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Original Research Article

Prevalence and predictors of iron deficiency anaemia in adolescent girls in India

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ABSTRACT

Background: In India, iron deficiency anaemia is highly prevalent, particularly among women of reproductive age group. Following early childhood, during adolescence, the risk of iron deficiency and anaemia reappears for both boys and girls, but remains more susceptible to girls because of menstrual loss. The aim of this study was to find the prevalence and predictors of iron deficiency anaemia in adolescent girls in India.
Methods: This study was a descriptive form of review of literature on data from comprehensive national nutrition survey (CNNS 2016-2018). CNNS was conducted to collect data on the nutritional status of Indian children from 0-19 years of age. The data collection period was from 26 February 2016 to 24 October 2018 and data was collected using individual and household questionnaires.
Results: In the study, prevalence of various levels of anaemia (mild, moderate and severe) was higher in adolescent girls as compared to adolescent boys. Adolescent girls had 31.3% iron deficiency whereas adolescent boys had 11.5% iron deficiency. Anaemia prevalence was also higher in the age group 15-19 years as compared to 10-14 years.
Conclusions: It was concluded that iron deficiency anaemia was more prevalent in adolescent girls than boys. Inadequate intake of iron rich foods and vitamin C, less knowledge about anaemia, low socio economic conditions along with poor hygiene and sanitation practices are the major factors that contribute to iron deficiency anaemia.

Keywords: Adolescent girls, Haemoglobin, Iron deficiency anaemia, Menstruation, Nutrition

INTRODUCTION

Millions of adolescent girls still struggle to get the nourishing diets and care they require for optimal nutrition in today's world. Adolescent girls and women experience a variety of negative effects due to micronutrient deficiencies, also referred to as "hidden hunger". A micronutrient shortage called iron insufficiency is the main contributor to iron deficiency anaemia. Iron deficiency anaemia (IDA) is common in all age groups, with teenagers and pregnant women being more susceptible. Due to this, the risk of cognitive and physical development problems as well as mortality and morbidity rates increases. Anaemia has a variety of causes, including genetic causes such as thalassemia and sickle cell anaemia, infectious cause such as malaria, autoimmune disorder like hemolytic anaemia as well as poor socioeconomic conditions.[1]

Iron deficiency anaemia is a condition in which the haemoglobin levels are below a certain threshold; the threshold varies depending on the age group, sex, physiological status, smoking habits, and altitude of the group being tested. According to the World Health Organization, iron deficiency anaemia is characterized by a haemoglobin concentration of 110 gm/l at sea level in children under the age of five and pregnant women, and a haemoglobin concentration of 120 gm/l in non-pregnant

women. Anaemia affects almost half a billion women 15-49 years of age and 269 million children 6-59 months of age worldwide. In 2019, 30% (539 million) of non-pregnant women and 37% (32 million) of pregnant women aged 15-49 years were affected by anaemia.[2]

Iron deficiency anemia is the most advanced stage of iron deficiency. In general, serum iron levels decrease in the presence of acute and chronic infections, extensive inflammatory processes, malignant neoplasms, during menstruation and mainly when there is deficiency of iron in the diet. Iron requirement is high because of intense growth, poor intake of dietary iron and muscle development, resulting in an increase in blood volume. Another characteristic that is common among adolescents is the change in dietary habits which result from peer influence, a need for self-affirmation within the family or as the result of the behavioral or social changes that teenagers face during this phase.[3]

Anaemia had a 25% global frequency from 1993 to 2005, according to a WHO research. Nutritional anaemia which is predominantly brought on by iron deficiency, is a significant public health issue in India, according to WHO guidelines for controlling IDA. According to data from the National Family Health Survey-3 (NFHS-3), anaemia affects 56% of adolescent girls (15-19 years old). According to the National Nutrition Monitoring Bureau Survey (NNMBS) 2006, 68.6% of teenage girls (12-14 years old) and 69.7% of females (15-17 years old) had anaemia. In India, teenage girls have a high frequency of anaemia (haemoglobin 12 gm%), which reduces GDP by 1.8%. For teenage girls, the daily requirement for iron is 0.8 mg/1000 Kcal of dietary energy.[4]

Measures taken by the government of India

In 2000, the "India's adolescent anaemia control programme" was started in 2,000 public schools which was then spread over to 20 districts and five states. There were three interventions which include- providing education on nutrition, health and weekly iron-folic acid supplementation.

Another effort by the Indian government is "National Nutrition Anaemia Prophylaxis Programme". The primary objective of the 1970-established project was to safeguard both mothers and children against nutritional anaemia. Expectant and nursing mothers and those who use birth control, were each given one iron and folic acid pill containing 60 mg elementary iron, which has been increased to 100 mg elementary iron.

After that, "Anaemia Mukt Bharat (AMB)" was launched in 2018 as a part of the strengthened nationwide iron plus initiative project. The main aim of the programme was to lower the anaemia rates by one to three percentage points yearly. Children aged six to fifty-nine months, kids aged five to nine years, teenagers aged thirteen to nineteen, women in the reproductive age range (15-49 years), expecting women, and nursing moms are the target demographics of Anaemia Mukt Bharat.

Targets of the Anaemia Mukt Bharat are- i) cases of anaemic and severely anaemic pregnant women are being identified and tracked using a health information system and a mother-infant monitoring system, ii) in order to identify and treat cases of anaemia with the assistance of medical officials, the Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) was created, iii) pregnant women receive deworming treatments approximately every three months for six months to combat anaemia brought on by worm infection, iv) to meet the challenges posed by severe anaemia, steps are being taken to operationalize blood banks at district hospitals and blood storage units at sub-district institutes.[5]

METHODS

This study was a descriptive form of review of the literature on research data from comprehensive national nutrition survey (CNNS 2016-2018). To provide robust data on the shifting conditions of both undernutrition and overweight and obesity, the Ministry of Health conducted the comprehensive national nutrition survey (CNNS) to collect a comprehensive set of data on the nutritional status of Indian children from 0-19 years of age. It is the largest micronutrient survey ever conducted. Adolescents within 10-19 years were included in the survey.

The data collection period was from 26 February 2016 to 24 October 2018. Data was collected in all 30 states of India including urban and rural areas. Assessment was done on multi-factorial causes of anaemia such as- iron and haemoglobin deficiencies, infection and inflammation, dietary diversity.

Sample size

The sample size was calculated to be 122,100 adolescents from 2035 primary sampling units across the country.

Sampling method

The study design was a cross sectional, household survey, which was conducted using multi stage random sampling.

Data collection and analysis

In the CNNS data was collected by using household and individual questionnaires for all participants. In the household questionnaire, the interviewer listed all the usual residents in the household and all the visitors who stayed at the house the night before the interview. The data has been analyzed using Microsoft Excel.

RESULTS

Table 1 shows that prevalence of anaemia was more in adolescent girls as compared to adolescent boys.

Table 1: Percentage of adolescents (10-19 years) classified as having anaemia and iron deficiency selected by background characteristics, India, CNNS 2016-18.

Background characteristics	Anaemia status by haemoglobin levels			Iron deficiency
	Mild	Moderate	Severe	Percent
Sex of child				
Male	13.1	4.0	0.4	11.5
Female	21.9	16.5	1.5	31.3
Age in years				
10-14	15.0	8.6	0.7	18.9
15-19	20.2	11.9	1.2	24.5
Type of diet				
Vegetarian	18.4	11.0	0.8	22.9
Vegetarian with egg	14.8	7.6	1.6	21.7
Non-vegetarian	16.7	9.6	0.9	19.4
Schooling status				
Currently in school	16.0	9.6	0.8	20.5
Not in school	22.4	11.8	1.5	24.9
Mother's schooling				
No schooling	18.5	11.7	1.0	20.4
<5 years completed	17.7	8.3	1.4	21.4
5-7 years completed	16.4	9.5	0.8	21.7
8-9 years completed	15.6	9.4	0.4	21.7
10-11 years completed	15.1	6.7	0.9	24.1
≥12 years completed	17.1	6.8	0.5	25.7
Residence				
Urban	15.3	10.8	0.9	26.6
Rural	18.2	9.9	0.9	19.7
Wealth index				
Poorest	20.9	11.8	0.8	15.2
Poor	18.8	9.2	1.1	16.5
Middle	17.1	10.2	1.2	21.3
Rich	16.9	11.1	0.6	27.0
Richest	13.9	8.5	1.0	26.5

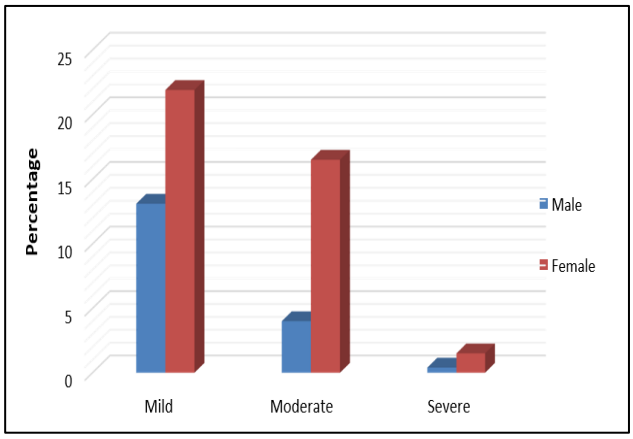

Figure 1: Percentage of anaemia status by haemoglobin levels (mild anaemia, moderate anaemia and severe anaemia) among male and female adolescents within the age group 10-19 years.

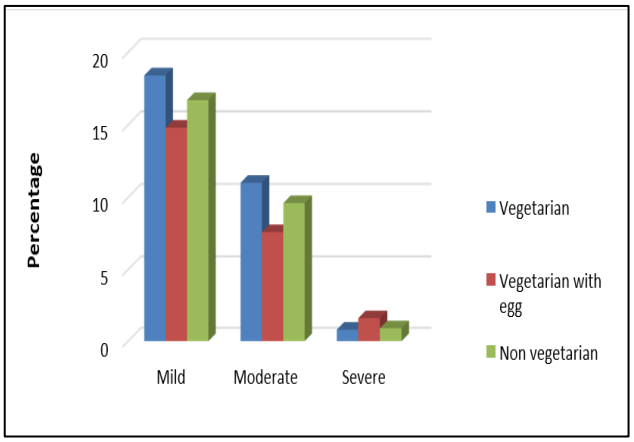

Figure 2: Percentage of anaemia status by haemoglobin levels (mild anaemia, moderate anaemia ad severe anaemia) based on the type of diet consumed.

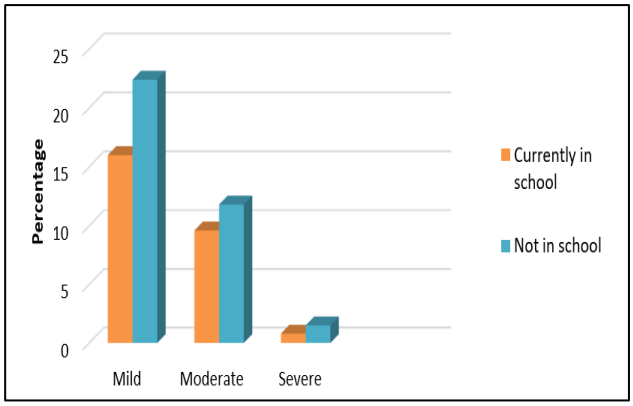

Figure 3: Percentage of anaemia status by haemoglobin levels (mild anaemia, moderate anaemia and severe anaemia) on the basis of schooling status of the paticipants.

Adolescent girls had 31.3% iron deficiency whereas adolescent boys had 11.5% iron deficiency. Anaemia prevalence was also higher within the age group 15-19 years than 10-14 years. Participants consuming a vegetarian diet had higher prevalence of iron deficiency anaemia. Participants consuming non-vegetarian diet had a low prevalence of anaemia. According to the level of education, students who do not go to school were anaemic as compared to students who are in school. Anaemia was more prevalent in those adolescents whose mothers had no schooling.

According to the type of residence, iron deficiency was 26.6% in people residing in urban areas and 19.7% in people living in rural areas. Therefore, anaemia prevalence was much more in those areas regions than rural areas. Income wise, anaemia was more prevalent in the poorest section in comparison to poor, middle income, rich and richest sections.

DISCUSSION

On the basis of this study, it was found that there was a higher prevalence of anaemia in adolescent girls as compared to adolescent boys. Adolescent girls had 21.9% (mild anaemia), 16.5% (moderate anaemia) and 1.5% (severe anaemia). Whereas in adolescent boys there was a prevalence of 13.1% (mild anaemia), 4.0% (moderate anaemia) and 0.4% (severe anaemia). Iron deficiency was also 19.8% more in adolescent girls than boys. Late adolescents (15-19 years) had higher degrees of anaemia and iron deficiency as compared to early adolescents (10-14 years). Participants who consumed a vegetarian diet had 18.4 (mild anaemia), 11.0% (moderate anaemia) and 0.8% (severe anaemia). This was higher than partcipants who consumed a non vegetarian diet or a vegetarian diet with egg. Iron deficiency was also 22.9% in participants consuming a vegetarian diet. A similar study conducted in Maharashtra by Rahman et al among school going adolescent girls came up with the conclusion that majority of girls were non-vegetarian (75%) and only few (25%) were vegetarian. Prevalence of anaemia among vegetarians was 31.6%, out of which 21.7% were mildly anaemic and 10% were moderately anemic. 20% of girls among them had iron deficiency. Whereas, 22.8% prevalence of anaemia was seen among non-vegetarians, out of them 20% had mild anaemia, 2.8% had moderate anaemia and 8.3% had iron deficiency.[7]

Participants who are not in school had higher prevalence of anaemia and iron deficiency than participants currently enrolled in school. Also, participants whose mother did not attend school had higher prevalence of anaemia. This is because, due to lack of education they do not undergo healthy lifestyle practices which are necessary to prevent anaemia. People living in urban areas had 26.6% iron deficiency and people residing in rural areas had 19.7% iron deficiency. Anaemia prevalence was also high in people residing in urban areas. People who belong to the poorest sections had 20.9% (mild anaemia), 11.8% (moderate anaemia) and 0.8% (severe anaemia), which means that the prevalence was higher than those who belong to poor, middle, rich and richest sections.

A study conducted by Goyle et al in Jaipur, Rajasthan to determine the iron status of adolescent girls (10-15 years) also concluded that a very high percentage of adolescent girls from a known socio economic background were found to be anaemic when the cutoff point was <12 gm/dl.[8]

CONCLUSION

It has been observed that iron deficiency anaemia is more prevalent in adolescent girls, which is mainly due to experience of rapid growth and increase in blood volume, which requires a greater amount of iron to produce haemoglobin for new blood cells in girls. Additionally, adolescent girls may follow restrictive diets or engage in disordered eating behaviours, which leads to inadequate iron intake. By increasing intake of iron rich foods such as meat, poultry, fish, beans, lentils, dry fruits, fortified cereals etc along with vitamin C, iron deficiency anaemia can be prevented. Vitamin C helps with the absorption of iron. Therefore, adolescent girls should be encouraged to eat foods high in vitamin C such as oranges, strawberries, lemon, kiwi, tomatoes, guava etc. If girls are unable to meet their nutritional needs through diet, they can take iron supplements after consulting with a healthcare professional. Girls should manage their menstrual bleeding to prevent excessive blood loss by using menstrual products that are appropriate for the amount of bleeding, such as tampons or pads and changing them regularly.

It is also necessary to educate people and create awareness about the consequences, causes and symptoms of anaemia, so that they can adopt healthy practices to prevent anaemia and seek medical attention immediately after getting symptoms. Adolescent girls should also not feel embarrassed about anaemia because it is a common

condition that can affect anyone. It is important to understand that anaemia is a medical condition that can be treated or managed with appropriate care. Also by discussing the condition openly with family, friends or a healthcare professional, awareness about anaemia can be raised which will help to break down the stigma surrounding it. The Indian government has already taken several steps to address this issues, such as the distribution of iron folic acid tablets, however more measures can be taken to address the underlying cause of iron deficiency anaemia.

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