**n**	**Normal**	**Mild**	**Moderate**	**Severe**	**Total Anaemia**	**95% CI**
1+	22	9.1	18.2	68.2	4.5	90.9	78.9-102.9
2+	76	27.6	14.5	53.9	3.9	72.4	62.3-82.5
3+	119	37.8	22.7	36.1	3.4	62.2	53.5-70.9
4+	187	51.9	21.9	24.1	2.1	48.1	40.9-55.3
Pooled	404	40.8	20.5	35.6	3.0	59.2	54.4-64.0
1-3	98	23.5	15.3	57.1	4.1	76.5	68.1-84.9
3-5	306	46.4	22.2	28.8	2.6	53.6	48.0-59.2
Gender							
Boys	243	43.2	21.8	32.1	2.9	56.8	50.6-63.0
Girls	161	37.3	18.6	41.0	3.1	62.7	55.2-70.2

CI: Confidence Interval
Significance levels are two-tailed

Table 3. Association [a] between Anaemia and different socio economic variables

Variable	**n**	**Anaemia**	**P-value [b]**
Community			
Schedule Tribe	40	72.5	0.296
Schedule Caste	99	59.3	
OBC [c]	189	56.1	
Others [d]	76	59.2	
Age(yrs)			
1-3	98	76.5	0.000
3-5	306	53.6	
Occupation			
Labours	184	60.3	0.925
Agriculturists	131	56.5	
Artisans	10	60.0	
Others	79	60.8	
Family size			
< 4	124	64.5	0.252
5-7	223	55.6	
≥ 8	57	61.4	
Female Literacy			
Illiterate	164	57.9	0.677
Literate	240	60.0	
Sanitary latrine			
Absent	354	58.5	0.457
Present	50	64.0	

a Chi-square
b Significance levels are two-tailed
c Other Backward Caste
d Others=Forward caste

Discussion

This study revealed that 59% of pre-school children of rural areas of Maharashtra were anaemic, indicating the prevalence of anemia is a severe public health nutritional problem (40%)[16] in rural Maharashtra. However, the prevalence was marginally low when compared to the figures reported for rural pre-school children of India[18] and West Bengal[19, 20]. The corresponding figures for pre-school children of Africa and Asia were 64.6% and 47.7%, respectively[21].

The prevalence of anaemia was significantly ($p < 0.001$) higher among 1-3- year- children compared to the prevalence in 3-5- year-children. Similar findings were reported by McLean *et al*[21]. The prevalence of anaemia among 1-3- year age group is comparable with the figures reported by NFHS-2[8], while, it was lower reported NFHS-3[22] for rural India. We may attribute this to poor maternal iron stores during pregnancy and lactation, rapid growth, poverty and delayed initiation of complementary foods. We may also attribute it to longer duration of exclusive or predominant breast-feeding in rural areas, which causes increased risk for iron deficiency in 1-3- year children[23].

One of the reasons for this high prevalence of anaemia among the pre-school children could be attributed to poor dietary intakes of iron. According to NNMB survey[24], the rural pre-school children of Maharashtra were subsisting on inadequate diets, where the median intake of iron was deficit by 65-67% as against the recommended dietary allowances[25], and about 75% children were consuming inadequate (<70% of RDA) amounts of iron. The NNMB survey also reported the poorer intakes of meat and other flesh foods (7-9g), the rich sources of heme iron by the pre-school children of rural Maharashtra. This correlates with observations made by Allen et al[26], who reported high prevalence of anaemia in countries such as India and sub-Saharan Africa, where the meat consumption, the source of heme iron was low.

In 1991, the Government of India included pre-school children (1-5 years) as beneficiaries for iron-folate supplementation in its "National Nutritional Anaemia Control programme"[27]. However, in rural Maharashtra, the coverage of pre-school children under this progamme was very poor, where only 3.5% of the pre-school children reportedly received stipulated number of (≥90) IFA tablets. The NNAC programme also included "nutrition education" as a key tool to promote the consumption of iron rich foods. However, in this study, only 15% women imparted health and nutrition education.

Majority of the rural pre-school children of Maharashtra were practicing open defecation, as the sanitary latrine facility was absent in 88% of households. Therefore, periodic deworming among the children is essential, since they are at risk to hookworm infestation, the most common cause of iron deficiency anaemia in children practicing open defecation[28,29] therefore, the emphasis should be on preventive interventions like increasing the coverage of children for IFA supplementation[30] under the existing NNAC programme. Community needs to be sensitized towards the problems of anaemia and encouraged to diversify their dietary pattern by consuming micronutrient rich foods to reduce the multiple micronutrient deficiencies in general and iron deficiency in particular through health & nutrition education, IEC activities and behavioural change communication (BCC). It is also recommended that the staples of rural community should be fortified with micronutrients including iron and included in menu of existing supplementary feeding programme for pre-school children, adolescent girls, pregnant women and lactating mothers under Integrated Child Development Services scheme (ICDS)[31] to control and prevention of the anaemia among vulnerable groups.

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