PREVALENCE OF ANAEMIA AMONG ADOLESCENTS UNDER IBSY IN RURAL BLOCK OF A DIST. OF NORTHERN INDIA

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ABSTRACT:
Research Question: What is the prevalence of Anaemia among adolescents under Indira Bal Swasthya Yojna in rural block of a dist. of northern India?

Objective: To determine prevalence of Anaemia among adolescents under Indira Bal Swasthya Yojna in rural block of a dist. of northern India

Study design: Cross-sectional, descriptive


Statistical analysis: Percentage, simple proportion, chi square test

Participants: 1650 participants covered under IBSY.

Results: The overall prevalence of anaemia was 67.7%. 1116 out of 1650 students had varying severity of anaemia while anaemia was absent in 534 participants. Out of the 1650 students, 663 (40.2%) were mildly anaemic, 450 (27.3%) were moderately anaemic and 3 (0.2%) were severely anaemic.

Conclusion: the present study revealed anaemia to be a major public health problem among adolescents.

INTRODUCTION
The word adolescence is derived from the Latin word, ‘adolescere’; meaning “to grow, to mature” [1]. The WHO has defined adolescence as the age period between 10 to 19 years of age for both the sexes (married and unmarried). This is the formative period of life when the
maximum amount of physical, psychological, and behavioral changes take place. This is a vulnerable period in the human life cycle for the development of nutritional anemia, which has been constantly neglected by public health programs. Adolescents are at high risk of iron deficiency and anemia due to accelerated increase in requirements for iron, poor dietary intake of iron, high rate of infection and worm infestation as well as the social norm of early marriage and adolescent pregnancy. During this stage the requirement of nutrition and micronutrients is relatively high. Therefore, adolescents, especially girls, particularly those between the ages of 12–15 years, are vulnerable to iron deficiency mainly because requirements are at a peak [2].

There are about 1.2 billion adolescents in the world, which is equal to 1/5th of the world’s population and their numbers are increasing. Out of these, 5 million adolescents are living in developing countries. India’s population has reached the 1 billion mark, out of which 21% are adolescents [3].

The world’s adolescent population is facing a series of serious nutritional challenges which are not only affecting their growth and development but also their livelihood as adults. Yet, adolescents remain a largely neglected, difficult-to-measure and hard-to-reach population, in which the needs of adolescent girls in particular, are often ignored [4].

Indira Bal Swasthya Yojna (IBSY) was launched on 26th January 2010 with the objective to cover children (0-5 years) of Anganwadis and Govt. Schools (6-18 years) for 3 Ds (Disease, Deficiency and disability) in collaboration with the department of Education, Women and Child Development and Social Justice and Empowerment. In the FY 2012-13, all children (up to the age of 18 years) studying / freshly enrolled in Govt. Primary, Middle, High & Sr. Secondary Schools and Anganwadis only in the state of Haryana with follow-up of the previously screened and newly screened cases [5].

The WHO Global Database on Anaemia for 1993–2005, covering almost half the world’s population, estimated the prevalence of anaemia worldwide at 25 per cent [6]. Although the prevalence of anaemia is estimated at 9 per cent in countries with high development, in countries with low development the prevalence is 43 per cent [7]. In absolute numbers anaemia affects 1.62 billion people globally with about 293 million children of preschool age, 56 million pregnant women, and 468 million non-pregnant women estimated to be anaemic [6]. Children and women of reproductive age are most at risk, with global anaemia prevalence estimates of 47 per cent in children younger than 5 years, 42 per cent in pregnant women, and 30 per cent in non-pregnant women aged 15–49 years [7]. Africa and Asia account for more than 85 per cent of the absolute anaemia burden in high-risk groups and India is the worst hit.

Anaemia is estimated to contribute to more than 115,000 maternal deaths and 591,000 perinatal deaths globally per year. Analysis of data on global prevalence shows that anaemia is disproportionately concentrated in low socioeconomic groups, and that maternal anaemia is strongly associated with child anaemia [8].

Nutritional anaemia is a major public health problem in India and is primarily due to iron deficiency. The National Family Health Survey-3 (NFHS-3) data suggests that anaemia is widely prevalent among all age groups. The prevalence of anaemia among girls (Hb <12 gm %) and boys (Hb <13 gm %) is alarmingly high as per the reports of NFHS-3 and the National Nutrition Monitoring Bureau Survey (NNMBS). Percentage prevalence of anaemia among adolescent girls in the age group 15–19 years and in the older age group 20–29 years remains almost stagnant at 55.8 per cent and 56.1 per cent respectively. On the other hand, among adolescent boys,
prevalence of anaemia for the age group 15–19 years is higher (30.2%) than the post-adolescence stage (19.3 per cent for the age group 20–29 years) [9].

Anaemia has major consequences on human health as well as social and economic development. Anaemia is the world’s second leading cause of disability and is responsible for about 1 million deaths a year, of which three-quarters occur in Africa and South-east Asia [10]. In terms of lost years of healthy life, Iron Deficiency Anaemia causes 25 million cases of Disability Adjusted Life Years (DALYs); this accounts for 2.4 per cent of the total DALYs worldwide [11].

In the World Health Organization (WHO)/World Bank rankings, IDA is the third leading cause of DALYs lost for females aged 15–44 years [12, 13]. Physical and cognitive losses due to IDA cost developing countries up to 4.05 per cent loss in gross domestic product (GDP) per annum, thereby stalling social and economic development. When results are expressed as a percentage of GDP these losses are 1.18 per cent of GDP in India. In absolute dollar terms, the losses in South Asia are staggering: close to $4.2 billion annually in Bangladesh, India and Pakistan [14].

METHODOLOGY

Study Design

The present cross-sectional study was conducted in all the 29 Government schools (High and Senior Secondary) under CHC Chiri block of Dist. Rohtak. The study period was from February 2013 to March 2013.

Source of the Data

Inclusion criteria: school going adolescents of the age group of 11-19 years.

Selection of the participants: All the students from class 6th to 12th of Government High and Senior Secondary schools under CHC Chiri block (age group, 11-19 years) enrolled as study participants. The parents of the participants were informed about the study and informed consent was obtained from the heads of the school authorities as well as the parents. A pre-designed and pre-tested proforma was used to collect the information about the participants. A brief, relevant clinical examination was also done. Taking $P = 0.56$ [9], allowable error ($d$) = 4% of $P$, and using this in the formula of sample size $n = \frac{Z^2 \cdot \alpha \cdot P \cdot (1-P)}{d^2}$, sample size was estimated to be 1346. [15]

In our study we have enrolled all the students as study participants hence sample size taken as $n=1650$.

Exclusion Criteria:

The students who were absent, their parents had not given consent and those who were not willing to be examined excluded from the study.

Training for Hb testing using Hemoglobin Colour Scale

Training of Master trainers (DSHOs) at state level and reorientation of the program along with training for Hb testing using Hemoglobin Colour Scale has been conducted in convergence with the representatives of stake holder departments (Education, WCD & Social Justice) under the chairmanship of MD, NRHM.

SMO I/C of CHC of all the CHCs trained in the district level training in all aspects of IBSY according to the guidelines, roles and responsibilities and formats for reporting.
Block level designated School Health team of Paramedical staff (12-15 members for 1 block) for Hb estimation submitted by SMO to the DSHO. The team comprised of LT/LHV/MPHS/ANM/MPHW-M

Training at Education Block Level
Participants: Medical Officers, Dental surgeons at PHCs, Supervisors of ICDS, Nodal Teachers
Trainer: SMO
Facilitator: BEEO, BEO, CDPO
Venue: CHC Chiri
Content of Training
   a) Screening of adolescents for symptoms identification & vision testing
      (10 adolescents called for demonstration)
   b) Modes and levels of interventions, referral and follow-up.
   c) Nutritional advice (for anemia, malnutrition, Vit. A def), Sanitation & Personal Hygiene, Menstrual Hygiene
   d) Disability Screening

Training At School Level:
Participants: Class Teachers
Trainer: Trained Nodal Teachers
Facilitator: Principal
Venue: School
The training attended by health official (Dental surgeon/LHV) informed by the principal about the training schedule for proper compliance.

Data collection
TEST PRINCIPLE:

Haemoglobin (Hb) estimation is one simple and economic laboratory parameter to assess anaemia and is thus used quite frequently in population studies [16]. Several methods are available for estimation of Hb in the field setting, such as the copper sulphate specific gravity method, the Lovibond comparator and portable Hb meters [17]. Currently Sahli’s haemoglobinometer method for Hb estimation is the one recommended by the Government of India for use by the health workers in the field and in laboratory facilities [18]. WHO developed the haemoglobin colour scale (HCS) to screen for anaemia in the absence of laboratory-based haemoglobinometry [19]. It is a simple and inexpensive device for providing a reliable indicator of the presence and severity of anaemia [20]. Various studies have been conducted globally to validate the HCS and its sensitivity for detecting anaemia ranged from 75% to 97% while specificity ranged from 41% to 98%. However, the studies had heterogeneous populations, health care settings, anaemia prevalence and findings so controversy about the usefulness of HCS still persists. In a colour scale corresponding to the appearance of the blood sample at the different haemoglobin levels, drops of blood were placed on test strips of Whatman 3 ET Chr paper and, as soon as the blood stains had lost their sheen, the spectral characteristics of their colours were measured by a computerized analytic spectrophotometer. To meet these specifications, printing inks (resistant to fading due to ultraviolet rays) were prepared from pigments of the three primary colours and a neutral diluent. The different shades were then printed on strips of acid-free paper at a defined ink thickness, and dried and varnished [21].
How does it work?
The scale comprises a small card with six shades of red that represent haemoglobin levels at 4, 6, 8, 10, 12 and 14 g/dl respectively. The device is simple to use:

- place a drop of blood on the test strip provided
- wait about 30 seconds
- match immediately the colour of the blood spot against one of the red shades on the scale [22].

Figure: 1 haemoglobin colour scale (HCS) to screen for anaemia

Validation in the field

Since the early series of studies carried out by WHO in 1995 and the first published data describing the device in the same year, extensive testing and field trials have been carried out on the performance of the scale. An international validation study and recent published papers have confirmed its reliability when used in general health centres and antenatal clinics, and in blood transfusion centres for donor selection [23].

Sensitivity and specificity of the Scale to screen for anaemia

For severe anaemia, the Scale shows a sensitivity of 95% and a specificity of 99.6%. To distinguish normal Hb levels from mild anaemia, the sensitivity and specificity are 98% and 86% respectively, results that are well above the reliability of any clinical measurement [24].

Effect of time on the colour of blood stains

Blood stains on absorbent paper change in colour with time, as the haemoglobin converts to the reduced form and to methaemoglobin. This change begins after a couple of minutes and comparisons with the colour scale must therefore be made as soon as the sheen disappears.

- the colour standards (20 x 40 to 60 mm) are printed in a continuous row without any separation so as to allow matching of test strips also against one side of the colour scale;

- circular apertures of 8-9 mm diameter are placed in the centre of each colour standard (to facilitate comparisons when test strips are placed behind the colour scale);
- the colour scale is mounted on a rigid white polyvinyl chloride or polypropylene sheet or thick card with a neutral pale-grey matt background of laminated board for easy cleaning; and

- the test papers (12-15 x 60 mm) are supplied in small packets separately from the colour scale [25].

### Table 1: Haemoglobin levels to diagnose anaemia (g/dl) [26]

<table>
<thead>
<tr>
<th>Age group</th>
<th>No Anaemia</th>
<th>Mild anaemia</th>
<th>Moderate anaemia</th>
<th>Severe anaemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children 6-59 months</td>
<td>≥11</td>
<td>10-10.9</td>
<td>7-9.9</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Children 5-11 years</td>
<td>≥11.5</td>
<td>11-11.4</td>
<td>8-10.9</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Children 12-14 years</td>
<td>≥12</td>
<td>11-11.9</td>
<td>8-10.9</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Non-pregnant women (15 yrs of age and above)</td>
<td>≥12</td>
<td>11-11.9</td>
<td>8-10.9</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>≥11</td>
<td>10-10.9</td>
<td>7-9.9</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Men</td>
<td>≥13</td>
<td>11-12.9</td>
<td>8-10.9</td>
<td>&lt;8</td>
</tr>
</tbody>
</table>

Source: Haemoglobin concentration for the diagnosis of anaemia and assessment of severity. WHO

**Data analysis:** Codes were prepared for the options of the proforma. The master chart was prepared by using the EXCEL2007 software. The SPSS version 17.0 software was used for the analysis of the data. Tables and graphs were prepared by using the Microsoft Windows 2007 software. Chi-square test was used for the statistical analysis. The differences were considered as significant at a p value of <0.05.

**Results**

The present cross-sectional study was conducted in all the 29 Government Schools (High and Senior Secondary) in rural block Chiri of Dist. Rohtak covering 1650 students. The overall prevalence of anemia was 67.7%. 1116 out of 1650 High and Senior Secondary school students had varying severity of anemia while anemia was absent in 32.3%. Out of the 1650 students, 663 (40.2%) were mildly anaemic, 450 (27.3%) were moderately anaemic and 3 (0.2%) were severely anaemic.

- The range of haemoglobin among the participants was 4-14gms/dl.

Among 1650 participants, 1004 were girls (60.8%) and rest 39.2% were boys. Out of 1004 girls, 67% girls have varying degree of severity of anaemia which includes 39.6% mildly anaemic, 27.1% moderately anaemic and 0.3% were severely anaemic. On the other hand out of 646 boys, 68.7% have varying degree of severity of anaemia which includes 41% mildly anaemic, 27.5% moderately anaemic and 0.2% were severely anaemic. Thus prevalence of anaemia in girls was 67% and among boys 68.7%. This was found to be statistically non-significant (p value >0.05).
Table-2: Distribution of study participants in relation to anemia

<table>
<thead>
<tr>
<th>Anemia</th>
<th>Study participants</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemic</td>
<td></td>
<td>1116</td>
<td>67.7</td>
</tr>
<tr>
<td>Non-anemic</td>
<td></td>
<td>534</td>
<td>32.3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1650</td>
<td>100</td>
</tr>
</tbody>
</table>

Prevalence of Anaemia among adolescents under IBSY

32.30%

[Fig-2]: Distribution of study participants in relation to anaemia

Prevalence of varying degree of Anaemia among adolescents under IBSY

![Graph showing the distribution of varying degrees of anaemia among adolescents under IBSY]

[Fig-3]: Distribution of study participants in relation to the severity of the anemia

Table-4: Sex-wise distribution of study participants in relation to anemia

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Anaemia</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Moderate Anaemia</td>
<td>178</td>
<td>272</td>
<td>450</td>
</tr>
<tr>
<td>Mild Anaemia</td>
<td>265</td>
<td>398</td>
<td>663</td>
</tr>
<tr>
<td>No Anaemia</td>
<td>202</td>
<td>332</td>
<td>534</td>
</tr>
<tr>
<td>Total</td>
<td>646</td>
<td>1004</td>
<td>1650</td>
</tr>
</tbody>
</table>
DISCUSSION

Adolescence more broadly refers to the phase of human development which encompasses the transition from childhood to adulthood. This period is very crucial, since these are the formative years in the life of an individual, when major physical, psychological and behavioural changes take place. The nutritional and the health needs of the adolescents are also more because of the growth spurt and the increase in physical activity in them [27].

In females, adolescence marks the beginning of the menstrual cycle or reproduction. Adolescents gain 30% of their adult weight and more than 20% of their adult height between 10-19 years, which we call as growth spurt [28].

Adolescent girls are at a high risk for anaemia and malnutrition. Inadequate nutrition during adolescence can have serious consequences throughout the reproductive years of life and beyond [1]. Very often, in India, girls get married and pregnant even before the growth period is over, thus doubling the risk for anaemia [29]. The nutritional anaemia in adolescent girls attributes to the high maternal mortality rate, the high incidence of low birth weight babies, high perinatal mortality and the consequent high fertility rates. This phase of life is also important due to the ever-increasing evidence that the control of anaemia in pregnant women can be more easily achieved if a satisfactory iron status can be ensured during adolescence [30]. About 43% of the adolescent deaths are related to pregnancy. Pregnancy during adolescence deprives the girls from achieving their full growth according to their genetic potential [31].

The following cut off points which were suggested by the WHO were used to determine whether iron deficiency anaemia was a major problem among the general population: [6]

<table>
<thead>
<tr>
<th>Prevalence</th>
<th>Public health problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5%</td>
<td>Not a problem</td>
</tr>
<tr>
<td>5-14.9%</td>
<td>Low magnitude</td>
</tr>
<tr>
<td>15-39.9%</td>
<td>Moderate magnitude</td>
</tr>
<tr>
<td>40% and above</td>
<td>High magnitude</td>
</tr>
</tbody>
</table>

In the present study, it was found that out of 1650 adolescents, 1116 (67.7 %) were suffering from various degrees of anemia and that 534 (32.3 %) were non-anaemic. This indicated that it was a public health problem of high magnitude as per the WHO guidelines [6]. In a multi-country study on the nutritional status of adolescents, which was carried out by the International Centre for Research on Women (ICRW), anemia was found to be the most widespread nutritional problem and its prevalence ranged from 32-55% [32].

A study which was conducted in the rural areas of Tamilnadu revealed that the prevalence of anemia among the adolescent girls was 44.8% [33].

Verma R, Govila V.K, Kuldeep, Kharb M (2013) conducted a study on ‘Prevalence of anemia in college going youths in rural blocks of a dist. of northern India’ found that overall prevalence of anemia was 43.76% [34]. Studies which were conducted in rural Wardha and Lucknow to estimate the prevalence of anemia among adolescents, found that the prevalence of anemia in those areas was 59.8% and 56% respectively [35]. In a study which was conducted in rural South India, it was found that 30% of the adolescents were anaemic [36]. Thus, the results of various studies which have been mentioned above, demonstrated that the prevalence of anemia in this
study was high as in other parts of the country. This indicated the importance of including adolescents in the risk group to improve their iron status and the need for planning intervention programs that would increase the haemoglobin levels among the adolescents age group through prophylaxis treatment, dietary modification and helminth control.

In our study, the prevalence of severe anemia was 0.2%, that of moderate anemia was 27.3% and that of mild anemia was 40.2%.

Verma R, Govila V.K, Kuldeep, Kharb M (2013) conducted a study on ‘Prevalence of anemia in college going youths in rural blocks of a dist. of northern India’ found that prevalence of severe anemia was found to be 3.58%, that of moderate anemia was 11.16% and that of mild anemia was 29% [34]. In a study which was conducted in rural Tamilnadu, the prevalence of severe anemia was found to be 2%, that of moderate anemia was 6.3% and that of mild anemia was 36.5% [33]. Another study which was conducted in rural Wardha showed the prevalence of severe, moderate and mild anemia found to be 0.6%, 20.8% and 38.4% respectively [36]. A study which was conducted among school going adolescents in Ahmedabad revealed that 55.2% adolescents were mildly anaemic, 44.9% were moderately anaemic and that 0.6% were severely anaemic [37]. The high prevalence of mild and moderate anemia demands due emphasis on iron and folic acid supplementation and health education on the consumption of iron rich foods, so as to bring down the total prevalence of anemia among the adolescents age group.

CONCLUSION & RECOMMENDATIONS
In conclusion, the present study revealed anaemia to be a major health problem among the adolescents in rural areas.

There was a higher prevalence of mild anaemia anaemia as compared to moderate and severe anaemia.

There is no significant difference observed among adolescent boys and girls with respect to prevalence of anaemia.

Weekly Iron and Folic Acid Supplementation (WIFS) Programme for Adolescent Girls and Boys (10–19 Years)
Supplementation through the Life Cycle
For this target segment the following interventions are proposed:
• Administration of supervised weekly IFA supplementation (100 mg elemental iron and 500 mcg folic acid) throughout the calendar year, i.e., 52 weeks each year
• Albendazole (400 mg) tablets for biannual de-worming for helminthic control
• Screening of target groups for anaemia & referring these cases to an appropriate health facility
• Information and counseling for improving dietary intake and for taking action for prevention of intestinal worm infestation

Implementation modalities for WIFS
The WIFS programme will be implemented in urban and rural areas for adolescent boys and girls in school (10–19 years) through the platform of Government/Government aided/ municipal schools. WIFS will also reach out-of-school girls in the age group 10–19 years through the platform of Anganwadi Kendras. The strategy involves a “fixed day – Monday” approach for IFA distribution. Teachers and AWWs will supervise the ingestion of the IFA tablet by the beneficiaries.
There is need to include iron rich food in the diet of adolescents. Grams, maize, Mustard leaf, powder milk and red meat has high iron component so at least once in a week girls should eat rich food to get recommended iron per day to gain normal body mass index. Mustard leaf is affordable for adolescents so easily they can purchase and include twice or thrice in a week. Students are taking food twice a day, they can increase food intake thrice a day so from this at least adolescents will be able to get 18 mg/d iron. Thrice in a day having food can help them to increase the iron content in their body. At the time of preparing vegetables use of iron pot will also increase iron mineral in the body. 

We can go for policy advocacy because government have special program of ICDS to give enhanced ration to adolescent girls. Other than ICDS, Nutrition program for underweight adolescent girls, Kishori Shakti Yojana. 

Community plays a significant role in providing health services and information to the people. Social marketing is one of the ways to create awareness of anaemia and demand for supply of the health services from the government side. Counseling can be done to empower adolescents to make understand the importance of precaution measures to avoid anaemia in adulthood. New innovative and cost effective method should be developed for the fortification of common people food. This will help to increase the iron in the food of adolescents for long term in a sustainable manner. Training program should be organized to make people aware about fortification of food as well as importance of iron for adolescents. Monitoring and evolution of government program like ICDS Supplementary Nutritional Program should be strengthened. Most of the programs are running on paper not on ground level. Monitoring of these programs should be done properly and effectively time to time.

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