

## STUDY ON PREVALENCE OF ZINC AND ANAEMIA ASSOCIATION IN SCHOOL CHILDREN OF INDIA

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### ABSTRACT

*In India, Anaemia and zinc deficiency is a comprehensive worldwide health issue among children. Maximum studies belong to anaemia in children aged lower than five years. This study is associated to find out anaemia, zinc deficiency and allied among children of age group 5-9 years using a national survey report Comprehensive National Nutrition Survey (2016-18). In this study, we have taken sample size of 14664 children of aged 5-9 years who are anaemic and having zinc deficiency. The analysis of result includes mainly three background characteristics- characteristics of children, characteristics of mothers, and household. The study uses binary logistic regression analysis as a tool to calculate predictors of anaemia in the selected sample. The outcome indicates that a small level of zinc, vitamin B12, iodine, iron and folate were connected with high anaemia in children. Anaemic children of age 5-9 years need improvements in deficiencies of micronutrient and nutritional level and also investment in socioeconomic status and mother's education.*

**Keywords:** Anaemia, Haemoglobin, zinc, Micronutrient, socio-economic etc.

### 1. INTRODUCTION

Micronutritional deficiencies are becoming a common problem worldwide. Out of these, anaemia is the most common deficiency. Developing countries like India show big unequal occurrence of anaemia, the reasons being poverty, unbalanced diet, few diseases, pregnancy and lactation, and lack of availability of services related to health. Prevalence of anaemia is defined in children 5-9 years was 41% to 69% and in adolescents 12-18 years was 16% to 84.3%. For children aged 5 years, the level of haemoglobin <112 g/L and for children aged 6-11 year, haemoglobin level <118 g/L was defined as anaemic. (CNNS, 2016-18).

This article evaluates the chief role of nutrition in child health with a focus on low and middle-income group. It was found that anaemia has significant adverse effect on children because of their rapid growth and associated high iron and zinc requirements. Children suffering from this problem or malnutrition have greater death rates, poor academic performance and lower earning capacity compared to adults [18]. It not only affects the present health status of a person, but it also has a deleterious effect in the future. Anaemia is a main worldwide health issue [20]. It is one among the most common haematological abnormalities found in children. So it is necessary to understand the reasons of occurrence of anaemia and its cure. Anaemia is a medical situation the count of red blood cell is less than the required level. Anaemia in men, is established when the level of haemoglobin is less than 13.5 gram/100ml and the level of the same being less than 12.0 gram/100ml in women. Red blood cells contain haemoglobin which is a protein that carries oxygen in the bloodstream. Anaemia is a term that describes a situation when there is not proper formation of haemoglobin, growth and red blood cells. The results in adverse can effects on the development of brain as well as psychomotor development [17]. The deficiency of iron, shortage of zinc, vitamin A and B12 are main reason of anaemia. The poor dietary pattern followed by higher socioeconomic group with more of Snacks and junk foods, which lack micro-nutrients explaining the higher prevalence of anaemia among them [30].

In developing country, the deficiency of vitamin A is more as compared to developed country nearly 25% of rural children had deficiency of vitamin A compared to 15% in urban children. Deficiency of vitamin A indicates a critical mass health issue in children having age 24 -59 months. A problem of data limitation has arisen in responsibility for anaemia in children [24].

Zinc plays an important role in body's normal functioning of body and is associated with various enzyme systems. Zinc shows a serious part in ordinary working of body system of enzyme. Anaemia is commonly expected with iron deficiency caused by Low haemoglobin concentrations. Gradually more, the role of supplementary nutritional and non-nutritional elements as an analyst of haemoglobin are being recognized.

Deficiency of zinc may affect globally up-to 2 billion people. In children the same can result into delayed growth and has been proved to be the reason of stunted growth in 1/3 of total population. Lack of Zinc in children was 62.8% also related to anaemia in infants and young children [4].

### 2. SUBSTANCES AND TECHNIQUES

#### 2.1 Data Source

This investigation uses data from the CNNS (report) in 2016 to 18. The worldwide pressure of lack of nutrition is excessively more, out of total data, 50 percent (%) death having age below 5 years children related to malnutrition [19]. The CNNS (2016-

18) is the major micronutrient study ever done and included worldwide data. This study was analyzed to recognize lack of micronutrient which is associated to anaemia in school-age children 5 to 9 years. The survey was applied under the supervision of the UNICEF, MoHFW, the US CDC and Technical Advisory Group (TAG). The data was investigated by 4 survey agencies, two quality mechanism laboratories are AIIMS and NIN (National Institute of Nutrition), one assurance team in the field, one in-field and lab-based assurance team Clinical Development Services Agency, one main laboratory and assisting management agency Population Council. Survey agencies namely, Indian Institute of Health Management Research, Jaipur, Gkf Mode Pvt. Ltd., New Delhi, KANTAR Public New Delhi, SIGMA Research and Consulting Pvt. Ltd., For survey data, third level of eminence assurance was given by PGIMER; Chandigarh, UNICEF and Population Council. But at International level, final approval received by Population's Council IRB (Institutional Review Board), New York.

## 2.2 Sample Design

The CNNS sample was collected in multi-stage preferred with household characteristics and children having age 5 to 9 years throughout 30 states of India. In rural area, sample was collected in two levels: In first level, data is collected through probability proportion sampling involved Primary Sampling Unit's. In second level, data is collected through systematic sampling involved households. At the primary stage, the list of villages provided by the 2011 census as the sampling framework designed in provincial zones and the list of urban wards of that state in 2011. PCA stratified through topographical locale as likelihood relative to measure strategy was outlined in urban areas. The next following stage involves one Census Enumeration Block by arbitrarily selection from individually selected ward. The sampling of third stage involves households by randomly selection from Census Enumeration Block (CEB).

## 2.3 Sample Size

In this survey, the collected sample size was around 38355 school aged children 5 -9 years out of 122100 young people from 2035 essential testing units 0 -19 years over 30 states of India. The reaction rate was 97.8% for age gather 5-9 years in this study. 61% sample was collected of 5-7 years of school aged children and left over 39% sample were of 8-9 a long time children. 42% mothers having children of age 5 to 9 years never attended school. The full test measure of 14664 children had anaemia in this study. For biological sample, the response rate was 75%. [7]. For the CNNS, the children of age 5 to 9 years were interviewed with help from parents/Caregivers.

## 2.4 Main Variable

For this study, Anaemia in children having age varying between 5-9 years was the diverse result. If the quantity of haemoglobin is less than ( $<$ ) 11.5g/dl in children then the level of anaemia was categorized by 1. If the quantity of haemoglobin is greater than ( $>$ ) 11.5g/dl (anemic), then the level of anaemia in children was categorized by 0. [22]. Furthermore, the data in this survey was balanced for the level of haemoglobin for the height with study identification zones greater than ( $>$ ) 1000 meters used for superior results [7], [22]. Moreover, with the use of cyanmethaemoglobin method, deficiency of iron was measured using haemoglobin concentration got from venous entire blood. The significance of the cyan methaemoglobin method to measuring level of haemoglobin was recorded in the study. [14].

## 2.5 Predictor Variables

These expressive factors were considered into 3 bunches specifying: 1) characteristics of children 2) maternal characteristics 3) characteristics of household.

### 2.5.1 Children Characteristics

Micronutrients have important command on anaemia. [10]. The micronutrients contain Zinc, Folate, Vitamin B12, Vitamin D, and Iodine as the indicator in this analysis. In this paper, we enrolled multivitamin supplementation, IFA and deworming dose and Children's (male & female) of age group 5-7 years old and 8-9 years old has been considered [7]. Children's tutoring status had noted right now going & not attending.

### 2.5.2 Maternal Characteristics

In Maternal characteristics, mother's age is described as below 30 years and over 30 years. Tutoring is described different categories as informal Education, up to essential level, over essential to auxiliary level, and over auxiliary level.

### 2.5.3 Household Characteristics

If straight data on earnings and usage is not accessible in the family surveys, then centered on the ownership of family resources, the riches file is measured and utilized as a substitution for determining the financial position of family [9]. Moreover, considers have claimed riches file shows the height of success is same with income size & expenditure. Broadly tried in many nations to find the disparities within the economic position of the family [26]. In this ponder, riches list is calculated by employing PCA (principal component analysis) strategy with extend of strong resource proprietorship, of lodging features, reach to advantages, and foundation. Analytically, Wealth index is divided into three types: destitute, center, and wealthy. As Religion is considered into Hinduism, Muslim, Sikhism and other ones. Caste is also considered as Backward Class and Scheduled Caste and Others. The locations are described as North, West, East, south & Middle North-East.

## 3. Statistical Analysis

In this paper, bivariate analysis and Descriptive had used to examine the prevalence of anaemia and rate conveyance in with sample of 14664 children having age of 5 to 9 years

old. The study will discuss children, maternal and family characteristics. The Binary Logistic Descriptive economic and dichotomous subordinate factors in children having age 5 to 9 years old in India.

**Table 1.** The percentage distribution of children having age of 5 to 9 years (whose anaemia test done) by chosen Children characteristics in India (Total Sample-14664) (CNNS Report, 2016-18)

| Zinc deficient | Vitamin B12 deficient | Iodine deficient | Multi vitamin tablets taken | Deworming tablets taken | IFA tablets taken | Sex  |      | Age (in years) |      | Schooling |        |
|----------------|-----------------------|------------------|-----------------------------|-------------------------|-------------------|------|------|----------------|------|-----------|--------|
|                |                       |                  |                             |                         |                   | M    | F    | 5-7            | 7-9  | C.A.      | C.N.A. |
| 16.7           | 17.1                  | 4.3              | 10.3                        | 40.3                    | 9.6               | 51   | 49   | 59.5           | 40.5 | 92.3      | 7.7    |
| 2447           | 2506                  | 632              | 1505                        | 5908                    | 1406              | 7476 | 7188 | 8728           | 5936 | 13529     | 1135   |

- C.A.- Currently Attending, C.N.A. – Currently Not Attending

*Source:* The Comprehensive National Nutrition Survey (2016-18)

**Table 2.** The percentage distribution of children having age of 5 to 9 years (whose anaemia test done) by chosen Maternal's characteristics in India (CNNS Report, 2016-18)

| Mother's Age |      | Mother's Schooling  |               |                            |                 |
|--------------|------|---------------------|---------------|----------------------------|-----------------|
| <30          | >=30 | No Formal Schooling | Up-to Primary | Above primary to Secondary | Above Secondary |
| 38.6         | 61.4 | 39.5                | 16.7          | 31.7                       | 12.1            |
| 5659         | 9005 | 5789                | 2450          | 4648                       | 1776            |

*Source:* The Comprehensive National Nutrition Survey (2016-18)

**Table 3.** The percentage distribution of children having age of 5 to 9 years (whose anaemia test done) by chosen Household's characteristics in India (CNNS Report, 2016-18)

| Wealth Quintile |        |      | Residence |       | Religion |        |        | Caste |      |        | Region |         |      |            |      |       |
|-----------------|--------|------|-----------|-------|----------|--------|--------|-------|------|--------|--------|---------|------|------------|------|-------|
| Poor            | Middle | Rich | Rural     | Urban | Hindu    | Muslim | Others | SC/ST | OBC  | Others | North  | Central | East | North-east | West | South |
| 38.3            | 21.1   | 40.6 | 5.2       | 24.8  | 80.9     | 14.2   | 4.9    | 34.8  | 40.2 | 25     | 12.6   | 27.7    | 27.5 | 3.6        | 12.9 | 15.7  |
| 5616            | 3094   | 592  | 11029     | 3635  | 11857    | 2087   | 721    | 5106  | 5889 | 3667   | 1851   | 4065    | 4033 | 521        | 1889 | 2307  |

*Source:* The Comprehensive National Nutrition Survey (2016-18)

**Table 1:** The occurrence of anaemia among children having age (5-7) was 60% (8728), of age (8-9) was 40% and equally distributed by sex (51% male, 49% female). Introduction of deficiencies occurred in the form of zinc deficient 16.7%, Vitamin B12 17.1%, Iodine 4.3%. The consumption of tablets of multi vitamin, deworming and IFA was 10.3%, 40.3% and 9.6% respectively. **Table 2:** A larger proportion of mother's age above 30 (61.4%) had no formal education (39.5%), their schooling from primary to secondary was 31.7% and above secondary was 12.1%. **Table 3:** The richest record could be quintile, so it is similarly disseminated over the test populace at the national level. However the CNNS report affirms that 5616 children out of 14664 belong to poor families, 592 children from rich families in which 11029 rural, 3635 urban background. According to survey, the majority 81% of Hindu religion, 14.2% Muslims & 4.9% from other religion. Around 40% of the children belong to backward classes (OBC), 34.8% from scheduled castes (SC) / scheduled tribes (ST). In India, overall prevalence of anaemia of children having age between 5 to 9 years occurred in different regions i.e. East (27.5%), west (12.5%), North (12.6%), South (5.7%), and central region (27.7%).

**Table 4.** Percentage distribution of prevalence of anaemia in children having age between 5-9 years with Children background characteristics, CNNS (2016-18). (Percentage of Prevalence of Anaemia (Haemoglobin level < 11.5g/dl)

(India- 23.4%)

| Zinc Level |      | Vitamin B12 Level |      | Iodine Level |      | Multivitamin |      | Deworming |      | IFA  |      | Sex  |      | Age (in years) |     | Schooling |        |
|------------|------|-------------------|------|--------------|------|--------------|------|-----------|------|------|------|------|------|----------------|-----|-----------|--------|
| Normal     | Low  | Normal            | Low  | Normal       | Low  | Yes          | No   | Yes       | No   | Yes  | No   | M    | F    | 5-7            | 7-9 | C.A.      | C.N.A. |
| 19.7       | 23.1 | 20.5              | 21.1 | 19.4         | 21.6 | 19           | 20.3 | 18.9      | 21.4 | 22.7 | 19.8 | 22.2 | 24.7 | 27.8           | 17  | 22.7      | 2      |

*Source:* The Comprehensive National Nutrition Survey (2016-18)

**Table 5:** Percentage distribution of prevalence of anaemia in children having age between 5-9 years in Maternal's background characteristics, CNNS (2016-18)

| Mother's Age |      | Mother's Schooling  |               |                            |                 |
|--------------|------|---------------------|---------------|----------------------------|-----------------|
| <30          | >=30 | No Formal Schooling | Up to Primary | Above primary to Secondary | Above Secondary |
| 25.9         | 21.8 | 27.5                | 25.7          | 20.5                       | 14.4            |

*Source:* The Comprehensive National Nutrition Survey (2016-18)

**Table6:**Percentage distribution of prevalence of anaemia in children having age between 5-9 years in Household's background characteristics, CNNS (2016-18)

| Wealth Quintile |        |      | Residence |       | Religion |        |        | Caste |      |        | Region |         |      |           |      |       |
|-----------------|--------|------|-----------|-------|----------|--------|--------|-------|------|--------|--------|---------|------|-----------|------|-------|
| Poor            | Middle | Rich | Rural     | Urban | Hindu    | Muslim | others | SC/ST | OBC  | Others | North  | Central | East | North-ast | West | South |
| 29.6            | 22.3   | 18.1 | 24.3      | 20.6  | 23.5     | 22.2   | 25.7   | 28.8  | 20.6 | 20.5   | 15.9   | 22.4    | 30.5 | 30.9      | 24.1 | 16.5  |

**Source:** The Comprehensive National Nutrition Survey(2016- 18)

**Table4:** This study provides a rundown in information about deficiencies of micronutrient in anaemic children. The occurrence of anaemia was 23.4% in children having age between 5-9 years in India and also had normal zinc deficiency 19.7% & low 23.1%. Nearly one fifth (20.5%) had a deficiency of low vitamin B12, 19.4% had a normal Iodine deficiency & 19% of multivitamin. The present study revealed that the rate of IFA was 22.7%, children were equally dispersed by sex in both age categories 22.2% male & 24.7% female. The percentage of children 5-7 years was 27.8% female & 8-9 years was 17%, the rate of currently not attending the school was 32%.

**Table5:** A larger proportion of mothers aged below 30 was 25.9% and above 30 was 21.8%. The mothers who had no formal education 27.5% but up to primary schooling was 25.7% & above secondary was 14.4%. **Table 6:** About 29.6% children belong to poor families, 24.3% of rural areas, 20.6% of urban area, 23.5% of Hindu religion, 25.7% of other religion, 28.8% of scheduled caste/scheduled tribes, 20% of OBC & 20.5% of other caste. The results of the present study were relatively higher than reports from East region (30.5%), Central 30.50%, North-East 30.90%, North 15.9%, West 24.10% & South 16.50%.

**Table7:** Odd Ratios showing the adjusted effect of zinc deficiency on anaemia in children of age 5-9, India with children's characteristics, CNNS (2016-18)

| Zinc Level |         | Vitamin B12 Level |      | Iodine Level |      | Multivitamin |      | Deworming |       | IFA |      | Sex |       | Age (in years) |         | Schooling |        |
|------------|---------|-------------------|------|--------------|------|--------------|------|-----------|-------|-----|------|-----|-------|----------------|---------|-----------|--------|
| Normal     | Low     | Normal            | Low  | Normal       | Low  | Yes          | No   | Yes       | No    | Yes | No   | M   | F     | 5-7            | 7-9     | C. A      | C.N.A. |
|            | 1.25*** |                   | 0.97 |              | 1.17 |              | 1.05 |           | 1.11* |     | 0.97 |     | 1.11* |                | 0.68*** |           | .02    |

\*\*\*-P<0.01, \*\*-P<0.05, \*-P<0.1

**Source:** The Comprehensive National Nutrition Survey(2016-18)

**Table8:** Odd Ratios showing the adjusted effect of zinc deficiency on anaemia in children of age 5-9 with parental characteristics, India, CNNS(2016-18)

| Mother's Age        |              | Mother's Schooling         |                 |                            | Mother's work status |              |                   |             |  |
|---------------------|--------------|----------------------------|-----------------|----------------------------|----------------------|--------------|-------------------|-------------|--|
| <30                 | ≥30          | No Formal Schooling        | Upto Primary    | Above primary to Secondary | Above Secondary      | Non-working  | Agricultural work | Other work  |  |
|                     | 0.84***      |                            | 0.99            | 0.83**                     | 0.73***              |              | 1.07              | 1.08        |  |
| Father's schooling  |              | Father's work status       |                 |                            |                      |              |                   |             |  |
| No Formal schooling | Upto Primary | Above primary to Secondary | Above Secondary | Agriculture Work           | Production work      | Service work | other work        | Not working |  |
|                     | 0.85*        | 0.70***                    | 0.72***         |                            | 1.03                 | 1.02         | 1.03              | 1.13        |  |

\*\*\*-P<0.01, \*\*-P<0.05, \*-P<0.1

**Source:** The Comprehensive National Nutrition Survey(2016-18)

**Table9:** Odd Ratios showing the adjusted effect of zinc deficiency on anaemia in children of age 5-9, India with household's characteristics, CNNS (2016-18)

| Wealth Quintile |        |         | Residence |       | Religion |        |         | Caste |         |         | Region |         |         |            |         |       |
|-----------------|--------|---------|-----------|-------|----------|--------|---------|-------|---------|---------|--------|---------|---------|------------|---------|-------|
| Poor            | Middle | Rich    | Rural     | Urban | Hindu    | Muslim | others  | SC/ST | OBC     | Others  | North  | Central | East    | North-East | West    | South |
| 29.6            | 0.81** | 0.68*** |           | 1.00  |          | 0.84*  | 0.71*** |       | 0.75*** | 0.69*** |        | 1.26**  | 1.90*** | 1.46***    | 1.35*** | 0.78* |

\*\*\*-P<0.01, \*\*-P<0.05, \*-P<0.1

**Source:** The Comprehensive National Nutrition Survey,(2016-2018)

**Table7:** reveals a high deficiency of zinc during anaemia among children of age group between 5 to 9 years was (1.25, -p<0.01). The prevalence of vitamins B12 & iodine deficiency was 0.97 & 1.17 with no multivitamin 1.05 & no deworming (1.11, -p<0.1), IFA was 0.97%. The ratio of zinc deficiency in female (1.11, -p<0.1) of age 8-9 year 0.68, -p<0.01) with currently not attending school (1.02). **Table8:** Women's interests in study and work status were known statistically calculated connected with anaemia. According to study, the ratio of mother's age ≥ 30 was (0.84, -p<0.01), schooling up to primary level 0.99, above primary to secondary (0.83, -p<0.05) and above secondary (0.73, -p<0.05) with agriculture work 1.07 and other work 1.08. Similarly the ratio of father's education up to primary level (0.85, -p<0.1), primary to secondary (0.70, -p<0.01) above secondary (0.72, -p<0.01), work status in service 1.02,

production and other fields are same 1.03 but maximum ratio 1.13 is without work. **Table 9:** The riches record could be a quintile and it is similarly conveyed over the test populace at the country level. However the CNNs report affirm that the ratio of children belong to middle families 0.83,  $-p < 0.05$  with 1.00 urban According to survey, high prevalence of Muslim children 0.84,  $-p < 0.05$  and other religion 0.77,  $-p < 0.01$  with backward class (OBC) 0.75,  $-P < 0.01$  and others 0.69,  $-P < 0.01$ . The presence of anaemia in our study is higher in east region 1.90,  $-P < 0.01$ ,  $-P < 0.01$ , west 1.35,  $-p < 0.05$ , central 1.26,  $-p < 0.05$  and south 0.78,  $-p < 0.05$ .

#### 4. DISCUSSION

This study examined the presence and main factors related to anaemia among Indian children ageing 5 to 9 years. The record describes the recent study peculiarly as the utilised data from the worldwide famous comprehensive national nutrition survey. Furthermore, the study is too exclusive to cover anaemia in children having age between 5 to 9 years. The previous research papers mostly connected with anaemia have shown the results among children under the age of five years [2]. In this study we have discussed numerous essential outcomes. First, anaemia due to deficiency of micronutrients in children having age between 5 to 9 years who had a less level of zinc, iodine, vitamin B12 and multivitamins were greater precisely have anaemia. The main cause of anaemia in children having age between 5 to 9 years due to deficiency of zinc [3]. Next, children having age between 5 to 7 years were most expected to suffer from anaemia comparatively children having age 8 to 9 years. As mother's age above 30 was associated with less risk of anaemia in their children. Educated parents were less associated with risk of anaemia among children. There are important socio-financial imbalances correlated with the risk related to anaemia in India. In household characteristics of wealth quintile, the rich families have less risk of anaemia in children. Urban children were less associated with anaemia than rural children. The anaemic rate in Southern region of India was lower and in eastern region of the country was higher comparatively Northern region.

The predominance of anaemia in children ageing between 5 to 7 years was found to be 27.80 % comparatively decreased in the ratio of children of aged 8-9 years which was found to be 17%. The presence of anaemia found in the present study was 58.70% among children of aged below 5 years. [2]. Moreover, the rate of anaemia was lower in children having age between 5 to 9 years than other ages of children (below five years, adolescent age). Between NFHS-4 (2014-2015) and NFHS-5 (2019-2020), the anaemic rate among children of age more than 6 months and upto 59 months has increased from 53.80 percent (%) to 68.90 percent (%) and in adolescent women of aged 15-19 years was 49.7 percent to 57.2 percent. A new study examined that in India, the rate of anaemia among children ageing between 12 to 23 months was 68.1%, children of aged 24 to 35 months was 58.7 %, children of aged 24 to 35 months was 58.7 %, children of aged 36 to 47 months was 49.4 % and children of aged 48 to 59 months was 42.7 % [1]. The vital role of micronutrients pays for the growth of children also with micronutrient deficiency may lead to anaemia in children [13]. The finding of this paper showed a good relationship among development of lower level of zinc, iodine, vitamin B12 & anaemia. In preschool-age children, anaemia deficiency with vitamin A was 20.5 %, Zinc was 44.5 % and vitamin D was 39.60 %; nearly 33.3% of children were anemic, and Fe deficiency children was 10.7 % [11]. With the coordination of previous studies, a positive relation examined between deficiency of micronutrient and anaemia [6]. Iron deficiency effects to anaemia which is linked with the development of physical and mental coordination of children. The adverse effect of iron deficiency mostly found in infant lead to anaemia [21]. Haemoglobin level can also be improved with the intake of zinc because the intake of very low level of zinc originates to be connected with high occurrence

of anaemia in children [29]. Zinc deficiency is considered by growth retardation, lessened immunefunction and loss of appetite. In maximum cases, the deficiency of zinc causes hair loss, diarrhoea, hair loss, eye and skin lesions [28]

This study could not originate an important relationship between the intake of amount of vitamin B12 and anaemia probability in youngster. Though, past studies examined the constructive consequence of vitamin B12 in refining the level of anaemia [25]. The deficiency of Folic acid is less likely to be found and mostly seen with deficiency of iron. The deficiency of Vitamin B12 is considerably rare to be found [21]. This record reported a transposed link among intake of Vitamin D and refining the level of anaemia among children; who consume less recommended Vitamin D has lower risk of anaemia. Though, it is examined in their recognizing the correlation between Vitamin D and anaemic level in children [16]. Then the dietary trends obeyed by higher socio-economic group taking maximum quantity of fast foods, that have few micro-nutrients elaborate the higher anaemic prevalence among them.

This study showed that parents' education is a second analytical factor in determining the anaemia in children. Earlier studies emphasized the significance of guardian's education is decreasing the anaemia level in children [5]. Mother's education with increased knowledge of required care regarding health and amount of diet in children is decreasing the anaemia deficiency in children [8].

According to previous study the improving level of anaemia in children also positively correlated with mother's age [12]. For young mothers, it is difficult to handle child healthcare with limited resources of their discarding, consequential in deterioration of health in children [12]. The poor level of anaemia in children may be associated with socio-demographic drawbacks because of span of matured mothers. The children of higher educated parents had less anaemic comparatively less educated parents children [15]. Moreover, mothers aged above 30 had children with low level of anaemia due to some factors like duration of having a child [27].

The another factor is wealth which is also linked with anaemia in children. In our study, rich children had less anaemia than in poverty stricken. Many studies consistently have noted that the level of anaemia is low in children belonged to the rich wealth quintile comparatively the poor wealth status.[1],[5]. In Eastern region, the level of anaemia in children is highest comparatively the Northern region. In Southern region, the existence of anaemia is lower in children having age between 5 to 9 years. According to previous studies, in the Eastern region the anaemic level is more in children ageing under five years and in Southern region the level of anaemia is lower[1]. In Southern Region of India, the socio-economic status is better than in other regions the outcomes in children.[23]. In Comprehensive National Nutrition Survey, the design of sample size was according to state level only not a district level.

Furthermore, the present study is related to presence and factors of anaemia in children having age 5 to 9 years only but most examined studies are related to children having age between 0 to 5 years. This record is necessary in the direction that restricted study has been commenced to find the occurrence and factors related to anaemia in Indian children ageing between 5 to 9 years. Factors of anaemia in children having age 5 to 9 years only but most examined studies are related to children having age between 0 to 5 years. This record is necessary in the direction that restricted study has been commenced to find the occurrence and factors related to anaemia in Indian children ageing between 5 to 9 years. Mostly 6 micronutrients has been examined by sample of blood of this study population and it can be calculated as one major strength of the report more in children ageing under five years and in Southern region the level of anaemia is lower.[1].

## 5. CONCLUSION

The prior studies related to anaemia among children ageing between 0-5 years in India, the present data observed the presence and factors related to anaemia in children of age 5 to 9 years. The anaemia is a health problem of majority of population in Indian nation. This paper described that one out of every four children was anaemic in the age 5-9 years old. Furthermore, children having anaemia examined by parents characteristics and domestic factors. The study also observed that the level of anaemia was more in the children with lower level of consumption of zinc, folate and vitamin-A. Moreover, anaemia level was observed to be high in the children having age between 5 to 7 years, It was also observed in children whose mothers age was less than (<) 30 years, whose mothers education was not formal, who belong to poor background and who were from SC/ST background also. The southern region's children were observed with lower level of anaemia. So it is suggested that to commence further study which check the outcomes of this study before we might suggest likely policy implications. Examinations are needed to study the detailed causes related with anaemia in those children having age from 5 to 9 years. With the policy prospectus, this is necessary to pay attention on anaemia in children between 5 to 9 years of age. The parents of these anaemic children especially mothers need indulgence in education to improve the social economic position so that adequate nutritional level of children can be maintained. The study can help the policymaker to Design Proper interference with suitable steps that aimed to children of aged 5-9 years old. Poverty is also main cause of childhood anaemia so some Strategies should be applied to minimize it.

## REFERENCES

1. Bharati, S., Pal, M. and Bharati, P. 2020. Prevalence of anaemia among 6-to 59-month-old children in India: the latest picture through the NFHS-4. *Journal of biosocial science*, 52(1), 97-107. <https://doi.org/10.1017/S0021932019000294>
2. Dutta, M., Bhise, M., Prasad, L., Chaurasia, H. and Debnath, P. 2020. Prevalence and risk factors of anaemia among children 6–59 months in India: A multilevel analysis. *Clinical Epidemiology and Global Health*. <https://doi.org/10.1016/j.cegh.2020.02.015>
3. Rahman, M. H. U., Chauhan, S., Patel, R., Boro, B., Anwar, T., Kumar, Pand Srivastava, S. 2020. Anaemia among Indian children: A study of prevalence and associated factors among 5–9 years old. *Children and Youth Services Review*, 119, 105529.
4. Palacios, A. M., Hurley, K. M., De-Ponce, S., Alfonso, V., Tilton, N., Lambden, K. B. & Black, M. M. (2020). Zinc deficiency associated with anaemia among young children in rural Guatemala. *Maternal & child nutrition*, 16(1), e12885.
5. Sharma, H., Singh, S. K. and Srivastava, S. 2020. Socio-economic inequality and spatial heterogeneity in anaemia among children in India: Evidence from NFHS-4 (2015–16). *Clinical Epidemiology and Global Health*. <https://doi.org/10.1016/j.cegh.2020.04.009>
6. Kessy, J. P., Philemon, R. N., Lukambagire, A., Abdulrahmani, M., Urrio, G., Beyanga, G. and Majaliwa, E. 2019. Iron Depletion, Iron Deficiency, and Iron Deficiency Anaemia Among Children Under 5 Years Old in Kilimanjaro, Northern Tanzania: A Hospital-Based Cross-Sectional Study. *EA Health Research Journal*, 3(1), 42-47. <https://doi.org/10.24248/eahrj.v3i1.597>
7. Ministry of Health and Family Welfare (MoHFW), Government of India, UNICEF and Population Council. 2019. Comprehensive National Nutrition Survey (CNNS) National Report. New Delhi. [https://www.popcouncil.org/uploads/pdfs/2019RH\\_CNNSreport.pdf](https://www.popcouncil.org/uploads/pdfs/2019RH_CNNSreport.pdf).
8. Ojoni, O. O., Odimegwu, C. O., Olamijuwon, E. O. and Akinyemi, J. O. 2019. Does education offset the effect of maternal disadvantage on childhood anaemia in Tanzania? Evidence from a nationally representative cross-sectional study. *BMC pediatrics*, 19(1), 89. <https://doi.org/10.1186/s12887-019-1465-z>

9. Jung, J., Rahman, M. M., Rahman, M. S., Swe, K. T., Islam, M. R., Rahman, M. O. and Akter, S. 2019. Effects of hemoglobin levels during pregnancy on adverse maternal and infant outcomes: a systematic review and meta-analysis. *Annals of the New York Academy of Sciences*, 1450(1), 69-82
10. Gonmei, Z. and Toteja, G. S. 2018. Micronutrient status of Indian population. *The Indian journal of medical research*, 148(5), 511-521. [https://doi.org/10.4103/ijmr.IJMR\\_1768\\_18](https://doi.org/10.4103/ijmr.IJMR_1768_18)
11. Ahmed, F., Prendiville, N. and Narayan, A. 2017. Micronutrient deficiencies among children and women in Bangladesh: progress and challenges. *Journal of nutritional science*, 5, e46. <https://doi.org/10.1017/jns.2016.39>
12. Kuziga, F., Adoke, Y. and Wanyenze, R. K. 2017. Prevalence and factors associated with anaemia among children aged 6 to 59 months in Namutumba district, Uganda: a cross-sectional study. *BMC pediatrics*, 17(1), 25. <https://doi.org/10.1186/s12887-017-0782-3>
13. Sarvar, R. and Bant, D. D. 2017. Clinical assessment of micronutrient deficiencies among children (1-5 years) enrolled in Anganwadis of old Hubli slums, Karnataka, India. *International Journal of Community Medicine and Public Health*, 4(2), 598-602. <http://dx.doi.org/10.18203/2394-6040.ijcmph20170297>
14. Bansal, P. G., Toteja, G. S., Bhatia, N., Gupta, S., Kaur, M., Adhikari, T. and Garg, A. K. 2016. Comparison of haemoglobin estimates using direct & indirect cyanmethaemoglobin methods. *The Indian journal of medical research*, 144(4), 566. <https://doi.org/10.4103/0971-5916.200882>
15. Khan, J. R., Awan, N. and Misu, F. 2016. Determinants of anemia among 6-59 months aged children in Bangladesh: evidence from nationally representative data. *BMC pediatrics*, 16(1), 3. <https://doi.org/10.1186/s12887-015-0536-z>
16. Lee, J. A., Hwang, J. S., Hwang, I. T., Kim, D. H., Seo, J. H. and Lim, J. S. 2015. Low vitamin D levels are associated with both iron deficiency and anemia in children and adolescents. *Pediatric hematology and oncology*, 32(2), 99-108. <https://doi.org/10.3109/08880018.2014.983623>
17. Soliman A, De Sanctis V, Elalaily R 2014. Nutrition and pubertal development. *Indian J Endocr Metab* ;18:39-47.
18. Adair, L. S., Fall, C. H., Osmond, C., Stein, A. D., Martorell, R., Ramirez-Zea, M., and Victora, C. G. 2013. Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income: findings from five birth cohort studies. *The Lancet*, 382(9891), 525-534. Ding, W. and Marchionini, G. 110107A Study on Video Browsing Strategies. Technical Report. University of Maryland at College Park.
19. Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M. and Maternal and Child Nutrition Study Group. 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890), 427-451.
20. Stevens, G. A., Finucane, M. M., De-Regil, L. M., Paciorek, C. J., Flaxman, S. R., Branca, F. and Nutrition Impact Model Study Group. 2013. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population-representative data. *The Lancet Global Health*, 1(1), e16-e25. [https://doi.org/10.1016/S2214-109X\(13\)70001-9](https://doi.org/10.1016/S2214-109X(13)70001-9)
21. Kotecha, P. V. 2011. Nutritional anaemia in young children with focus on Asia and India. *Indian journal of community medicine*, 36(1), 8-16. <https://doi.org/10.4103/0970-0218.80786>
22. World Health Organization. 2011. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity
23. Joe, W., Mishra, U. S. and Navaneetham, K. 2010. Socio-economic inequalities in child health: recent evidence from India. *Global Public Health*, 5(5), 493-508. <https://doi.org/10.1080/17441690903213774>
24. Pasricha, S. R., Black, J., Muthayya, S., Shet, A., Bhat, V., Nagaraj, S., and Shet, A. S. 2010. Determinants of anaemia among young children in rural India. *Pediatrics*, 126(1), e140-e149. <https://doi.org/10.1542/peds.2009-3108>
25. Benoist B, McLean E, Egli I, Cogswell, eds. Worldwide Prevalence of Anaemia 1993-2005. Geneva, Switzerland: World Health Organization; 2008. Available at: [whqlibdoc.who.int/publications/2008/9789241596657\\_eng.pdf](http://whqlibdoc.who.int/publications/2008/9789241596657_eng.pdf)
26. Indian Institute for Population Sciences (IIPS) and MoHFW. National Family Health Survey Available from: <http://rchiips.org/nfhs/pdf/NFHS4/India.pdf>. Accessed June 12, 2017.
27. De Pee, S., Bloem, M. W., Sari, M., Kiess, L., Yip, R. and Kosen, S. 2002. The high prevalence of low hemoglobin concentration among Indonesian infants aged 3-5 months is related to maternal anemia. *The Journal of nutrition*, 132(8), 2215-2221. <https://doi.org/10.1093/jn/132.8.2215>
28. World Health Organization. 2004. *The World health report: 2004: changing history*. World Health Organization.
29. Kolsteren, P., Rahman, S. R., Hilberbrand, K. and Dintz, A. 1999. Treatment for iron deficiency anaemia with a combined supplementation of iron, vitamin A and zinc in women of Dinajpur, Bangladesh. *European journal of clinical nutrition*, 5(2), 102-106. <https://doi.org/10.1038/sj.ejcn.1600684>
30. Verma, M., Chhatwal, J. and Kaur, G. 1998. Prevalence of anemia among school children of Punjab.

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