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Prevalence of Anemia and Associated Factors among Female Students in a Health Science College

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ABSTRACT

Anemia is a condition defined with less hemoglobin (Hb) level than the normal range in the body, which decreases oxygen-carrying capacity of red blood cells to tissues. A cross-sectional study was conducted to, estimates the prevalence of anemia and associated risk factors among female students in College of Health and Medical Sciences. Of a total of 422 surveyed 13.5% were anemic in which 61.3% and 26.1% were mild and moderate respectively. Univariate analysis of the potential risk factors has depicted that history of malaria and folic supplementation showed a statistically significant association with the proportion of anemic ($p < 0.05$). With multivariable analysis, only folic supplementation showed a statistically significant association with anemia ($p < 0.05$). As a result, students on the iron supplement (OR=7.39, 1.45-37.57) were at higher risk of anemic than non-iron supplements. The present study has also demonstrated the existence of a high prevalence of anemia and deep-rooted the importance of iron supplements as possible causes of anemia. It is therefore, recommended to prevent anemia in women by considering potential risk factors.

Keywords: Anemia, Prevalence, Associated factors, Health, Health Science College, and Female student.

INTRODUCTION:

Anemia is defined as condition with less hemoglobin (Hb) level than the normal range in the body, which decreases oxygen-carrying capacity of red blood cells to tissues (Nutrition WA, 2005). World Health Organization (WHO) and Center of Disease Control and Prevention (CDC) definitions for anemia differ with age, sex and pregnancy status. The classification is as follows: children 6 months to 5 years anemia is defined as a Hb level < 11 g/dl, children 5-11 years Hb < 11.5 g/dl, adult males Hb < 13 g/dl; non-pregnant women Hb < 12 g/dl and pregnant women Hb < 11 g/dl (Benoiste

et al., 2008; Regasa and hyder, 2019). Anemia is a globally public health problem that affects both developing and developed countries with a high impact on human health, social and economic growth. It is prevalent at all stages of life, but it is more prevalent in female adolescents and young women (Nutrition WA, 2005).

Young women including adolescent females are susceptible to anemia because of their biological demands for micronutrients associated with rapid body growth and the depletion of these nutrients due to parasitic infestations (Benoiste *et al.*, 2008). Anemia is also com-

mon in puberty due to the onset of menstruation, which alters an individual's iron status by generating more demand for iron, blood loss and pro-inflammatory processes due to menstrual cycles (Regasa and hyder, 2019). Globally, it was estimated that one-third of the total population (32.9%) is suffered from anemia with sub-Sahara African countries contributed to the highest anemia burden (Kasseeburne *et al.*, 2014).

More than half of young women world-wide have suffered from anemia and this figure is significantly higher than the World Health Organization's cut-off value for identifying anemia as a public health problem (Yasutahe *et al.*, 2013). Approximately one-quarter of young women in developing countries are anemic (WHO, 2005). Most African and other low and middle-income countries contribute to the highest-burden of anemia among young women. Anemia burden among young women is also common in sub-Saharan country which ranges from 13.7% in Ethiopia to 61.5% in Ghana (Yasutahe *et al.*, 2013). Ethiopia also shares the high burden of anemia in young women which ranges from 24% to 38%, with an average rate of 29% (Gebreyesus *et al.*, 2019). Anemia in young women is a serious condition which impedes them from reaching their full potential by reducing educational achievement, labor productivity as well as their cognitive capacity and affects their mental health (WA, 2008; Sen and Rennani, 2006). Besides, in pregnant women, the risk of birth complications and the delivery of low birth weight infant are increases with anemia (Soekarjo *et al.*, 2001; Shahen *et al.*, 2019).

According to different studies, many factors such as educational status, marital status, wealth status, nutritional status, occupation, type of toilet facility, source of drinking water, contraceptive use, distance from the health facility, and region are associated with anemia in young women (Regasa & Hyder, 2019; Tembrhe *et al.*, 2015; Kibret *et al.*, 2019). The extra needs of nutrients because of rapid growth and physical change in young women commonly result in nutritional deficiencies which are the common causes for anemia. Despite its common occurrence in young women, most previous studies focused on anemia among the reproductive age group (15 to 49 years) (Sadeghien *et al.*, 2013; Win & Ko, 2015) and to our knowledge, there is a scarcity of information on the prevalence of anemia

among young women and its determinants in Africa including Ethiopia. Anemia due to nutritional deficiency rises at the beginning of puberty and associated physical and physiological changes that occur in adolescents and young women that place a major demand on their nutritional requirements, making them more vulnerable to nutritional deficiency anemia (Benoist *et al.*, 2008; Sharif *et al.*, 2019).

As many literatures reported, the potential factors affecting reproductive age and young women's anemia are not similar, as young age is the time where nutritional demand is highest. Besides, this study was conducted based on nationally representative Ethiopian Demographic and Health Survey (EDHS) data with a larger sample size that could provide valid information for countries, particularly sub-Saharan African countries and other low- and middle-income countries that had similar socio-economic and socio-cultural patterns. Therefore, this study aimed to investigate the prevalence of anemia and its determinants among young women in Ethiopia. The findings of this study could help to inform policymakers as well as governmental and non-governmental organizations about the magnitude of this problem as well as the potential factors associated with anemia to plan intervention strategies.

MATERIALS AND METHODS:

Study Area

This study was collaboration with Bangladesh and Harar Health Science College students. Harari regional state which is located in eastern parts of Ethiopia. It is 526 km from Addis Ababa to East direction and an elevation of 1885 meters above sea level. It has a temperature that range from 23-30⁰c, the average annual rainfall of 565mm³ and the town has an altitude of 1885m/6184ft. The total population of the region are 250903, out of those 122942 are men and 127961 are women. The Ethnic group in the region includes Oromo (52.3%), Amhara (32.6%), Harari (7.1%) and other (HRHB). Study Design Cross-sectional study was conducted from June 2021 - September 2021 in health Science College.

Study participants

The study participants were female student greater than 18 years old and who were volunteer for blood donation in Health Science College.

Inclusion and Exclusion Criteria

Inclusion

Only female students in Health Science College.

Exclusion

Those pregnant one unwilling to response was excluded.

Sample Size Determination

The sample size will be determined by using single population proportion formula by considering the assumption of 95% confidence interval 5% margin of error.

$$N = \frac{(z\alpha/2)^2 P(1-P)}{d^2}$$

Where,

N = sample size

P = estimate of prevalence of the proportion=50%

z = value that corresponding 95% confidence=1.96

d = margin of error=5%

$$n = (1.96)^2 \times 0.5 \times 0.5 / (0.05)^2$$

$$n = 0.960 / 0.0025$$

$$n = 384$$

By adding 10% Non-respondent rate the total sample size will be 422.

Sampling techniques and procedures

From total female students (1016) k-interval was determined that is –

$$K = N/n = 1016/422 = 2.4 \sim 2.$$

So sample were taken by skipping 2 until sample size fulfilled

Method of data collection

Questionnaire

Data on socio-demographic characteristics of study participants and determinant factors of anemia were collected using interviewer based questionnaire by the taught data collectors.

Hemoglobin determination

A venous blood sample was taken, from interviewed female students in Harar health science college and filed to micro cuvette, and then placed in the cuvette holder device for measuring hemoglobin concentration and anemia status was determined based on the WHO classification using the hemoglobin level of the respondents (Kennedy et al., 2021)

Operational definition

Mild anemia hemoglobin level 11.9gm to 10gm/100 ml blood

Moderate anemia hemoglobin level 9.9gm to 7gm/100 ml blood

Severe anemia hemoglobin level < 7gm /100ml blood

Anemia in non-pregnant woman hemoglobin level <12 gm/100 ml blood

Variables

Dependent variable

Anemia

Independent variables

Age, resident, medical history and nutritional habit.

Quality Control

Questionnaires were pre-tested prior to the actual data collection. The collected data were checked for consistency and completeness. All the laboratory procedures were conducted as per the standard operating procedures.

Data Analysis

Data was collected, checked whether missing data or outliers or incomplete and then transported to Statistical Package of Social Science (SPSS version 16). Univariate analysis and Independent variables which P - value <0.025 were candidate for multivariate logistic regression. Variables in which p -value < 0.05 will be declared as significant by adjusted odd ratio with 95% Confidence interval.

RESULTS:

Socio-demographic characteristics

All students recruited this study were female. A total of 422 female student participated in the study. Most 304 (72%) of the participant had age of 18-25 and 115 (27.5%) student had age of 26-34 at a time of surveyed. All most all female student participated in study were single 69.9% and the reaming 2.6% was married time of surveyed. The mean age of the study participants was (ranged from 18 to 41 years). Out of 422 participants, (60.7%) were living in urban areas and the rest 87 (39.3%) in rural residents. More than half, 412 (97.6%), of the study participants occupation were student and the rest of participant (2.3%) was both house wife and student (**Table 1**).

Table 1: Socio-demographic characteristics of female student (n=422).

| Variable | Category | Frequency | Proportion % |
|----------------|------------------------|-----------|--------------|
| Age | 18-25 | 303 | 71.8% |
| | 26-34 | 119 | 28.2% |
| Marital status | Single | 409 | 96.9% |
| | Married | 13 | 3.1% |
| Residence | Urban | 256 | 60.6% |
| | Rural | 166 | 39.3% |
| Occupation | Student | 412 | 9.7% |
| | House wife and student | 10 | 2.3% |
| Family size | 2-4 | 299 | 70.8% |
| | 4-6 | 123 | 29.1% |

Table 2: Laboratory finding of anemic type.

| Hematocrit value (Hb value) | Number of cases (%) |
|------------------------------------|---------------------|
| Anemic < 33% (< 11 gm/dl) 57 (7.9) | 57(61.4%) |
| Not-anemic > 33% (> 11 gm/dl) | 15(26.3%) |
| Total | (100%) |
| Severity of anemia | |
| Mild | (61.5%) |
| Moderate | (26.5%) |
| Sever | (12.3%) |
| Total | 100% |

Laboratory findings of female student

Among 422 study participants 57 (13.5%) were anemic (Hb: < 11 g/dl) and not-anemic > 33% (> 11 gm/dl) 365 365(86.5%). Of which 35(61.4%) mild anemia, 15(26.3) moderate and (12.3%) was severe based on the morphology of red blood cells.

Nutritional characteristics

Vegetables were consumed weak to weak and (30.6%) of female does not regularly. Almost more than fifty

present of students consume teff (61.6%) per day while small proportion (62%) did not consume per day. Meat was the least frequently consumed food item, since 99.9% of the study participants reported that they never consumed it per day (**Table 3**). Of all participants, (89.1%) reported that they had a habit of consuming tea and/or after a meal, (89.1%) once per day and only (1.6%) did not.

Table 3: Nutrition related characteristics of female student.

| Characteristics | Frequency | Proportion % | |
|-----------------|------------------|--------------|-------|
| Vegetable | Weak to weak | 293 | 69.4% |
| | Not regular | 129 | 30.6% |
| Teff | Yes | 260 | 61.6% |
| | No | 262 | 62.1% |
| Tea | After every meal | 376 | 89.1% |
| | Once per day | 44 | 10.4% |
| | Not at all | 2 | 0.5% |
| Coffee | After every meal | 27 | 6.4 |
| | Once per day | 388 | 91.9% |
| | Not at all | 7 | 1.6% |

Pervious medical history of female student

Only (12.1%) of female student was taken deworming regularly while 87.9% was not regularly. Of all UniversePG | www.universepg.com

respondents, (82.9%) did not took iron folate supplement at least once in the preceding four weeks but (17.1%) reported full compliance with the supplement

in the reference period. However all study participant was negative for HIV test (Table 4).

Table 4: Clinical history of female student in harar Health College.

| Characteristics | | Frequency | Proportion % |
|-----------------|-----|-----------|--------------|
| Malaria | Yes | 43 | 10.2% |
| | No | 379 | 89.8% |
| Regular deworm | Yes | 51 | 12.1% |
| | No | 371 | 87.9% |
| Iron supplement | Yes | 72 | 17.1% |
| | No | 350 | 82.9% |

Laboratory Findings of Female Student

Among 422 study participants 57 (13.5%) were anemic (Hb: < 11 g/dl) and not-anemic > 33% (> 11 gm/dl) 365 365(86.5%).Of which 35(61.4%) mild anemia, 15(26.3) moderate and (12.3%) was severe based on the morphology of red blood cells (Table 2).

Univariable logistic rig ration

The bivariate analysis showed that age, resident and iron supplementation were variable which had association, but the only variable which has association in multivariate analysis was iron supplementation (OR = 7.39; 95% CI: 1.45-37.57) (Table 5).

Table 5: Bivariate analysis of anemia with independent variables.

| Risk factor | Category | Total (N) | Number Positive | Prevalence (%) | Univariable Analysis | |
|-----------------|----------|-----------|-----------------|----------------|----------------------|-------------|
| | | | | | COR (95% CI) | p-value |
| Age | 18-22 | 303 | 40 | 13.2 | 1.00 ^a | |
| | 22-34 | 119 | 17 | 14.3 | 1.4(1.23-3.49) | 0.06 |
| Marital status | Single | 410 | 56 | 13.6 | 1.00 ^a | |
| | Marred | 12 | 1 | 8.3 | 1.78(0.76-4.14) | 0.13 |
| Residence | Urban | 256 | 35 | 3.12 | 1.00 ^a | |
| | Rural | 166 | 22 | 13.2 | 2 (1.49-4.30) | 0.08 |
| Family size | 1-4 | 293 | 40 | 13.6 | 1.00 ^a | |
| | +4 | 123 | 17 | 13.8 | 1.08 (0.09-2.40) | 0.23 |
| Malaria | Yes | 43 | 14 | 32.5 | 2.4(0.89-6.07) | 0.08 |
| | No | 379 | 43 | 11.3 | 1.00 ^a | |
| Iron supplement | Yes | 72 | 5 | 6.9 | 1.00 ^a | |
| | No | 350 | 52 | 14.8 | 1.46 (1.23-3.49) | 0.03 |

Multivariate analysis

In the final multivariate analysis the only variable which has association with occurrence of anemia was folic supplementation and found to be independent

explanatory variably in female student. Non folic supplement were at more risks for anemic than those in other (OR = 7.39; 95% CI: 1.45-37.57) (Table 6).

Table 6: Multivariate analysis of anemia with independent variables.

| Risk factor | Category | Total (N) | Number Positive | Prevalence (%) | Univariable Analysis | |
|-----------------|----------|-----------|-----------------|----------------|----------------------|---------|
| | | | | | AOR (95% CI) | p-value |
| Iron supplement | Yes | 43 | 14 | 32.5 | 1.00 ^a | |
| | No | 379 | 43 | 11.34 | 7.4(1.45-37.57) | 0.003* |

DISCUSSION:

In this study the overall prevalence of anemia in the female student was 13.5% this was in line with previous finding of other researcher 12.5% in Saudi (Baroot et al., 2010) 9.7% in Debra Berhan (Abere,

2014), 10% in Sudan, (Abdelgader et al., 2014),1.6% Addis Ababa (Gebreweld and Tsee, 2018) and Iran, 13.6% (Kumari and Priya, 2016). However, our finding was lower than previous studies conducted in South East Ethiopia, 27.9% (kefyelew et al., 2014).

The difference might be due to host sampled, geographical variation, and dietary habits of the study participants. In this study, the majority of anemic cases, 61.3% were mild type followed by moderate cases of anemia 26.5%. This result was similar with reported in Kenya (62.5% and 37.5%) (Siteti *et al.*, 2014) and Nepal (67. 1%, and 28.6%) (Singh *et al.*, 2013). In which majority of the cases was mild anemia followed by moderate anemia respectively. However the present study were In contrast with (70.7% and 26.3%) report in Kenya (Tekeste, 2015) and (60% and 34.3%) report in southern Ethiopia (Gedefew *et al.*, 2014). Folic supplementation was the major risk factor for increased anemia prevalence and factor remained significant in the final model. This finding was in agreement with result of (Brhane Berhe *et al.*, 2018). This might be due to low amount of meat and vegetable in daily consumed food in the study area. In the present study, there was positive association between medical history of malaria in student and prevalence of anemia. This result was close agreement with report of (Brhane Berhe *et al.*, 2018) that prove that having history of medical history of malaria condition was the major risk factor for increased anemia prevalence, but showed no stastically significance association.

CONCLUSION AND RECOMMENDATIONS:

This study found an overall prevalence of anemia among its sample of apparently healthy female student in harar health Science College was 13.5%. The study also reported that the main risk factors in relation to contracting anemia were inadequate intakes of iron, frequent tea consumption, infrequent red meat consumption, and a past personal history of malaria and irregular deworming. The findings presented here suggest a need for focused education and awareness strategies designed to improve nutritional habits by encouraging the consumption of rich sources of iron in the diet like red meat. The current work has set a standard for possible future research in the form of randomized trials which would help to build greater understanding of this health issue and would also support the development of a strong and suitable public health policy which can efficiently tackle anemia. In line with the findings of the present study, the following recommendations are forwarded in order to mitigate the effects of the anemia:

- Based on the identified risk factors, the approach to anemia control should ensure that preventive strategies be targeted to all female student
- Stool analysis and nutrition intervention and dietary supplement should be strongly inculcated
- Anti-helminthes should be given as prophylaxis to adolescent and young adult women, before their reproductive career
- All female student greater than 18 age joined harar health science college should be screened and treated routinely for intestinal parasitic infection

Ethical Approval

Ethical approval was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Sciences official letter of support was sent to Ambo town health office and to other concerned bodies. This study was conducted in accordance with the Declaration of Helsinki

CONFLICTS OF INTEREST:

The authors declare that there is no conflict of interest.

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