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Prevalence and Determinants of Anemia among Adolescent Girls in Rural Nepal

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ABSTRACT

Background: Adolescence is a period of rapid growth and increased nutritional requirements, making girls in low- and middle-income countries, such as Nepal, vulnerable to iron deficiency anemia. In rural areas of Nepal, menstrual blood loss, poor diet, and socio-cultural barriers all increase this risk. Despite national programs, anemia remains a major public health concern, affecting cognition, immunity, and future reproductive health. This study assessed the prevalence and determinants of nutritional status, including anemia, in adolescent girls.

Methods: A cross-sectional school-based study was conducted from July to August 2024, with 501 adolescent girls aged 10 to 19 years, using a census method in Annapurna Rural Municipality, Kaski, Nepal. Data were collected using face-to-face interviews, anthropometric assessments, and blood tests. BMI-for-age z-scores (BAZ) were computed using WHO Anthro-Plus, and anemia was categorized based on laboratory-established ferritin guidelines. Data were analysed using descriptive statistics, the χ^2 test, and logistic regression ($p < 0.05$).

Results: Considering ferritin (< 40.7 ng/mL) and hemoglobin (≤12 g/dL), the prevalence of anemia was found to be 67.6% and (≤12 g/dL), respectively. Maternal education, family type, and parental marital status were found to be significantly associated with anemia ($p<0.05$). Similarly, ethnicity, maternal education, and family type were found statistically associated with nutritional status ($p <0.05$).

Conclusions: The study highlighted a concerning magnitude of anemia among adolescent girls in rural Nepal, with two-thirds being anaemic. The findings underscore that nutritional deficiencies are not merely biological issues but are deeply rooted in social and educational determinants such as maternal education, family structure, and ethnicity. Addressing this challenge requires a comprehensive approach such as strengthening nutrition education, promoting iron-rich diets, ensuring regular screening, and enhancing maternal awareness through community and school-based programs to effectively reduce anemia and improve adolescent health outcomes.

Keywords: Adolescent girls; adolescent health; anemia; obesity; overweight.

INTRODUCTION

Adolescence (10-19 years) is a critical period of development characterized by increasing dietary requirements and susceptibility to health concerns.[1-3] Undernutrition, obesity, and anemia are serious concerns among adolescent girls, particularly in low- and middle-income countries like Nepal.[4,5] These conditions can have an impact on cognitive development, immunology, and future reproductive health.[6,7] Despite governmental efforts such as the Weekly Iron and Folic Acid Supplementation Program, anemia persists among adolescent girls in Nepal, particularly in rural regions.[8-10] Furthermore, the rising prevalence of overweight and its potential link to anemia is a growing worry.[11,12] Poor dietary diversification and socioeconomic disparities exacerbate these issues.[13,14] However, only a few localized and school-based studies have assessed both

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anemia and nutritional status among rural adolescent girls.[15,16] Moreover, few studies have explored the concurrent existence of undernutrition, obesity, and micronutrient deficiencies like anemia in this population. Therefore, this study aimed to assess the prevalence and determinants of anemia and nutritional status among adolescent girls in a rural municipality of Nepal.

METHODS

A analytical cross-sectional study was conducted from July to August 2024 in Annapurna Rural Municipality, Kaski, Gandaki Province. The study population was school-going adolescent girls aged 10-19 years who formally consented to participate in this study. The sample size was calculated using OpenEpi, using a 21% prevalence of anemia[11] in adolescent females, with a 95% confidence level, ±5% precision, and a design effect of 2 for cluster sampling. With a finite population of 1,500 and a 20% non-response adjustment, the final sample size was 501. A census method was applied, selecting all public schools, and recruiting eligible female students aged 10–19 who had begun menstruation. Before involving adolescents in this study, consent forms were distributed to students several days prior to data collection, with the support of the school, to obtain parental consent. In cases where parents were unable to read the consent form or did not initially provide consent due to limited understanding, follow-up phone calls were made to explain the study in detail. Written consent was subsequently obtained through a signature or thumbprint. After securing parental consent, assent was obtained from each participating student in the classroom. Data collection was then conducted only among those who provided both parental consent and participant assent..

Data were collected through face-to-face interviews using semi-structured questionnaires that covered demographic and socioeconomic characteristics, Theory of Planned Behavior constructs, menstrual distress, health literacy, biomarkers, and physical measurements. Each interview lasted approximately 30–40 minutes. The study instrument was derived from Brouwer AM & Mosack KE's study (2015).[17] Anthropometric measures were performed using standard techniques and calibrated equipment. Lead investigators and trained research assistants collected data and performed quality control. Research assistants received training on the study methodology and data collection procedures. Blood samples were collected and analyzed by certified laboratory technicians and technologists. Participants who were classified as anemic received health-related counseling. Provide school-based health education courses on anemia and nutrition.

Fieldworkers measured each participant's height and weight three times using World Health Organization (WHO) guidelines. Height and weight measurements were taken using an electronic Body Mass Index (BMI) Scale-POCT (with individuals wearing light clothing and no shoes).[18] The mean of the height and weight was used for the analysis. Although BMI is commonly used to describe adult weight, it cannot be used to determine overweight during periods of growth, such as adolescence.[31] Thus, z-scores (standard deviations) for BMI was also used, which have been adjusted for sex and age according to the WHO reference 2007 values for school-age children.[19] BMI z-scores were categorized as thin/underweight (<-1), overweight (> 1 to <2), and obese (≥ 2).

The anemia status was determined by serum ferritin levels. Certified laboratory personnel obtained a 5 mL venous blood sample from each participant under sterile settings, using conventional venipuncture protocols to ensure minimal discomfort. The samples were transported under controlled conditions to the Clinical Analysis Laboratory at Fistel Hospital Pvt. Ltd. in Pokhara, Nepal. Serum ferritin levels were tested with a fully automated chemiluminescence immunoassay analyzer, and serum iron was determined with an Iron Test Kit. A Benesphera 3-part hematology analyzer was used to determine haematological parameters for a complete blood count. Anemia was diagnosed using known ferritin cutoff values, which are generally recognized indications of iron deficiency and anemia. To ensure data accuracy and reliability, quality control methods were implemented throughout the collection, transportation, and analysis processes.

Sociodemographic data on adolescents (age, menstrual onset, ethnicity, school grade) and households (female and male guardians' education, female and male guardians' work, family type, and international wealth index (IWI) were collected. The principal component analysis (PCA) was used to determine household worth from 12 assets. These assets consist of seven consumer durables (TV, Refrigerator, Phone, Bike, Car, Cheap utensils, Expensive Utensils), access to two public services (Electricity and Source of drinking water), and three housing characteristics (Toilet facility, Floor, and No. of sleeping rooms).

The household wealth score were classified into tertiles and defined as poorest, poorer, poor, and rich based on score distribution. Similarly, parents' education were categories as either having 'no education, primary, secondary education, Higher secondary and above. Likewise, ethnicity were categories in two groups: disadvantaged ethnic group (Dalit & disadvantaged Janajati) and advantaged ethnic group (Brahmin/ chhetri & advantaged Janajati). The parental marital status was classified as 'couple parenting' and 'other' where 'Couple parenting' refers to married couples who share responsibility for raising their children while "Other" includes separated, divorced, single mother or single father who independently care for their children.

Data were entered into the Kobo toolbox software, cleaned, coded, and analyzed using SPSS version 25. Anthropometric data were recorded and evaluated with the WHO Anthro-plus version 1.0.4 software. A descriptive summary (frequency distribution, proportion, mean, and standard deviation) was applied to summarize the variable. Bivariate and multivariable logistic regression were used to examine the associations between anemia and socio-demographic, nutritional, and other significant factors, using odds ratios and 95% confidence intervals. A p-value of fewer than five percent was considered statistically significant. BMI for age z-scores (BAZ) were calculated using the WHO Anthro-plus software version 1.0.4 to classify adolescents' nutritional status. Adolescents identified as BAZ were underweight (<−2SD) or overweight/obese (>+1SD).

Ferritin was classified as low (< 40.7 ng/mL) and normal (≥ 40.7 ng/mL) based on the reference range provided by the diagnostic analyzer and reagents used in the testing laboratory (MAGLUMI®, Snibe Diagnostics).[20] Although the WHO typically recommends a ferritin threshold of 15 ng/mL for adolescents, this study adopted 40.7 ng/mL following the manufacturer's standards, which reflect the operational calibration and sensitivity of the specific assay used. In addition, Dietary knowledge was assessed using twelve questions, with a score below average (<6) indicating non-acceptable knowledge and a score of average or higher indicating acceptable knowledge. Principal components analysis was used to determine the household asset quintile of all respondents.

RESULTS

Among the 476 participants, the majority (54%) were aged 10–14 years, while 46% were 15–19 years old. Most participants were in grade 10 (36.8%). More than half of the participants (59%) experienced menarche at or before the age of 12. Regarding ethnicity, Dalits constituted the largest group (50.3%). Most participants (92.2%) had married parents. In terms of socioeconomic factors, nearly half of the mothers (47.3%) had primary education, Similarly, most fathers (43.7%) had secondary education, regarding occupation, the majority of mothers were engaged in agriculture (37.4%) or were homemakers (37.7%), while fathers predominantly worked in foreign jobs (36.4%) or agriculture (24%). The majority of the participants (70%) belonged to nuclear families; based on the wealth index, 50.8% were classified as poor. Regarding health parameters, 9.4% had hemoglobin levels ≤12 g/dL Serum iron levels were normal (35–145 μg/dL) in 80.9% of participants, Almost all participants (99.6%) had normal TIBC levels (149–492 μg/dL), Ferritin levels were low (<40.7 ng/mL) in 67.6% of participants, Based on BMI-for-age Z-scores, 3.6% were underweight, 80.9% had a normal BMI, 12.8% were overweight, and 2.7% were obese. Lastly, only 36.1% had acceptable dietary intake knowledge (**Table 1**).

The study found that anemia was significantly associated with a mother's education (p=0.011) and broadly associated with age(p=0.053), leading to higher anemia proportions among girls whose mothers had no education. Only family type (p=0.014) had a significant association with nutritional status, with girls from joint or extended households being more likely to be malnourished. Other variables, such as age, grade, ethnicity, parental occupation, wealth index, and dietary knowledge, had no significant relationship with either anemia or nutritional status.

Multiple logistic regression models were utilized to explore the association between anemia and selected sociodemographic characteristics of adolescent girls. In the unadjusted model (Model I), girls from non-nuclear households had a greater risk of anemia (OR: 1.39, 95% CI: 0.92-2.11). Model II was adjusted for age and family type, while Model III incorporated maternal education and parents' marital status. In the fully adjusted model (Model IV), Girls whose mothers were illiterate had significantly higher odds of anemia (AOR: 0.28, 95% CI: 0.12-0.63), emphasizing maternal education as a key determinant factor. Furthermore, adolescent girls aged 15-19 years were considerably more likely to be anaemic than those aged 10-14 years (AOR: 1.50, 95% CI: 1.01-2.24). In all models, parents' marital status and family type were not substantially related to anemia.

Multiple logistic regression models were employed to identify risk variables for undernutrition among adolescent girls attending school. In the unadjusted model (Model I), no significant connections were found.

Model II adjusted for ethnicity and family type; Model III also included the parents' marital status; and Model IV adjusted for the mother's occupation. In the fully adjusted model (Model IV), girls from disadvantaged ethnic groups had a significantly reduced risk of undernutrition than girls from advantaged groups (AOR: 0.59, 95% CI: 0.34-1.00). Girls from single-parent families had a significantly increased risk of nutritional status (AOR: 1.79; 95% CI: 1.09-2.95). In none of the models were parents' marital status or the mother's work significantly associated with nutritional status. (**Table 5**).

Table 1. Demographic and socioeconomic characteristics and biomarkers of participants.

Characteristics	N (%)	Characteristics	N (%)
Sociodemographic Factors		**Occupation of Father (N=462)**	
Age Group		Foreign Job	168 (36.4)
10-14 years	257 (54)	Agriculture	111 (24)
15-19 years	219 (46)	Service	62 (13.4)
Grade		Daily wages	58 (12.6)
7	102 (21.4)	Business	49 (10.6)
8	93 (19.5)	Others	14 (3)
9	106 (22.3)	**Family Type**	
10	175 (36.8)	Nuclear	333 (70)
Onset of Mensuration		Joint	126 (26.5)
≤ 12 years	281 (59)	Extended	17 (3.6)
>12 years	195 (41)	**Wealth Quantile (IWI)**	
Ethnicity		Poorest (<35)	12 (2.5)
Dalit	241 (50.6)	Poorer (35-50)	129 (27.1)
Upper caste	132 (27.7)	Poor (50-70)	242 (50.8)
Disadvantage Janajati	66 (13.9)	Rich (>70)	93 (19.5)
Relatively advantageous Janajati	37 (7.8)	**Biomarkers and BMI**	
Marital Status of Parents		**Haemoglobin**	
Married	439 (92.2)	≤11 g/dl	13 (2.7)
Widowed	17 (3.6)	>11 g/dl	463 (97.3)
Other(marital)	20 (4.2)	**Serum Iron Level**	
Socioeconomic Factors		Normal (35-145 ug/dl)	385 (80.9)
Mother Education (N=469)		High (>145 ug/dl)	91 (19.1)
Illiterate	27 (5.8)	**TIBC Level**	
Basic	222 (47.3)	Low (<149 ug/dl)	2 (0.4)
Secondary	175 (37.3)	Normal (149-492 ug/dl)	474 (99.6)
Higher Secondary & above	45 (9.6)	**Ferritin Level**	
Father Education (N=462)		Low (< 40.7 ng/ml)	322 (67.6)
Illiterate	17 (3.7)	Normal (>40.7 ng/ml)	154 (32.4)
Basic	165 (35.7)	**BMI for age z-score (BAZ)**	
Secondary	202 (43.7)	Underweight	17 (3.6)
Higher Secondary & above	78 (16.9)	Normal	385 (80.9)
Occupation of Mother (N=469)		Obesity	61 (12.8)
Agriculture	185 (39.4)	Obese	13 (2.7)
Homemaker	177 (37.7)	**Dietary Intake Knowledge**	
Business	47 (10)	**Knowledge of Dietary Intake**	
Service	33 (7)	Acceptable	172 (36.1)
Others	27 (5.7)	Non-acceptable	304 (63.9)

Table 2. Association of anemia and Nutritional status with demographic characteristics of participants.

Variables	Anemia		p-value	Nutritional status		p-value
	Yes N (%)	No N (%)		Normal N (%)	Malnourished N (%)	
Age group			**0.053**			0.502
10-14	164(63.8)	93(36.2)		205 (79.8)	52 (20.2)	
15-19	158(72.1))	61(27.9)		180 (82.2)	39 (17.8)	
Grade Basis			0.197			0.476
7	62(60.8)	40(39.2)		77 (75.5)	25 (24.5)	
8	69(74.2)	24(25.8)		76 (81.7)	17 (18.3)	
9	69(65.1)	37(34.9)		88 (83)	17 (18)	
10	122(69.7)	53(30.3)		144 (82.3)	31 (17.7)	
Onset of Mensuration			0.225			0.211
≤ 12 years	184(65.5)	97(34.5)		222 (79)	59 (21)	
>12 years	138(70.8)	57(29.2)		163 (83.6)	32 (16.4)	
Ethnicity			0.172			0.075
Disadvantaged ethnic group	201(65.5)	106(34.5)		241 (78.5)	66 (21.5)	
Advantaged ethnic group	121(71.6)	48(28.4)		144 (85.2)	25 (14.8)	
Marital Status of the parent			0.146			0.087
Couple Parenting	293(66.7)	146(33.3)		359 (81.8)	80 (18.2)	
Others	29(78.4)	8(21.6)		26 (70.3)	11 (29.7)	
Mother Education			**0.011**			0.656
Illiterate	11(40.7)	16(59.3)		20 (74.1)	7 (25.9)	
Basic	153(68.9)	69(31.1)		180 (81.1)	42 (18.9)	
Secondary and above	151(68.6)	69(31.1)		179 (81.4)	41 (18.6)	
Father Education			0.163			0.668
Illiterate	11(64.7)	6(35.3)		15 (88.2)	2 (11.8)	
Basic	103(62.4)	62(37.6)		134 (81.7)	30 (18.3)	
Secondary and above	199(71.1)	81(28.9)		224 (80)	56 (20)	

Table 3. Association of anemia and Nutritional status with socioeconomic characteristics of participants.

Variables	Anemia		p-value	Nutritional status		p-value
	Yes N (%)	No N (%)		Normal N (%)	Malnourished N (%)	
Occupation of the mother						
Agriculture	121(65.4)	64(34.6)		150 (81.1)	35 (18.9)	
Homemaker	121(65.4)	56(34.6)	0.379	148 (83.6)	29 (16.4)	
Business	28(59.6)	19(40.4)		38 (80.9)	9 (19.1)	0.061
Service	23(69.7)	10(30.3)		27 (81.8)	6 (18.2)	
Others (Foreign job and daily wages)	22(81.5)	5(18.5)		16 (59.3)	11 (40.7)	
Occupation of Father						
Foreign Job	115(68.5)	53(31.5)		135 (80.4)	33 (19.6)	
Agriculture	70(63.1)	41(36.9)	0.674	92 (82.9)	19 (17.1)	0.292
Service	42(67.7)	20(32.3)		45 (72.6)	17 (27.4)	
Daily wages	39(67.2)	19(32.8)		51 (87.9)	7 (12.1)	
Others (Homemaker and unemployment)	46(74.2)	16(25.8)		50 (80.6)	12 (19.4)	
Family Type						**0.014**
Nuclear	232(69.7)	101(30.3)		279 (83.8)	54 (16.2)	
Joint or extended	90(62.9)	53(37.1)	0.150	106 (74.1)	37 (25.9)	
International Wealth Index						0.427
Rich	258(66.3)	131(33.7)	0.192	312(80.2)	77 (19.8)	
Poor	64(73.6)	23(26.4)		73 (83.9)	14 (16.1)	
Dietary Intake Knowledge						0.786
Low Knowledge	208(68.4)	96(31.6)		247 (81.3)	57 (18.8)	
Normal Knowledge	114(66.3)	58(33.7)	0.631	138 (80.2)	34 (19.8)	

Table 4. Correlates of anemia among school-going adolescent girls.

Variables	Model I* 95% CI for OR			Model II** 95% CI for OR			Model III*** 95% CI for OR			Model IV**** 95% CI for OR		
	OR	Lower	Upper	OR	Lower	Upper	OR	Lower	Upper	OR	Lower	Upper
Family Type												
Nuclear	Ref			Ref			Ref			Ref		
Others (Joint or extended)	1.39	0.92	2.11	1.44	0.95	2.20	1.46	0.95	2.23	1.42	0.92	2.18
Marital status of parents												
Couple Parenting				Ref			Ref			Ref		
Single parenting and others				0.65	0.28	1.52	0.60	0.25	1.43	0.60	0.25	1.45
Mother Education												
Illiterate							0.30	0.13	0.67	0.28	0.12	0.63
Educated							Ref			Ref		
Age of adolescent girls												
10-14 years										Ref		
15-19 years										1.50	1.01	2.24

*Model I- Respondent's family type and anemia

**Model II- Respondent's family type, parents' marital status, and anemia

***Model III- Respondent's family type, parents' marital status, mother's education, and anemia

****Model IV- Respondent's family type and parent marital status, and mother's education and anemia

Table 5. Correlates of nutritional status among school-going adolescent girls.

Variables	Model I* 95% CI for OR			Model II** 95% CI for OR			Model III*** 95% CI for OR			Model IV**** 95% CI for OR		
	OR	Lower	Upper	OR	Lower	Upper	OR	Lower	Upper	OR	Lower	Upper
Ethnicity												
Disadvantaged	0.64	0.39	1.07	0.67	0.40	1.12	0.63	0.37	1.06	0.59	0.34	1.00
Advantaged	Ref			Ref			Ref			Ref		
Marital Status parents												
Couple Parenting				Ref			Ref			Ref		
Single parenting and others				2.11	0.95	4.71	1.75	0.77	4.00	1.55	0.66	3.64
Types of family												
Nuclear							Ref			Ref		
Others(Joint or extended)							1.87	1.14	3.05	1.79	1.09	2.95
Occupation of mother												
Agriculture & Homemaker										1.40	0.79	2.46
Service, business and others										Ref		

* Model I- Respondent's ethnicity and nutritional status
**Model II- Respondent's ethnicity, parenting status, and nutritional status
***Model III- Respondent's ethnicity, parenting status, family type, and nutritional status
****Model IV- Respondent's ethnicity, family type, parenting status, and mother's occupation and nutritional status

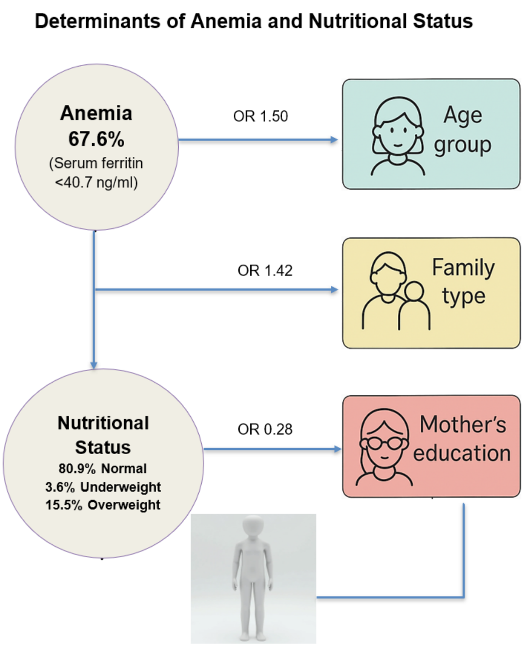

Figure 1.Determinants of Anemia and Nutritional Status among adolescents.

DISCUSSIONS

In the study, nearly two-thirds (67.6%) of school-going adolescents suffered from iron deficiency anemia (low ferritin). Similarly, approximately one in five participants were found to be malnourished (19.1%) based on BAZ (BMI for age z-score). We identified factors associated with anemia in this demographic factor family type, marital status of parents, mother's education, age of adolescents, and a few demographic factors, such as Ethnicity, marital status of parents, types of family, and occupation of mothers, were associated with nutritional status. Despite a low prevalence of clinical anemia based on hemoglobin levels 9.4% a significant proportion of participants (67.6%) exhibited low ferritin levels, indicating iron deficiency as a major risk factor for anemia. This finding aligns with previous studies highlighting the high prevalence of anemia among adolescent girls in Nepal, particularly in rural settings. For instance, studies in India have reported anemia prevalence rates of 48.63%[21] and 63.3%[22], while a systematic analysis revealed a pooled prevalence of 65.7% (95% CI: 59.3%–71.9%) among adolescent girls,[23] which closely mirrors our findings.

In contrast, studies conducted in low-income countries in Ethiopia reported comparatively lower anemia prevalence rates of 23.03% (95% CI: 17.07%–28.98%) and 19.1% (95% CI: 16.1%–24.6%)[24,25] in Bangladesh 46.8% [95% CI: 36.0–57.6].[26] These variations may be attributed to differences in geographic and ecological contexts, dietary patterns, socioeconomic conditions, and the characteristics of study populations. Additionally, iron deficiency anemia is often exacerbated by factors such as inadequate dietary intake, menstrual blood loss, and limited access to healthcare and nutritional resources.[27]

The study identified key sociodemographic factors associated with anemia among adolescent girls. In multivariate analysis, we found the multivariable analysis revealed that maternal education and the age of adolescent girls were statistically significant with anemia. Adolescent girls with illiterate moms were considerably more likely to be anemic (AOR: 0.28, 95% CI: 0.12-0.63), which is consistent with prior research from rural Haryana, India,[28] Nepal, and other low- and middle-income countries.[29] Maternal education has a significant impact on eating habits, hygiene, and access to health information, all of which are protective against anemia, in contrast, a study in Global Public Health found higher anemia prevalence among adolescents whose mothers lacked formal education (AOR:3.7, 95% CI: 2.1-6.4).[5] and similarly to the Ethiopian study, also had higher education's levels (AOR:3.27, 95% CI: 1.79-5.97).[30]

Furthermore, girls aged 15 to 19 were more likely to be anaemic than those aged 10 to 14 (AOR: 1.50, 95% CI: 1.01-2.24). This is consistent with data showing older adolescent girls are at a higher risk due to menstruation, growth spurts, and increasing physiological demands in late adolescence. Other variables, including family type and parental marital status, showed associations in unadjusted models but lost statistical significance with adjustment for additional confounding factors.

Regarding nutritional status, family type emerged as an important component. Girls in joint or extended family settings were more likely to be malnourished than those in nuclear homes (AOR: 1.79, 95% CI: 1.09-2.95). This could be attributed to resource sharing, lower per capita food allocations, or cultural food hierarchies in extended families. Similar tendencies have emerged in various South Asian contexts. In bivariate models, ethnicity and parental marital status appeared to influence nutritional outcomes, but these correlations were not statistically significant in the fully adjusted model. However, impoverished ethnic groups still maintained a borderline association with higher chances of nutrition status (AOR: 0.59, 95% CI: 0.34-1.00), indicating potential disparities in food access or health care.

Furthermore, the low prevalence of underweight (3.4%) contrasts with the major proportions of overweight (12.4%) and obesity (3.2%), indicating a growing double burden of malnutrition in rural areas. These trends reflect Nepal's changing nutritional environment, in which undernutrition coexists with rising overweight and obesity rates. The study emphasizes the need for comprehensive school-based programs that target both undernutrition and noncommunicable disease risks. Combining ferritin and anthropometric data provides important insights into the nutritional health of adolescent females, a group that is frequently overlooked in studies. The school-based setting additionally promoted rigorous data collection and identification of key sociodemographic and dietary determinants to inform targeted nutrition interventions.

This study has limitations. Self-reported data, particularly dietary information, may be influenced by recall or reporting biases. The study focused primarily on iron-related anemia, excluding other important micronutrients such as zinc, vitamin B12, and vitamin A, resulting in a narrower nutritional assessment. Future studies should include a larger set of biological indicators and apply theory-based behavioral approaches to better understand and influence dietary and health practices among adolescents and their families. Nonetheless, the study provides insight into how ethnicity, age, family size, and maternal education affect adolescent health, all of which are significant factors to consider when developing future interventions and policies.

CONCLUSIONS

The study revealed a substantial burden of anemia among adolescent girls in rural Nepal, with nearly two-thirds affected, underscoring a significant public health concern. Maternal education, family type, and ethnicity were key determinants influencing anemia and overall nutritional status. Strengthen school- and community-based nutrition programs, promoting dietary diversity, ensuring provision of regular iron and folic acid supplementation, and enhancing maternal education and awareness are crucial to improving the nutritional well-being of adolescent girls in rural communities. However, school-based interventions focusing solely on nutrition education and supplementation may not be sufficient. Future research should explore theory-driven behavioral change interventions to understand and modify dietary and health practices among adolescents and their families.

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CONFLICT OF INTEREST

Authors declare there are no any conflicts of Interest.

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