Prevalence and Predictors of Anemia Among the Ashram Shala Adolescent of Sabarkantha District, Gujarat, India

HAP Journal of Public Health and Clinical Medicine
1(1) 50–56, 2023

DOI: 10.1177/jpm.221115604
jpm.hapkerala.org

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Abstract

Background: Adolescence is a pivotal period of reproductive maturation and cognitive development; the right intervention during this phase can prevent future health consequences. This study aimed to assess the prevalence and predictors of anemia among the Ashram Shala adolescents in a tribal part of Gujarat.

Methods: In this cross-sectional study, 414 students enrolled from 8 Ashram Shalas of Sabarkantha, Gujarat. A pretested structured questionnaire was used to document sociodemographic profiles, food consumption patterns, handwashing practices, awareness about anemia, and availability of iron folic acid tablets. Hemoglobin was measured by "ToucHb," (provided by Biosense Technologies Private Limited, A-233, Road No.21-Y, Wagle Industrial Estate, Thane, Maharashtra, India-400604) a noninvasive device in which the amount of Hb was measured by clicking pictures of the conjunctiva of participants. Statistical analysis was conducted through Statistical Package of Social Sciences (SPSS) version 20 (developed by Norman H. Nie, Dale H. Bent, C. Hadlai Hull and aquired by IBM in 2009).

Result: Study documented the greater prevalence of anemia among girls compared to boys (51.2% versus 48.7%; *P* = <0.001). The prevalence of mild anemia was more among the boys (33.5% versus 28.0%), whereas the prevalence of moderate and severe anemia among the girls (19.2%, and 3.9%) was higher than that in boys (14.8% and 0.5%). The odds of having anemia among the girls were 3.875 [CI (2.523, 5.953)] times greater as opposed to boys. Similarly, the adolescents who were neither consuming eggs [OR = 2.297, CI (0.925, 5.708)] nor washing their hands after defecation [OR = 2.135, CI (0.717, 6.358)] were more likely to have anemia.

Conclusion: The high prevalence of anemia among girls is a significant issue. Integrated interventions to address nutrition and hygiene practices were identified in the study. Regular distribution of iron folic acid tablets can reduce the risk of anemia.

Keywords

Adolescence, anemia, nutrition

Introduction

Around the world, anemia is one of the most prevalent nutritional problems (all ages prevalence, 22.8% in 2019) with being higher among developing nations because of low socioeconomic status, poor health care access, malnutrition, infectious disease, inflammation, soil-transmitted helminths, genetic disorders that affect hemoglobin synthesis, and other biological factors. Other than that, education status, household wealth, food consumption pattern, mobile or internet access, open defecation, mother's age at marriage, and the number of family members are a few contributors to having anemia.[1-13] India documented 60% prevalence of anemia in children younger than 5 years, 54% in women of reproductive age and adolescent girls aged 15 to 19 years. However, anemia occurs in both sexes and throughout all stages of life, studies disclosed it as a significant nutritional problem among adolescents.

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Hence, there should be a system to monitor nutritional anemia in older children and adolescents of both sexes.[7,14,15]

Adolescence is a reproductive maturation and developmental transition period, not only physically but mentally and socially too. These developmental changes need surplus nutrition to fulfill the requirements. Deficiency in this critical period can affect health in adulthood, cognitive development, and future offspring. Studies documented negative impacts of anemia on the health of infants and young children, including impairments in mental, physical, and social development, which in later years can result in poor school performance and decreased work productivity.[2,5,16,17] However, the adolescent groups in developing countries are more vulnerable to nutritional requirement, there are no clear-cut data available for adolescent anemia, exceptionally for boys.[5,7,16-20] Adolescence is an opportune time for interventions to address anemia and studies documented that adolescents can be easily approachable from the school-based intervention programs, especially adolescent girls.

India has implemented many national- and state-level programs to address the anemia problem among adolescents,[21] such as weekly iron and folic acid supplementation (WIFS),[22] National Iron Plus Initiative,[23] National Nutrition Policy,[24] and The Adolescent Girls' Anemia Control Program[25]. Despite these efforts, it continues to be a problem of concern. For an effective intervention to address the context-specific causes of anemia, understanding the diverse and complex problems of anemia is vital. Some studies explore the prevalence of anemia among adolescents in Gujarat but studies related to anemia and its predictors among young adolescence (both sexes) staying in tribal Ashram Shala (boarding schools) in Gujarat are limited. The present study aims to document the prevalence of anemia among the adolescents staying in Ashram Shala, which is a less explored area in terms of research in the Gujarat context.

Methodology

Study Design and Sample Size Selection

This study adopted a cross-sectional design; it was carried out at Idar and Khedbrahma block of Sabarkantha district from January to February 2020.

Study Settings

General Setting

The study was conducted in Sabarkantha, one of the tribal districts of Gujarat, India. As per the census of 2011, 85.02% population in Sabarkantha lives in rural areas.

Specific Setting

Residential ashram schools of Idar and Khedbhrahma taluka were selected for the study. The major purpose of residential ashram schools is to provide affordable schooling and accommodation to the socially marginalized population. 8 ashram schools from 2 blocks, where a majority of the students were from a tribal background, were selected for the study purpose.

Sampling Method

Total 2 blocks (Khedbrahma and Idar) were having Ashram Shala in the Sabarkantha district. Of all 8 Ashram Shalas from 2 blocks, 7 from Idar and 1 from Khedbrahma were included purposively for this study. Students studying (554) in the 5th to 12th standard and present on the day of the survey as well as follow-up survey (414) in the selected Ashram Shala were included in the study. Therefore, the total sample size of the study was 414 students. As this was a boarding school, the participants were enrolled taking school authorities' permission and formal consent of the participant's class teacher.

Data Collection

Data were collected by pretested, structured, vernacular, questionnaire form and documented the sociodemographic profile, anemia prevalence, food consumption pattern, handwashing practices, awareness about anemia and its symptoms, availability of iron folic acid (IFA) tablets and its consumption, and any symptoms of anemia. Anemia is categorized as mild (10 to 11.9 gm Hb/100 mL blood), moderate (7 to 9.9 gm Hb/100 mL blood), and severe anemia <7 gm Hb/100 mL blood) based on WHO anemia classification. In addition to having academic performance as excellent (≥80%), satisfactory (70% to 80%), and poor (≤60%), absenteeism in the last 3 months and playing hours were also documented. Hb was measured using the "ToucHb" instrument, a noninvasive device in which Hb is measured by clicking pictures of the conjunctiva of participants. The sensitivity and specificity of this device are 73.1% and 51.5%, respectively.[26]

Ethical Approval

Ethical approval for the study was obtained from the Internal Ethics Committee of the Indian Institute of Public Health Gandhinagar (IIPHG-IEC) (Form II IIPHGIEC/Ver1/10, Dated 26.02.2020).

Data Analysis

Data were checked, coded, cleaned, and entered in Statistical Package of Social Sciences (SPSS) version 20. Univariate analysis was performed by taking gender as independent variables and other sociodemographic determinants, anemia determined based on the Hb level, availability, and consumption of IFA tablets were taken as dependent variables. In advance analysis, the chi-square test was used to explore the association between gender-specific prevalence of anemia. A predictive model of adolescent anemia was developed by using the binomial logistic regression technique. Odds ratios were computed to assess the degree of association between the predictors and status anemia. Before running the binomial regression model, correlation coefficient (pairwise correlation between the variables) and multicollinearity have been checked by using the Pearson correlation and linear correlation in SPSS software.

Result

Sociodemographic Information

As shown in Table 1, out of 414 adolescents from residential Ashram Shala enrolled in the study, 265 were boys and 149 were girls. As this Ashram Shala was specifically for the social disadvantage group, around 80% of the participants were from scheduled tribes. The mean age of boys was around 12 years, whereas, for girls, it was 13 years. The mean height of boys was lower (137.11±10.77) as compared to girls. Similarly, the mean weight of boys (around 29 kg, 137 cm) was also slightly lower than girls (32 kg, 141 cm).

The study documented a higher literacy rate among the fathers (63.8%) in comparison to mothers (44.7%). Agriculture and labor were the 2 primary occupations of most parents.

Anemia Prevalence

Of 414 adolescents, 203 were anemic; therefore, the prevalence of anemia was 49%, which was significantly higher among girls compared to boys (51.2% versus 48.7%; $P = <0.001$). Furthermore, the study showed all 3-category prevalence of anemia (mild, moderate, and severe) were highest among the girls than boys (Table 2). The category of anemia was classified based on the `World Health Organization classification.[27]

Association Between Anemia and Sociodemographic Factors, Handwashing Practices, and Type of Food Consumption

The association between anemia and sociodemographic determinants, handwashing practices, and type of food consumption in binomial regression is shown in Table 3. Of all characteristics, only gender, consumption of eggs, and handwashing practices after defecation were significantly associated with anemia. The odds of having anemia in girls was 3.875 greater as opposed to boys. Similarly, no consumption of eggs [OR = 2.297, CI (0.925, 5.708)] and no handwashing practices after defecation [OR = 2.135, CI (0.717, 6.358)] were documented to greater the likelihood of having anemia.

Table 1. Sociodemographic Information (n = 414).

Variable	Type	Boys (n = 265) N (%)	Girls (n = 149) N (%)	Total (n = 414) N (%)
Caste	SC	21 (7.9)	23 (15.4)	44 (10.6)
	ST	213 (80.4)	119 (79.9)	332 (80.2)
	OBC/SEBC	31 (11.7)	7 (4.7)	38 (9.2)
Age	Mean age of participants	12.31±1.25	13.25±1.73	–
Father's education	Illiterate	91 (34.3)	36 (24.2)	127 (30.7)
	Literate	161 (60.8)	103 (69.1)	264 (63.8)
	Do not know	13 (5)	10 (6.7)	23 (5.5)
Mother's education	Illiterate	147 (55.5)	68 (45.6)	215 (51.9)
	Literate	109 (41.1)	76 (51.0)	185 (44.7)
	Do not know	9 (3.4)	5 (3.4)	14 (3.3)
Father's occupation	Agriculture	179 (67.5)	109 (73.2)	288 (69.6)
	Labor work	46 (17.4)	17 (11.4)	63 (15.2)
	Business	8 (3.0)	3 (2.0)	11 (2.7)
	Others/not alive	32 (12.1)	20 (13.4)	52 (12.5)
Mother's occupation	Agriculture	162 (61.1)	69 (46.3)	231 (55.8)
	Labor work	69 (26.0)	68 (45.6)	137 (33.1)
	Business	4 (1.5)	0 (0.0)	4 (1.0)
	Others/not alive	30 (11.3)	12 (8.1)	42 (10.1)

Abbreviation: SC, scheduled caste; ST, scheduled tribe; SEBC, scheduled economically backward class; OBC, other backward class.

Table 2. Anemia Prevalence.

Variable	Boys (n = 265)	Girls (n = 149)	Total (n = 414)	*P*-Value
No anemia	166 (62.6)	45 (30.2)	211 (51.0)	<0.001
Mild anemic	68 (33.5)	57 (28.0)	125 (30.2)	<0.001
Moderate anemic	30 (14.8)	39 (19.2)	69 (16.7)	
Severe anemic	1 (0.5)	8 (3.9)	9 (2.2)	
Total	99 (48.7)	104 (51.2)	203 (49.0)	

Table 3. Association Between Anemia and Sociodemographic Factors, Handwashing Practices, and Type of Food Consumption Among 414 Adolescents in Binomial Regression.

Variables	Adjusted OR (CI)	Unadjusted OR
Gender		
Boys	–	–
Girls	3.88 (2.52, 5.95)	4.06 (2.60, 6.34)
Caste		
SC	–	–
ST	0.74 (0.4, 1.39)	1.005 (0.5, 2.04)
OBC/SEBC	1.28 (0.53, 3.08)	2.794 (1.05, 7.45)
Mother's education		
Illiterate	–	–
Literate	1.35 (0.91, 2.00)	1.08 (0.68, 1.71)
Father's education		
Illiterate	–	–
Literate	1.50 (0.98, 2.30)	1.32 (0.81, 2.14)
Consumption of eggs		
Yes	–	–
No	2.3 (0.93, 5.71)	2.279 (0.84, 6.15)
Handwashing practice after defecation		
Yes	–	–
No	2.13 (0.72, 6.36)	2.109 (0.66, 6.72)

Abbreviation: OR, odd ratio; SC, scheduled caste; ST, scheduled tribe; SEBC, scheduled economically backward class; OBC, other backward class.

The difference was statistically significant. Literate parents documented greater odds of having anemia among students compared to illiterate parents. This might be because of not any key role of parents in the improvement of Hb status as the study participant was staying in the Ashram Shala.

Discussion

Anemia is a prevalent nutrient deficiency worldwide, especially in developing countries, like India.[28] It occurs in each age group but is more prevalent in under-5 children, pregnant women, and adolescents. The adolescence period is considered a "preparatory phase for future health, the right intervention during this phase can prevent the future consequences."[29]

Literature documented that early adolescence (12–15 years) had a higher prevalence of iron deficiency anemia.[30] Yet, there is a paucity of data on the national prevalence of anemia among Indian adolescents.

According to NFSH-4, the prevalence of anemia among adolescent girls aged 15 to 19 years was 54%.[31] With the available data, it is not clear about both sex adolescent anemia prevalence. The present study showed a 49% prevalence of anemia among adolescents. Similar studies conducted in a different pocket of India documented the adolescent prevalence of anemia at 52.5% (girls) in Madhya Pradesh, 37% (boys) in Gujarat, and 48.63% (girls) in Tamil Nadu, 41.1% (girls) in Karnataka, 85.4% (girls) in Maharashtra, 21.5% (girls) in Shimla, 56.3% (girls) in Uttar Pradesh, 77.33% (girls) in Andhra Pradesh, and 19.13% among college students and 96.5% in tribal areas in Kerala.[29,32-37] We reported a higher prevalence of anemia among girls (69.8%) than boys (37.4%). This is similar to what has been reported elsewhere in various studies conducted in India.[5,36] In contrast, a study done in Ethiopia, which is also a developing country, reported a higher prevalence of anemia in boys (22.5%) as opposed to girls (19.7%).[38,39]

The literature cites that Indian tribal communities are socially and economically disadvantaged and not aware of health and nutrition policies, hence unable to consume adequate nutrition.[36,40] It is also evident that socioeconomic status is a significant determinant of access to health care which increases the risk of anemia.[41,42] In this study, participants were from scheduled caste (SC), scheduled tribe (ST), and scheduled economically backward class (SEBC) categories; the outcome of this study showed that ST participants were 54% less likely to have anemia in comparison to SEBC/other backward class (OBC). Similar to our findings, various other studies documented the high prevalence in the lower socioeconomic category compared to upper categories elsewhere in India, which is a matter of huge concern.

We reported a positive association of anemia with the frequency of iron folic acid supplementation to adolescents, handwashing practices, and consumption of eggs in a meal. In conformity to our findings, many other studies found the reduction of anemia through the supplementation of iron among different populations and the consumption of eggs in meals.[35,43-46] The literature cites a positive association between parents' education with the status of anemia. On the other hand, our study showed a higher prevalence of anemia among literate parents. It might be because our selected participants were residing in residential schools where parents' education could not impact.

Studies on the relationship between nutritional status and academic performance showed that the children with iron deficiency and with or without anemia had lower scores

than the children with normal iron status; hence, iron is a vital component of children's cognitive development.[47,48] Our study highlighted that nonanemic students performed better academically than their anemic counterparts. Thus, it is the need of the hour to address this nutritional deficiency among the adolescents through well-strategized, tailormade, cultural context intervention targeting nutritional status, and sanitation to have a healthy workforce of tomorrow.

Conclusion

The study found a high prevalence of anemia among adolescents, with greater risk in girls, compared to boys. The study also documented a positive association between the status of anemia with gender, handwashing practices, and consumption of eggs in the meal. Moreover, this study shows that even after the implementation of various programs for adolescents, such as The Adolescent Girls' Anemia Control Program and WIFS, there has not been much improvement in the nutritional status of adolescents. Integrated interventions that address nutrition, hygiene practices, and regular distribution of iron folic acid tablets with strict monitoring and evaluation of programs can reduce the risk of anemia and improve health among this critical age group.

Although this study awssessed both female and male adolescents, it only includes Ashram Shala's adolescents, not the whole general adolescent population, and could not follow-up. In addition to that, the study includes the use of a noninvasive method for hemoglobin estimation and the method of calculation of hemoglobin through clicking the picture of the conjunctiva of the participants so there is a chance of error in this method and there can be 0.5% to 1% difference in results as compared to the invasive method. But to improve the participation of children, this device was considered.

Acknowledgments

The authors would like to acknowledge the managing trustees and school teachers of the Ashram Shala for providing support during the data collection process. The authors would also like to acknowledge Dr Tapsvi Puwar and Dr Somen Saha, faculties from the Indian Institute of Public Health Gandhinagar, for providing technical support in the planning and execution of the project.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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