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Prevalence of anaemia among adolescent girls in rural mandals of Srikakulam district, India

Jayaprakash R.*, and C. Manjulatha

Department of Zoology, Andhra University, Waltair, Visakhapatnam 530001, Andhra Pradesh, India.

Abstract: Shortness of Iron is the most important cause of anaemia among school-going children in India. Anaemia accounts for a majority of the nutritional problem across the globe. Anaemia's prevalence is inordinately higher among developing nations because of low socioeconomic status and indigent access to healthcare services. This study was carried out to determine the prevalence of anaemia among adolescent girls in rural mandals of Srikakulam district. Our study estimated the prevalence of anaemia among hostel school children and investigated factors associated with this problem in adolescent girls living in rural areas of Bandapalli, Pathapatnam, Nelabonthu of Srikakulam District. This study was a cross-sectional study conducted among five hundred and thirteen adolescent girls from rural areas of selected mandals of Srikakulam district. After getting informed consent from the subjects, the information regarding age, sociodemographic status, menstrual history, and short clinical details were recorded. Haematological samples were collected and analyzed using an automated haematology analyzer. The overall prevalence of anaemia among adolescent girls was considered in the range of 7 to 10. Our analysis of data reports that the majority of subjects with anaemia were having mild anaemia (8 %) followed by moderate anaemia (91 %) and severe anaemia (1 %), respectively. An increased prevalence of anaemia was seen during the early and those belonging to low socioeconomic class. There is a significant relationship between anaemia and socioeconomic status, dietary modification, nutritional supplementation, and helminth control; besides, compliance with iron and folic acid tablets will prevent anaemia to a great extent among adolescent girls.

Keywords: Anaemia; Prevalence of anaemia; adolescent girls; Srikakulam district

Introduction

Adolescence is a vital stage of growth and development. It is a period of life that is associated with the growth spurt and attainment of puberty. Defined by WHO as individuals between the ages of 10-19 years, adolescents make up approximately 20 % of the world's population (UNICEF, 2005). Although adolescence is a time of enormous physiological, cognitive, and psychological change, it is acknowledged that adolescents remain a neglected group. Most of the adolescence triggers a growth rate more significant than in any other human life stage except for the first year of life. The adolescence period, especially early adolescence, is a very important age-group for interventions because adolescence is a period of profound growth and development. During adolescence, individuals gain about 15 % of their ultimate height and 50 % of their adult weight. This growth phase and development phase leads to an increase in nutrient demands, which is also significantly influenced by infection and energy expenditure (Cordeiro *et al.* 2006). Adolescent nutrition is the key to break the intergenerational cycle of malnutrition. Adolescence is a pivotal stage of the life cycle. It provides a unique opportunity to foster a healthy transition from childhood to adulthood and to ensure that the girl enters the reproductive phase adequately equipped with an excellent nutritional status, absence of anaemia, and iron status. Early marriages make adolescents more

Corresponding Author:
Dr. Jayaprakash R.,
E-mail: jayaprakashloknaik@gmail.com

vulnerable to nutritional deficiencies. First marriages are common in India, though gradually, the age of marriage is rising. At a young age, pregnancy sharply increases the likelihood of poor pregnancy outcomes like obstructive complications and the newborn's low birth weight, primarily because adolescents are still growing and may not meet the growing fetus's demands (Allan and Gillespie, 2001).

Therefore, there is an urgent need to address the existing weaknesses of calories and other nutrients, especially the micronutrients (Anantha krishnan *et al.* 2001). The literature reviewed shows the coexistence of a high prevalence of anaemia and undernutrition among younger and older adolescent girls, especially in developing countries. In one of the most extensive studies of rural school children in developing countries (Ghana, Tanzania, Indonesia, Vietnam, and India), the overall prevalence of stunting and underweight was high, ranging from 48-56 % for stunting 34-62 % for underweight.

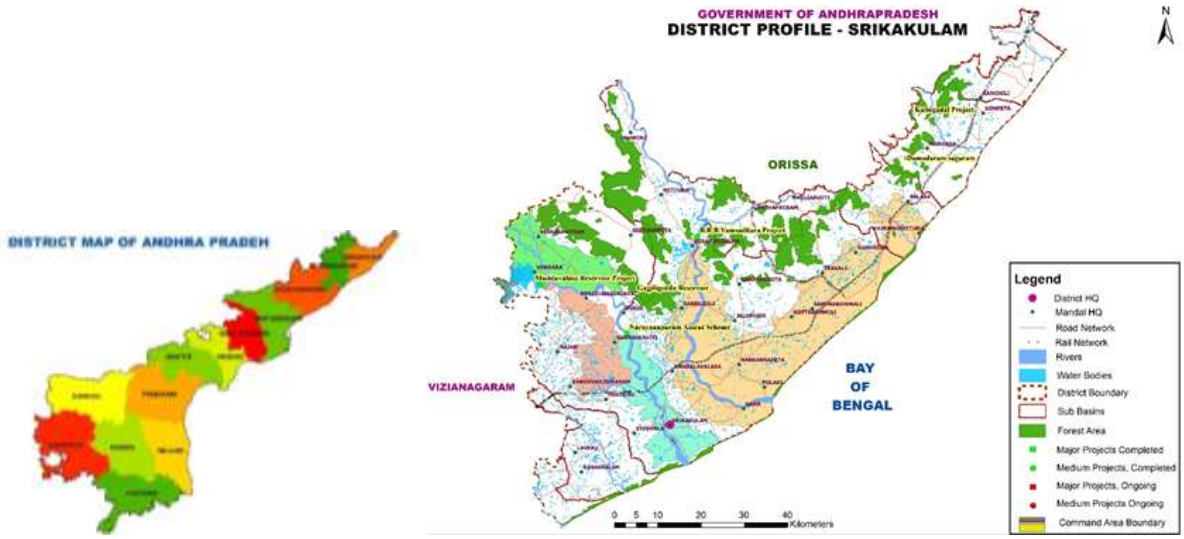
Iron Deficiency Anaemia (IDA) is a significant health problem the world over and throughout the life cycle, especially among women and adolescent girls. Besides being a significant threat to safe motherhood, anaemia contributes to poor growth, lowered resistance to infections, decreased work capacity, and poor cognitive development, which leads to high school dropouts and has an adverse impact on learning and adult productivity. Presently, the prevalence of anaemia among adolescent girls is on the rise in India. Since the adolescent period signalizes the beginning of the menstrual period in girls, they are at a higher risk for nutritional anaemia. In India's rural areas, girls get married and become pregnant during the late adolescent period, thus increasing the risk of adolescent anaemia and low birth weight babies. There were many studies focused on anaemia among pregnant women and children, but only few studies were available on anaemia among adolescent girls. This study aimed to find out the prevalence of anaemia among adolescent girls and correlate with socio-demographic status in a rural area of south India. Adolescent girls are chosen for the study as by improving anaemia and awareness among adolescent girls, maternal morbidity and mortality especially during pregnancy can be improved. There are only few studies focusing on anaemic adolescent girls. In view of the above, this study was carried out to find out the prevalence and factors associated with anaemia among adolescent girls.

Materials and Methods

The study aimed to assess the prevalence of anaemia among adolescent girls living in rural areas of Bandapalli, Meliaputti, Pathapatnam regions of Srikakulam District, Andhra Pradesh. Srikakulam district is located in the North-eastern corner of the state and lies approximately between 180 20′ to 190 10′ North latitudes and between 830 50′ to 840 50′ East longitudes 1,660 meters above mean sea level. Srikakulam district is bounded on the North by Koraput and Ganjam districts of Odisha State, East, and South by Bay of Bengal and West by Vizianagaram district. The district's total area is 5,837 square kilometers and ranks 22nd position contributing 2.12 % area of the State. The Northeastern part of the district is projected into the Bay of Bengal and Odisha State; a single Mandal Bhamini is projected towards North into Odisha State. Small projections are also found in Odisha at Palasa and Mandasa mandals in the North-western direction.

According to the 2011 Census, the Srikakulam district's total population stands at 27,03,114, with 13,41,738 males and 13,61,376 females. The total number of normal Households in the district are 6,81,330 as against 2,09,27,188 households in Andhra Pradesh. The district stands at 21st rank in the State as far as population is concerned. Out of the district's

total population, 22,66,411 persons constituting 83.8 % are residing in rural areas. And the remaining 4,36,703 persons i.e. 16.2 %, are residing in urban areas. The proportion of urban to total population is regarded as an index of urbanization, and it is 16.2 % for the Srikakulam district. The district returned 14,95,381 literates, forming 61.7 % of the population of the district. Comparing urban and rural areas, the literacy rate worked out to 78.4 % and 58.5 %, respectively.



Map of Srikakulam District with Revenue Mandalas

The following steps were taken for the study was as follows:

Selection of area: The study was carried out to assess the prevalence of anaemia among adolescent girls aged 11 to 15 years were living in rural of **Bandapalli**, **Pathapatnam** and **Nelabonthu** in Srikakulam District.

Inclusion criteria: All adolescent girls aged 11 to 15 years

Exclusion criteria: Other than adolescent girls.

Selection of the samples: A total of five hundred and thirteen (513) rural adolescent girls of Bandapalli (218), Pathapatnam (133) and Nelabonthu (162) of Srikakulam District were selected by random sampling method. The selected adolescent girls belonging to the lower middle class of age between 11 to 15 years were chosen for the investigation.

Collection of data:
For assessing the prevalence of anaemia among adolescent girls, we used the following different methods for data collection

Socioeconomic Survey: A socioeconomic study was undertaken with the help of a questionnaire cum clinical testing approach. The schedule consists of details about the socioeconomic status. i.e. environmental conditions of the house, educational status, number of family members, health status, Clinical parameters and nutritional knowledge of adolescent girls. This data was collected by the interview method.

Results and Discussion

Nutritional deficiency anaemia is a globally prevalent condition and is more perturbing in the developing nations. Adolescence is the period of rapid growth marked by physical and mental transition. During this period, an individual undergoes emotional, sexual, social, and educational problems; besides, unhealthy dietary habits and low socioeconomic background make them vulnerable to diverse nutritional morbidities. According to Aggarwal *et al.* a study conducted among adolescent girls in North East Delhi showed a 45 % prevalence of anaemia [Aggarwal, 1998].

Our study findings showed a slightly higher prevalence rate than other similar studies conducted in India's various rural parts of Srikakulam rural and urban areas, which showed a prevalence rate between 56 % and 68.8 %. Studies were done by Gawarika *et al.* and Toteja *et al.* among adolescent girls from various India's rural districts observed a prevalence rate between 90.1 % and 96.5 %. Five hundred and thirteen rural adolescent girls were enrolled with a response rate of 99.0 %. The majority of the study group belonged to the age 13-14 (33 %) followed by age group of 11-12 (24 %), 12-13 (22 %), 14-15 years (21 %). The study participation from the mandalas of Bandapalli 218 (42.4 %), Pathapatnan 133 (25.9 %), followed by Nelabonthu 162 (31.5 %).

Magnitude and severity of anaemia: The mean haemoglobin level of adolescent girls was 12.6 ± 1.4, ranging from 6 to 14.6 g/dl. The overall prevalence of severe anaemia was 6 (1 %). The proportion of moderate and mild anaemia was 466 (91 %) and 41 (8 %), respectively.

The overall prevalence of anaemia among adolescent girls was considered in the range of 7 to 10. The majority of subjects with anaemia were having mild anaemia (8 %) followed by moderate anaemia (91 %) and severe anaemia (1 %), respectively. This was comparable to the study conducted by Rajaratnam *et al.* (Rajaratnam, 2000) in Tamil Nadu and Biradar *et al.* (Biradar 2012) in Karnataka. Toteja *et al.* (2006) found a 90 % prevalence of anaemia among adolescent girls from 16 districts in India. In our study, there was a significant association between socioeconomic status and anaemia. However, these observations are based on univariate analysis.

Association of anaemia with age: Increased prevalence of anaemia was noted among girls age eleven years, followed by 14 years of age. An increased prevalence of anaemia was seen during the early adolescent age. A similar study conducted in Haryana on 110 adolescent girls who belonged to low socioeconomic groups observed a similar prevalence among girls who were more than 14 years of age Gupta *et al.* (2019).

Adolescence is the most crucial phase of growth from birth to maturity; in this period, a sudden and rapid acceleration of physical growth and development occurs. The present analysis revealed the age-wise distributions in different adiposity and body composition profiles of all adolescent girls. Among the study, 91 % are menarcheal girls, which shows that girls experience the highest.

Anthropometric measurements: In this present study, body mass index (BMI) is classified as underweight, overweight, and normal. Prevalence of underweight is seen in (68 %) of the study population, and prevalence of underweight was more in boys compared to girls with (26.9 %) of boys with grade III thinness as compared to (11.50 %) of girls and the overall prevalence of underweight of 39.1 %. The relationship between BMI a gender difference is found to be statistically significant ($p<0.05$). BMI for age z-core (BAZ) was used to determine the respondent's nutritional status, and nearly two-thirds (62.0 %) had normal BAZ status. Adolescents with thin BAZ status constituted 147.8 (33 %), while overweigh (+ 1 SD and + 2 SD) and obese (> + 2SD) were 16 (3.6 %) and 6 (1.4 %), respectively.

The maximum number of adolescent girls in rural area is 44.8 % attained their menarche at the age of 13 to 14 years and 34.4 % adolescent girls have achieved their menarche from 15 to 16 years. This study indicates that high-value anthropometric characters experience early menarche. According to Heitmann, body fat from skinfolds gives a more direct estimate of body fat mass, significantly more so on children and adolescents, and may be used in field studies.

Association of anaemia with socioeconomic status: In the study, most adolescent girls (55 %) belonged to socioeconomic class SC and ST. Adolescent girls belonging to lower socioeconomic groups showed a high prevalence of anaemia than the girls belonging to higher socioeconomic groups (45 % in class III), which was statistically significant. A significant relationship between anaemia and socioeconomic status strongly recommends developing and implementing policies that improve and eliminate socioeconomic disparities.

16 % of rural adolescent girls had a middle school education and 20.4 % of rural adolescent girls having secondary education. Whereas 17.6 % of rural girls had higher secondary education. It was observed that a low level of literacy was observed in rural areas due to poverty and gender discrimination from childhood.

The study result shows that samples 15 % of rural girls, belong to the nuclear family and 64 % of adolescent girls belonged to a joint family in rural areas. In the nuclear family case, full attention is given to adolescent girls as they support the girls in particular requirements compared to joint families. 28 % of the families were engaged in farming, 3 % were involved in small business, 9 % were engaged in private, government jobs, and 35 % of the families were working daily wages. Whereas the rest of the people i.e., about 4 %, worked as a school teacher in rural areas. It was found that the rural population's occupational structure mainly depends (directly or indirectly) on agricultural work. Therefore about 28 % in rural were engaged in agricultural activities. Business persons, Teacher, and Service holder parents provide more intensive and facilities to adolescent girls to fulfill the requirement; they will provide hygiene and health facilities. On the other hand, farmer & daily wage workers cannot offer hygienic & health facilities to their adolescent girls.

The cleanliness of the house & it's surrounding of rural adolescent girls. It was found that 11 % of families clean their surroundings regularly, and 9 % of families were irregular about cleaning their surroundings. 4 % of adolescent girls have trees around their homes, while 19 % of adolescent girls do not have trees surrounding their households. 28 % of teenage girls knew about the adolescent period and got this information from schools, doctors, while 3 % of adolescent girls don't know about their age. 28 % of adolescent girls know the changes which take place in the adolescence period in their body. They got this information from schools, books, and friends. While 3 % of adolescent girls don't know about their bodies' changes during the adolescent period. 4 % of adolescent girls regularly check up their weight, while 1 % of adolescent girls do not regularly check their weight because they don't give importance to it. 13 % of adolescent girls responded and cooperate for health check-ups. Programs were carried out regularly, and information is given about adolescent age, changes take place in this age, etc. In 8 % of schools, no such programs were carried out. 40 % of rural adolescent girls were responded that fatigue is the main symptom of anaemia. However, 17 % of rural adolescent girls answered that they don't know about anaemia symptoms. 26 % of rural adolescent girls were responded that anaemia is a deficiency of iron, but 11.2 % of rural adolescent girls were responded that anaemia occurs due to deficiency of the vitamin. The majority of the sample, i.e. 40 % rural were answered that they don't know about the deficiency of anaemia. Thus it may be concluded that 50 % of adolescent girls were unaware of the causes of anaemia.

It was seen that in rural areas, 18 % of adolescent girls were taking meals twice a day, and 28 % of adolescent girls were taking their meals thrice a day and only 1 % of adolescent girls in rural areas were having their meals four times a day. The

requirement for iron is to be higher during the adolescent period. The onset of menstruation in girls has increased the demand for iron. The leading causes of the high prevalence of anaemia were the low intake of iron and increased iron demand for growth and menstruation in adolescent girls. These aspects have been studied in the present investigation by taking more sensitive iron status parameters and hemoglobin estimation.

Discussion

The present study was undertaken to assess nutritional anaemia and body mass index for age z-score (BAZ) in rural and urban school going adolescent girls. Based on the adjusted hemoglobin cut-off points, the overall prevalence of anaemia was 91 %, and the majority suffered moderate anaemia. Compared with the WHO cut-off points of 20 – 39 %, the observed prevalence was of moderate public health significance and is consistent with the WHO estimate of adolescent girls' anaemia for developing countries, 27 % [Balci, 2012]. Similarly, the present finding concurs with the Indian study findings, which reported 75 % of adolescents' with moderate anaemia [Sajneetha, 2015].

The present study reported that the prevalence of moderate anaemia is 91 %. A similar result was reported in a study conducted in Haryana - India during 2009. The mean prevalence of anaemia in the studies conducted during the past 3 years (2008-2011) was 72.9 %. The average prevalence of anaemia from 2006 - 2008 was 71.3 %. On comparing its prevalence with the current study, it was elucidated that high-level rise indicates a significant health problem that requires a solution to decrease increasing trends. This rings an alarm where intervention targeting an individual's benefit to be focused. Type of family has a substantial relationship with anaemia in this study which explains its higher prevalence in nuclear families. Reports of this study are contrary to the analysis by Rawat et al. 2001, which indicates the higher prevalence in joint families and ironically to both of the aforementioned study conducted at Cuddalore in 2010 showed no influence of the type of the family. The current study concurs Gupta *et al.* 2019, which shows high prevalence in nuclear families. There is a sharing of responsibilities which gives economic and social security to the family.

The present study infers non-vegetarians are more anaemic than vegetarians, while Verma *et al.* described vegetarians' chance of being more anaemic. This survey supports the low prevalence of anaemia among those who consume more green leafy vegetables. 80.75 % of participants were unaware of anaemia. 19.25 % of subjects were aware of what anaemia is. There has been increased awareness in private schools which may be a factor for the less prevalence of anaemia in private schools.

Female students who participated in this study were asked to describe a person with anaemia. Very few were aware of anaemia and Hemoglobin levels. Very few i.e. 2-3 % knew that they were anemic. Majority of the respondents were unaware of cause and symptoms of anaemia. This emphasized the need to focus on awareness programs before implementing any interventions. This study showed higher Hemoglobin mean in premenarcheal girls. There is a correlation between girls who have higher menstrual bleeding and anaemia. There is no difference between the hemoglobin of premenarcheal girls and girls with a regular menstrual cycle. This study shows the influence of menstrual bleeding on anaemia which is significant statistically as well as clinically. This finding diverges from the reports of the study done in Nagpur-India, which explicated that the menstrual bleeding was not an associating factor for anaemia.

Results of this study show that there is a relationship between anthropometry and anaemia. The mean weight is significantly less than that of others. Besides this incertitude arises from the preponderance of anaemia in obese participants which stresses the need to investigate the inbuilt absorption by assessing various iron indicators and the quantitative analysis of their food.

The present study showed no significant association between anaemia and dietary diversity score. This apparent lack of association might be explained by the fact that other factors other than dietary intake might have contributed to anaemia's risk. Further studies with advanced dietary assessment and laboratory methods are recommended to investigate the causes of anaemia.

Conclusion

The high incidence of anaemia in adolescent girls has gained importance in the recent past. The prevalence of modarate anaemia in adolescent girls is alarmingly high (91 %) even though the prevalence of anaemia is high in underweight participants, this study also shows that the prevalence of anaemia in preobese and obese (91 %) participants which stresses the focus on inbuilt absorption of micronutrients. This study shows that the factors such as age, literacy status of the mother, type of family, community, weight, diet, frequency of intake of green leafy vegetables and fruits, menstrual discharge, and deworming are the factors contributing to the prevalence of anaemia. Socioeconomic status, age at onset of menarche, standard to which the participant belongs to are the factors which are not correlated to the prevalence of anaemia. Awareness of anaemia and its causes are very low among the study participants, especially in public schools. Our study reveals that anaemia prevails irrespective of socioeconomic status which stresses the need to increase awareness of the consequences of anaemia in all strata of the society and our recommendations to overcome the anaemia among school-going children is Educating parents and children about the importance of deworming and emphasize them to have dewormed once in six months. Parents, as well as teachers, should be sensitized on undernutrition, the role of healthy diet and consequences of anaemia

In-depth studies can be done on evaluation of iron indicators like serum ferritin, serum transferrin etc. along with stool examination with broader samples. Though initiation of Iron fortification had been done, it should be in commonly reachable vehicles like salt, sugar and available for all, which doesn't demand individual co-operation. Awareness is more in private schools than in public schools. This stresses the need for conducting awareness programs in public schools.

It is recommended to consume Iron supplementation. It is recommended to educate the girls, her mother, and the school teachers regarding the causative factors, Consequences, and prevention methods. They should be made aware of low cost, iron-rich food. This will enhance adolescent girls' health to prepare for more significant challenges like pregnancy in later life. Millennium Development Goals (MDGs) are aimed at the reduction of Infant and maternal mortality. To achieve this, we have to address anaemia in adolescent girls. As a period of growth and development, adolescence is considered the best time to assist in physical and mental development, preventing maternal anaemia later.

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