

**ANEMIA AND ASSOCIATED FACTORS AMONG ADOLESCENT GIRL  
ATTENDING HIGH SCHOOL IN MIZAN AMAN TOWN, BENCH  
SHEKO ZONE, SOUTHWEST ETHIOPIA,2020**



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Anemia and associated factors among adolescent girl attending high school in Mizan Aman Town, Bench Sheko Zone South West Ethiopia,2020

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## **Abstract**

**Background:** Worldwide Anemia is a common health problem, as well as around two billion people, were to suffer from anemia. In Ethiopia, the prevalence of anemia among adolescent girls is mild to moderate public health problem. Unfortunately, because initiatives to prevent anemia commonly target infants, children, pregnant, and lactating women, but adolescents may remain unmet and the consequences of anemia in adolescents continued. Besides, there are a few studies done on anemia among high school adolescents in Ethiopia, and no documented study is found in the study area.

**Objective:** To assess the prevalence of anemia and its associated factors among adolescent girls attending high school in Mizan AmanTown, Bench Sheko Zone, South west Ethiopia.

**Methods:** Institutional based cross-sectional study design was employed among randomly selected 281 high school adolescent girls in Mizan-Aman Town from March 08 to 19, 2020. Structured and pretested questionnaires were used to collect the data. Data were entered into Epi-Data version 3.1 and exported to SPSS version 24 for further analysis. On bivariate analysis  $p \leq 0.25$  were considered as candidates for multivariable logistic regression. Multivariable logistic regression was done to control for confounders and to identify factors independently associated with anemia. The level of statistical significance was declared at  $P < 0.05$ .

**Results:** A total of 281 adolescents were involved in this study with a response rate of 93.7%. The prevalence of anemia among adolescent girls was 23.5% with (95%CI: 18.9, 28.8). This study identified important Factors associated with anemia among adolescent girl in the study area were Father education (AOR=1.27;95%CI:0.67,5.70;P=0.0014), family size (AOR=3.23;95%CI:1.13,5.78;p=0.012), wealth index (AOR=6.00;95%CI:2.31,15.7;p=<0.001), duration of menstruation (AOR=2.63;95%CI: 1.03, 6.67;p=0.043) and dietary diversity score (AOR=2.13;95% CI:1.16, 8.43;p=0.024).

**Conclusion:** Prevalence of anemia among school adolescent girls was moderate public health problem. Father education, family size, lower wealth index, duration of menstruation and low dietary diversity score were independent significant predictors of anemia. Therefore, iron-rich food, nutritional education, and diversified food consumptions should be given attention to reducing the burden of anemia

**Keywords:** *Anemia, Adolescent girls, high school, Mizan Aman, Ethiopia.*

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## Table of Content

Abstract .....	I
Acknowledgment .....	II
Table of Content.....	III
List of tables .....	VI
List of figures .....	VII
Abbreviations & Acronyms .....	VIII
1. INTRODUCTION.....	1
1.1. Background .....	1
1.2. Statement of the problem .....	3
2. Literature review .....	5
2.1. Magnitude of Anemia among adolescent girl school students.....	5
2.2. Factor associated with anemia.....	6
2.2.1. Socio demographic and economic factors.....	6
2.2.2. Health, Sanitation and environmental health related factors.....	7
2.2.3. Anthropometric related factors.....	8
2.2.4. Nutritional related factors.....	8
2.2.5. Knowledge related factors:.....	9
2.3. Conceptual frame work .....	10
2.4. Significance of the study .....	11
3. Objectives.....	12
3.1. General objective.....	12
3.2. Specific objectives.....	12
4. Methods and materials .....	13
4.1. Study area and period.....	13
4.2. Study design .....	13
4.3. Population.....	13

4.3.1. Source of population: .....	13
4.3.2. Study Population .....	13
4.4. Inclusion and Exclusion Criteria .....	13
4.5. Sample size and sampling procedures.....	14
4.5.1. Sample Size Determination.....	14
4.5.2. Sampling technique and procedure .....	16
4.6. Data collection method.....	17
4.6.1. Data collection instruments and procedure .....	17
4.6.2. Data Collectors .....	19
4.7. Study variables .....	19
4.7.1. Dependent variable.....	19
4.7.2. Independent variables.....	19
4.8. Operational Definitions .....	20
4.9. Data processing and analysis.....	21
4.10. Data quality control .....	22
4.11. Ethical clearance .....	23
4.12. Dissemination plan.....	23
5. Results .....	24
5.1. Socio demographic and Socioeconomic Characteristics of the Study Participants .....	24
5.2 The prevalence of anemia among adolescent girls.....	26
5.3. Sanitation and environmental health related factors .....	27
5.4. Health and anthropometric characteristics of adolescent girls.....	28
5.5. Knowledge of adolescent girls related to anemia.....	32
5.6. Characteristics of dietary practice and related factors .....	32
5.7. Intestinal and blood parasitic characteristics of study participants .....	34
5.9. Factors associated with anemia .....	36
6. Discussion .....	38

6.1. Limitation of the study .....	40
7. CONCLUSION AND RECOMMENDATION .....	41
7.1. Conclusion.....	41
7.2. Recommendation.....	42
Reference.....	43
Annex-1: Participant Information Sheet and Consent Form for parents/students .....	48
Annex-2: English Questionnaire .....	49
Annex-3. Amharic version of the questioner .....	59
ANNEX -4: Standard operating procedures (SOP).....	68

## List of tables

Table 1: Sample size determination and assumptions used for the study on anemia and associated factors among high school adolescents girl of Mizan Aman Town, Southwest Ethiopia 2020. ....	15
Table 2: Distribution of socioeconomic and demographic characteristics among family of adolescent girls in Mizan Aman town, southwest Ethiopia, 2020. ....	24
Table 3: Sanitation and environmental health related factors among adolescent girl high school students in Mizan Aman Town, southwest Ethiopia, 2020. ....	27
Table 4: Health related characteristics of the study participants among adolescent high school girls in Mizan Aman Town, Southwest Ethiopia,2020. ....	31
Table 5: Individual Dietary diversity of the study participants among high school adolescent girls in MizanAman Town , Southwest Ethiopia, 2020. ....	33
Table 6: blood and Stool investigation result of adolescent girl high school students in Mizan Aman Town, Southwest Ethiopia, 2020. ....	35
Table 7: Bivariable and Multivariable logistic regression model predicting of anemia among adolescent high school girls in Mizan Aman, Southwest Ethiopia, 2020. ....	36



## List of figures

Figure 1: conceptual framework developed after reviewing different literatures, to assess anemia among high school adolescent girl students in Mizan AmanTown, South West, 2020.....	10
Figure 3:Figures shows how to study units were selected for data collection process among high school adolescents girl students at Mizan Aman Town, Southwest Ethiopia,2020.....	16
Figure 4: prevalence of anemia among adolescent girls attending high school in Mizan Aman Town, Southwest Ethiopia, 2020. ....	26
Figure 5: Height for age Z-scores of in high school adolescent girls, Mizan Aman Town, Southwest Ethiopia,2020.....	29
Figure 6: BMI for age Z-scores of high school adolescent girls, Mizan Aman Town, Southwest Ethiopia,2020. ....	30

## **Abbreviations & Acronyms**

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
BSC	Bachelor of Science
CI	Confidence Interval
COR	Crude Odds Ratio
CSA	Central Statistical Agency
DDs	Dietary Diversity score
FANTA	Food and Nutrition Technical Assistance
IDA	Iron-deficiency Anemia
IDDS	Individual Dietary Diversity Score
HHFs	household food security
Hb	Hemoglobin
MND	Micronutrient deficiency
SNNPR	Southern Nation Nationalities Peoples Region
SOP	Standard Operating Procedures
SPSS	Statistical Package for Social Sciences
STH	Soil Transmitted Helminths'
UNICEF	United Nation International Child Emergency Fund
UN	United Nations
WHO	World Health Organization

# 1. INTRODUCTION

## 1.1. Background

Anemia is a condition characterized by reduction in the number of red blood cells (RBCs) and/or hemoglobin (Hb) concentration in the human body, which decreases the oxygen-carrying capacity of hemoglobin to tissue (1). There are several types and classifications of anemia. The occurrence of anemia is due to the various red cell defects such as production defect (Aplastic anemia), maturation defect (megaloblastic anemia), defects in hemoglobin synthesis (iron deficiency anemia), genetic defects of hemoglobin maturation (thalassemia) or due to the synthesis of abnormal hemoglobin (sickle cell anemia) and physical loss of red cells (hemolytic anemia) (2).

The causes of anemia in developing countries are different factors from those the common cause are nutritional deficiencies (iron, folate, vit A and vitamin B12), infections (like intestinal parasite infestation, malaria), and health problems (inflammation, heavy menstruation and chronic illness) (3). In addition to these factors affecting anemia also gender, age, socio-demographic status, dietary habits, repeated pregnancies, postpartum hemorrhage, gastric ulcers, hemorrhoids, and pure vegetarian diet (1,4).

Among the causes of anemia around 50% of causes are considered due to iron deficiency. Adolescents are at high risk of iron deficiency and anemia due to Iron is necessary during adolescence time because of onset of menstruation and adolescent growth spurt and It has effect on productivity, cognitive functioning, school achievement performance and lowers physical working capacity or rapid growth with the sharp increase in lean body mass, blood volume and red cell mass, which increases iron requirements for Hemoglobin synthesis in the blood (5–8).

Nutritional deficiencies and poor eating behavior during adolescence can have long-term consequences like delayed sexual maturation and lower final adult height (9). Large scale implementation of anti-helminths delivered through the school system can significantly decrease infection and morbidity. The mass treatment has been shown to decrease in the prevalence of schistosomiasis and hookworm infection and a significant increase in hemoglobin (10).

The world health organization (WHO) recommends periodic treatment with anti-helminths medicines, without previous individual diagnoses to almost all living in endemic areas. Treatment is recommended once a year when the prevalence of soil-transmitted helminths' (STH) infections in the community are over 20%, and twice a year when the prevalence of the infections in the community exceeds 50% (1).

Hemoglobin concentration is varying due to age, sex, altitude, and physiologic status. Measurement of hemoglobin is the most effective and commonly used method to screen anemia. determining the concentration of hemoglobin, an iron-containing protein, in RBC is a more sensitive and direct indicator of anemia than hematocrit (% RBC in whole blood) (11). Classification of anemia considered as a problem of public health is generally classified as; when the prevalence exceeds 5% of the population. And the severity of the public health problem of anemia is expressed as mild, moderate, and severe if the prevalence of anemia reaches 5-19.9%, 20-39.9%, and  $\geq 40\%$  respectively (12).

Nutrition during adolescence plays an important role in the human life cycle and the diet of children and adolescents must be adequate to support normal and sometimes in rapid growth and development (13). They require 15 to 25% of final adult height and 50% of adult weight are attained with a bone mass increase of 45% (1,9).

In most of the cases, anemia is largely preventable and easily treatable if detected on time. Effective management of anemia includes treatment of the underlying causes, restoration of the hemoglobin concentration to normal levels, and prevention and treatment of complications (14). Initiatives to prevent anemia commonly target on infants, children, and pregnant and lactating women are important in preventing on consequences of anemia in adolescents continued (15–17). Given the multifactorial nature of this disease, correcting often requires an integrated approach to effectively combat anemia, the contributing factors must be identified and addressed (18).

In general, globally prevalence of anemia is dramatically incremented among high school adolescent girls, but it is easily treatable and preventable, so knowing the prevalence, underline cause, manifestation, and how to prevent the occurrence of the disease is important for preventing of high school adolescent girls.

## 1.2. Statement of the problem

Worldwide anemia is a common health problem, as well as around two billion people, were suffering from anemia and it affects 24.8% of the world population with burden varying with a person's age, sex, altitude, nutritional status, and physiological status (pregnancy states) (1).

WHO and International Center for Research on Women (ICRW) described that around 27% of adolescent girls in developing countries are anemic compared to developed countries (6%).with this high rate of anemia among adolescent girls in India (55%), Nepal (42%), Cameroon (32 %) and Guatemala (48%) (12,19).

In sub-Saharan Africa about half of adolescent girls are anemic (20). Mostly anemia is a result of nutritional deficiency disorder and poor dietary intake of iron and it is the most dangerous public health problem among adolescents. There is a high prevalence of anemia in the African Region and those factors affecting anemia in this region are malnutrition(undernutrition), malaria, parasitic infection, and poor dietary habit(21,22).

In Ethiopia, the prevalence of anemia among adolescent males ranged from 2.8% to 15%, and females 9.3% to 34.8% and in pregnant women is high (40% or more) (1,23). In a different part of Ethiopia studied about the severity of anemia among adolescent girls was mild to moderate public health problems such as Dembia (25.5%), Berahle (22.8%), Bahirdar ( 11.1%) and WayuTuqa (27%) (17,22,24,25). Intestinal helminths infections are very common and have a high association with the prevalence of anemia and undernutrition (26,27). but only a few studies were carried out to evaluate the impact of de-worming on anemia(28).

Anemia is a major public health problem and its burden or negative implications for poor growth, poor brain and cognitive development, reduced work capacity, and high maternal mortality rate(1,18). Correcting anemia requires an integrated approach based on identifying the magnitude and addressing the contributing factors. Based on different studies, the predictors of anemia among adolescent girls were varied in different studies such as age, the status of menstruation, socio economic status, parent level of education, wealth states of family, dietary iron intake status, household family size, nutritional status,being stunted, underweight, history of infestation parasitic infections (16,19,29). Besides, Knowledge of the severity and causes of anemia in adolescence is important, as this is a window of opportunity for school-based

interventions to improve adolescent health (13,16,30). However, most adolescents in the Mizan Aman town served coffee and tea together with a meal and after meal within less than 30 min. This may affect the process of iron absorption from the meal taken thus, exposed them for anemia. But most of the researchers are not considered on the environmental hygiene (source of water and latrine), knowledge, abortion, de-worming status, time of drinking coffee/ tea with /after a meal, diarrheal episode, and use and availability of ITN.

Furthermore, Mostly studies on anemia in Ethiopia were employed on pregnant, lactating women and children. Because they thought as adolescents are less vulnerable to nutritional deficiency than the other age groups which are not true, but the fact of that is adolescence increased demands on both micro-and macronutrients due to the rapid changes occurring in physical as well as in body composition specifically among girls at the time of their menarche. That why; there were few studies documented on anemia among high school adolescents in Ethiopia, and no documented study is found in the study area. **Therefore, this study aims to assess the prevalence of anemia and associated factors among high school adolescent girl students of Mizan Aman Town, southwest Ethiopia.**

## **2. Literature review**

Anemia is a common nutritional deficiency disorder and which affects both developing and developed countries with major consequences for human health and their social and economic development. Iron deficiency anemia (IDA) in adolescent girls has strong health implications during reproductive age(31).

### **2.1. The magnitude of Anemia among adolescent girl school students**

Based on a cross-sectional study employed in Nepal in 2018 the prevalence of anemia was 42.5% among school adolescent girls, this, the moderate and severe anemia was 38.1%, 4.4% girls respectively (32). The cross-sectional study design conducted in Rwanda, among 231 adolescent girls that revealed the prevalence of anemia was 29% that means the 67 adolescent girls were anemic (29%), from those the Prevalence of mild, moderate and severe anemia was 45 girls (19.47%), 18 girls (7.79%) and 4 girls (1.73%) respectively(33) cross-section study employed in south India specifically Permabular town reported that the prevalence of anemia among adolescent girl was 41.1% from this 37% moderate and 4.1% was mild anemia (34). another a cross-sectional study design was conducted in Delhi town , India the overall prevalence of anemia was 39% in adolescent girls from this the prevalence of severe, moderate and mild anemia was 0.5%, 10.6, and 27.9% respectively (31).

In Ethiopia, the prevalence of anemia among the age group of 15–19-year-old males and females ranged from 2.8% to 15% and 9.3% to 34.8% respectivelyCross-sectional study was done in Bahirdar City among 443 school adolescent girls then they reported that the prevalence of anemia was 11.1% (24). cross-sectional was done in babble district, Eastern Ethiopia among adolescent girls revealed that among 547 adolescents,32% were anemic and 1.8% of them were severe anemia (15). As well as a study conducted in Wollega among school adolescents girls reported that among 448 adolescents, the prevalence anemia was 27% of which 23% mild and 4% had moderate anemia (25).

A school-based cross-sectional study was done in the Gedeo zone among 443 school adolescent girls revealed that the prevalence of anemia among adolescents girls was 22%. higher among

those in early adolescence period compared to late adolescence (35). and in Kebena District among adolescent School Girls reported that the anemia prevalence was 12% (36).

According to a school-based cross-sectional study done in Bonga Town, the overall prevalence of anemia was 15.2%. The prevalence was showed that being a female had two folds higher risks to anemia than male for anemia among school adolescents and most of the anemic status was mild anemia (83.9%), followed by moderate (12.9%) and severe anemia (3.2%) (16).

## **2.2. Factor associated with anemia**

### **2.2.1. Socio-demographic and economic factors**

Socio-demographic and economic factors such as sex, age, marital status, family size, educational status of parents, occupation, and wealth status of parents play a great role in depriving a person of acquiring and maintaining an adequate amount of micronutrients by different mechanisms. Anemia is one of the most common problems among population groups with low socioeconomic status (30,37).

A cross-sectional study done in kebona district on adolescent girls School students, aged 10 - 14 years (early adolescence), was approximately three times more likely to have anemia, compared to those in the age group 15 -19 years (late adolescence). And it was positively associated with factor cause of anemia. (36). Another study also 49.41% and 46.62% of girls were found to be anemic in 10-14 years and 15-19 years age groups respectively, but the difference was insignificant (38). A study conducted at East wollega, the odds of developing anemia were 3.8 times more likely among late adolescents as compared to early adolescents (25).

The educational status of parents played a big role in the occurrence of anemia according to finding from different studies. a study conducted in Saudi Arabia, Bangladesh, and Ethiopia states that anemia prevalence is higher in illiterate than literate (14,39). A study conducted in Korea showed that adolescent with more educated mothers was less likely to develop anemia than were those with less educated mothers and also This group consumed more protein and iron from animal sources than children of less-educated mothers, as reflected by their greater feeding of meat and poultry(40).



A study conducted in Bonga shows that Fathers' educational status was significantly associated with the prevalence of anemia among school adolescents. thus school adolescents who were illiterate fathers were 9.03 times more likely to be anemic as compared to school adolescents who had fathers who were literate father (16). and also, Father's educational level was significantly associated with anemia among school adolescent girls and primary school children and Paternal education was positively associated with anemia (41). A cross-sectional study conducted in Bahirdar town reported that the predictor of anemia was household family size greater than five are three times more likely to develop anemia compared to those who had house hold family size less than five(24). And also Cross-sectional study conducted in Bonga, School adolescents from a family with a family size of greater than five were almost 2.6 times more likely to be anemic as compared to school adolescents from a family size of less than five (16).

### **2.2.2. Health, Sanitation and environmental health related factors**

According to a study done in Tanzania, anemia was significantly higher among not using bed nets and among those with malaria infection (42). The presence of malaria was increased the risk of developing anemia adolescents with malaria were four times more likely to be anemic as compared to adolescents without malaria (19).

A study conducted in Uganda reported that, severe malnutrition and interactions between Plasmodium Falciparum was significantly associated with lower hemoglobin as well as some study reported increase the malaria incidences and previous history of malarial infection were associated with anemia (43).

The presence of worm infestation was found to increase the odds of adolescent anemia by twelve times compared to the absence of the worm (19). and intestinal parasitic infection as well as Source of drinking water for households was also associated with anemia (41). had an association with anemia also showed in a study conducted in the southwest part of Ethiopia intestinal parasitic infections were the determinant of IDA (44). a cross-sectional study conducted in India adolescent girls reported that factors associated with anemia were vegetarians and history of excessive menstrual bleeding (45). a study conducted in Bonga southwest Ethiopia, The prevalence of anemia was higher (26.4%) among female school adolescents who

attained menarche than those who did not attain menarche (13.3%) (16). controversially, no significant difference was found among pre menarcheal and post menarcheal adolescent girls in India (38).

### **2.2.3. Anthropometric related factors**

A cross-sectional survey employed among adolescent girls in the Maharashtra state of India reported that the age gave a significant association of Hb levels with three variables (MUAC, weight, and height). Hb increased by 0.11 g/dl with each centimeter of increase in MUAC, Each kilogram of increase in the body weight showed an increase by 0.02g/dl Hb levels and with each centimeter of increase in height, Hb increased by 0.01g/dl. There was a consistent association between three measures of anemia in the study population (46). BMI for age was independent predictors to develop anemia among adolescent girls. Adolescent girls who had a low BMI for age were 3.2 times more likely to be anemic as compared to those who have a normal BMI for age (24).

### **2.2.4. Nutritional related factors**

A cross-sectional study employed in Pakistan, among adolescents with inadequate iron intake was approximately Nine times more likely to develop anemia compared to those adequate iron intake (19). a cross-sectional study was done in district Karnal, India among adolescents reported that most of the anemic adolescent girls were vegetarian (53.18%) (47). Regarding food source, according to a cross-sectional study done in southwest Ethiopia among non-consuming protein source food dairy products and calorie sources were predictors of IDA and also intake of plant food and animal food were significantly and independently associated with anemia (44).

In the frequency of foods consumed, the odds of being anemic was almost two times more likely among adolescents who not consumed meat or/and eggs weekly, almost five times more likely among adolescents who not consumed fruits per week as compared to who consumed each of those foods greater than three times per week and 2.2 times more likely among adolescents who not consumed vegetables weekly, In opposite to these, adolescents who consumed milk greater than three times per week were almost seven times more likely to be anemic compared those who did not consume Milk even once per week (17). A study conducted in Western

Uganda excess intake of fiber, inadequate intake of iron, protein, Folate, energy, and vitamin A were predictors of anemia (48).

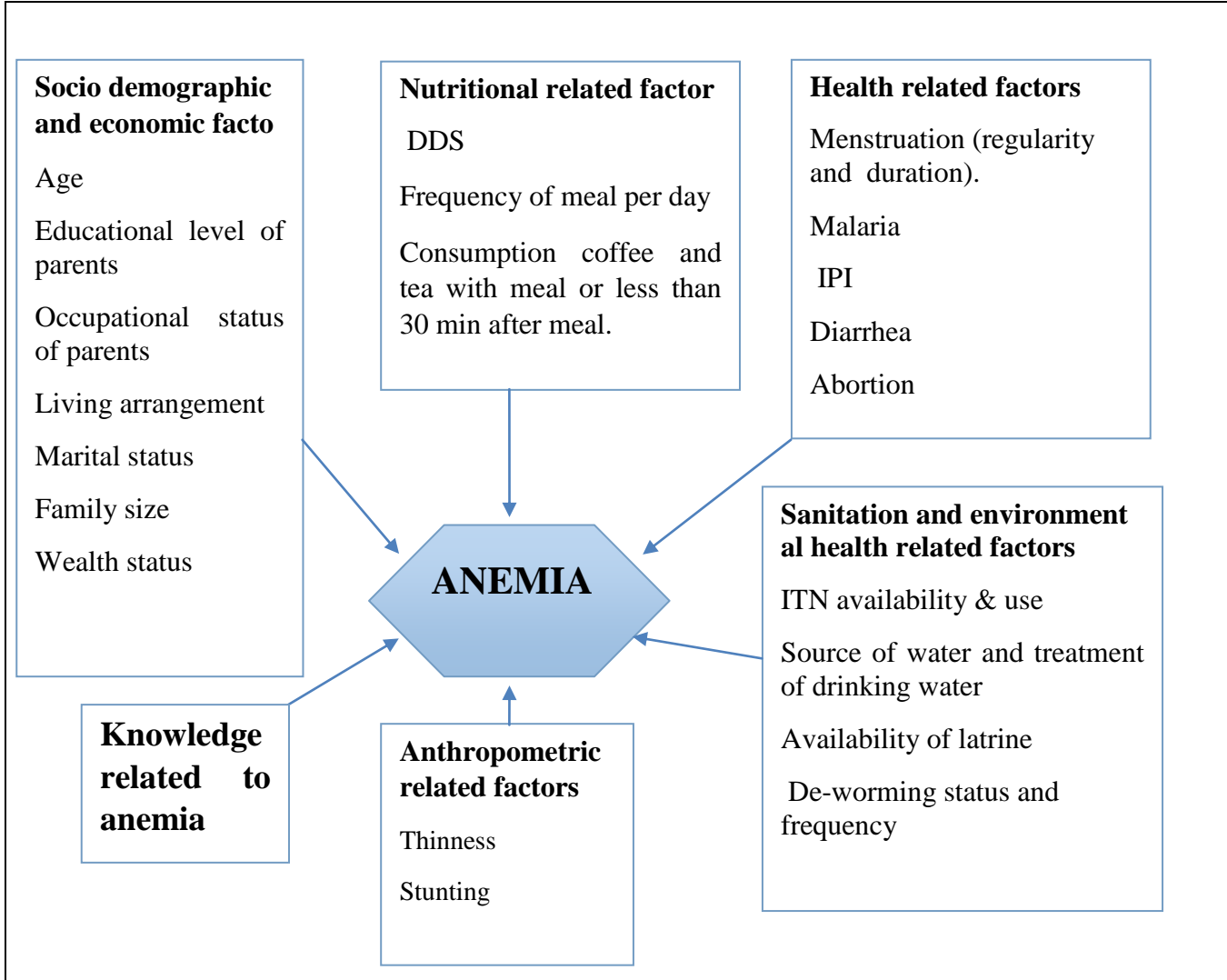
A cross-sectional study employed in three districts in Ethiopia reported that the prevalence of anemia was from 24% to 38% with an average 29%. From this adolescent girls lived in moderately food-insecure households (49). A cross-sectional study conducted in Dembia district northwest Ethiopia, among Adolescent Schoolgirls, revealed that factors associated with anemia were household food security status, dietary diversity score, the living status of adolescents with either of parents or guardians (22). Cross-sectional Study employed in Kersa, Eastern Ethiopia, reported that children who had irregular legume consumption were at higher risk for anemia and study in Menz, Eastern Ethiopia consumption of legumes was associated with anemia among primary school children (41,50).

**2.2.5. Knowledge related factors:** a study conducted in India among 106 adolescent school girls reported that only 35% of girls heard about anemia and 39% felt that anemia is a health problem. the reasons for anemia also around 8 (7.5%) could answer correctly (51).

A cross-sectional study done at three districts in Ethiopia (Damotegale, Debrelibanose, and Laygayint) reported that the overall prevalence of anemia ranges from 24 to 38% with an average of 29%. And around half of the adolescent girls heard the term and risk of anemia (52).

### 2.3. Conceptual framework

The conceptual framework has explained the relationship between independent Variables each other's and with dependent (outcome variables). Based on this, the adapted conceptual model, the independent variables included in the study are shown below figure.



**Figure 1:** conceptual framework developed after reviewing different literatures, to assess anemia among high school adolescent girl students in Mizan AmanTown, South West, 2020.

#### **2.4. Significance of the study**

The main reason focusing on adolescents is due to anemia is a common public health problem. Most researchers focused on pregnant, lactating women and children but the adolescent prevalence of anemia is still high. Understanding the prevalence and associated risk factors is a critical component of any effort that purposely to reduce the burden of anemia among high school adolescent girls.

Recently, Ethiopian Food and Nutrition policy include adolescent girls in the most at-risk group for nutritional demands particularly the deficiency of iron. Nutrition intervention in adolescent girls is important for breaking the intergenerational malnutrition cycle of the girls.

It will help in the district for planning, intervention, and evaluation practice of anemia prevention among school adolescents ‘girl’s in Mizan Aman town and to take appropriate action on anemia affecting school adolescent students.

It will have a positive contribution to local NGOs, policymakers, educators, health providers, and the District Health Office.

This study can also be used as a reference by any organization or individual researcher who wants to study on the prevalence and determinants of Anemia among adolescent girl school students for further study.

### **3. Objectives**

#### **3.1. General objective**

- ❖ To assess the prevalence of anemia and its associated factors among adolescent girl attending high school in Mizan Aman Town, Bench-Sheko Zone, Southwest Ethiopia, 2020

#### **3.2. Specific objectives**

- ✓ To determine the prevalence of anemia among high school adolescents girl students of Mizan Aman Town.
- ✓ To identify factors associated with anemia among high school adolescent girl students of Mizan Aman Town.

## **4. Methods and materials**

### **4.1. Study area and period**

The study was conducted from March 08 to 19, 2020 in Mizan Aman town High Schools Benchsheko Zone, South West Ethiopia. Mizan Aman town is found 561 km from the capital city Addis Ababa, and it is the largest town and administrative center for Bench Sheko Zone. This town has latitude and longitude of 70 'N 3535' E/ 7.000N 35.583E and an elevation of 1451 meter above sea level. According to the Mizan Aman Town education office in 2012 E.C, there are about six high schools in which four of them are governmental and the rest two are private schools. And the total number of students in both government and private in high schools are 7724 (Mizan 3003, Keke 932 and Aman 2862, Teklehaymanot 218, Msgana 353, Gacheb 356) in which 3590 are males and 4134 are females from this 3792 are an adolescent girl aged 10-19 years (53).

The main sources of income for residents in the town are trade, government employee, and agriculture, mostly main food crops in this zone include maize, godere (taro root), and Enset, sorghum, teff, wheat, barley, and coffee are cultivated to a significant extent. Although cattle, goats, and poultry are produced in limited numbers, meat and milk are very much appreciated. Cash crops include fruits (bananas, oranges) and spices (e.g. coriander and ginger) are grown in the zone. Honey is also an important local source of income(53).

### **4.2. Study design**

Institutional based cross-sectional study was conducted.

### **4.3. Population**

#### **4.3.1. Source of population:**

All high school adolescent girl students who attending their education in Mizan Aman Town.

#### **4.3.2. Study Population**

All randomly selected adolescent girl students in the high school in Mizan Aman Town.

4.3.3. **Study unit:** Individual adolescent girl students of Mizan Aman high school.

### **4.4. Inclusion and Exclusion Criteria**

#### **❖ Inclusion Criteria**

- ✚ Adolescent girls who are high school students in Mizan Aman Town were included in the study.

❖ **Exclusion Criteria**

- ✓ Adolescents who are ill during data collection.
- ✓ Blood donate within 16 weeks during data collection.
- ✓ On treatments of anemia.
- ✓ Adolescent girl student from another area joins in to study area (high school) within less than four month.

**4.5. Sample size and sampling procedures**

**4.5.1. Sample Size Determination**

To determine the sample size of this study depend on the outcome variable and different factors significantly associated with the outcome variable are considered. Accordingly, for the first and second specific objectives, the sample size was calculated separately and the larger sample size was taken to be used for this study.

**Specific objective 1:** For the prevalence of anemia, the sample size was estimated using the formula for a single population proportion with 95% ( $\alpha=5\%$ ), and precision(d) 5%. based on the assumptions: the study was conducted in 2015 in Dembia District, which revealed a **25.5%** prevalence of anemia among adolescent girl school students (22).

**Z=1.96, P=25.5%, d= 5% =0.05**, then

$$n = \frac{(Z)^2 \times p(1-p)}{(d)^2}$$

$$n = \frac{(1.96)^2 \times 0.255(1-0.05)}{(0.05)^2} = 292$$

n =292, the source of population are less than 10,000, so that using correction formula.

n = no /(1+ no/N), Where: N= Population size (3792),

$$n = 292 / (1 + 292 / 3792) = 273$$



By adding 10% non-response rates sample size becomes **300** adolescents.

Where **n**=the minimum sample size required, **p**= estimated proportion of anemia (0.255)

**z**= the standard value of confidence level of  $\alpha=95\%$ , **d** = the margin of error between the sample and the population.

**Specific objective 2:** Factors associated anemia among adolescent’s girl students

The sample size for the second specific objective of this study was determined by considering factors that are significantly associated with the outcome variable, two side confidence levels of 95%, margin error of 5%, power of 80% and the ratio of exposed to unexposed outcome 1:1 using Epi Info Version 7. The possible calculated sample size for the selected factors with 10% of the non-response rate is shown below.

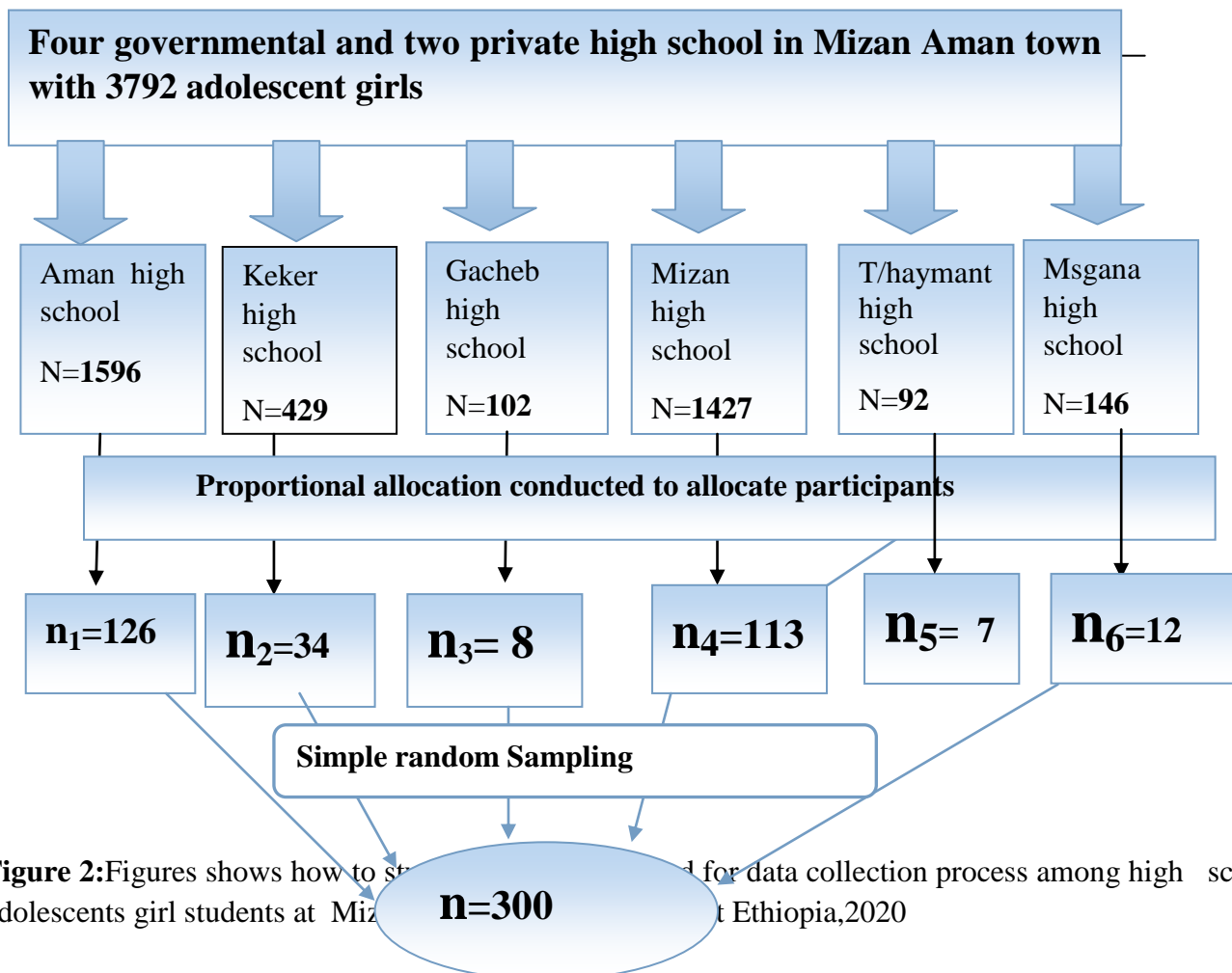
**Table 1:** Sample size determination and assumptions used for the study on anemia and associated factors among high school adolescents girl of Mizan Aman Town, Southwest Ethiopia 2020.

Associated variables	95%confid enc Level	P	1-p	Calculated Sample	10%non RR	Total S/ Size	References
Intestinal parasite infestation	1.96	9.1	0.09	127	13	140	(16)
Family size	1.96	7	0.93	100	10	110	(24)
Frequency Meat consumption	1.96	19	0.81	235	24	259	(17)
Duration of blood flow in each menses	1.96	7.6	0.92	108	11	119	(54)

Finally, as the sample size for estimation of anemia is larger, it will take to address both dependent and independent variables. Therefore, the subsequent report is based on the total sample of **300** study participant school adolescents girls was includes in this study.

#### 4.5.2. Sampling technique and procedure

First, take a list of all high schools with their list of students found in the town were registered in the Mizan Aman Town educational office. By using the student registration document as the sampling frame, which included name, age, and sex of all list students (from 9-12) were written in the registration document in each school with their level of grade. Then the eligible adolescent students are selected from each school, and then sample size was allocated proportionally for each school after that, Study participants were selected using a simple random sampling technique specifically by the computer-generated method to allocate the participant students. and for the data collection, the sequence of high schools from the first to the last was allocated by using a lottery method as, Aman, Keker, Mizan, T/haymanot, Msgana, and Gacheb high school. All eligible adolescents found in the school were included in the study as shown in the figure below.



**Figure 2:** Figures shows how to sample for data collection process among high school adolescents girl students at Mizan Aman town, Ethiopia, 2020

## 4.6. Data collection method

### 4.6.1. Data collection instruments and procedure

A structured pretested interviewer-administered questionnaire was developed in English and then translated into the Amharic language for simplicity then back-translated to the English language for its consistency by two different language expert individuals who speak both Amharic and English fluently. The questionnaire having socio-demographic characteristics, nutritional related characteristics; health-related information, sanitation and environmental health related factors, and parasitic infection-related characteristics were used.

**Specimen collection and processing:** Laboratory investigations were done for hemoglobin measurement and malaria status. Hemoglobin measurement was measured from capillary blood by collecting one drop of blood carefully from the middle finger. The finger of the adolescent pricked after rubbing the fingertip with sterile cotton (immersing in 70% alcohol) with a sterile disposable lancet. Automated HEMOCUE Hb 301, HEMOCUE AB, ANGELHOLM SWEDEN machines were used to determine the hemoglobin concentration, which was recommended elsewhere for survey in resource-poor settings and Adjusted Hb concentration was calculated as  $Hb = -0.32 \times (\text{altitude in meters} \times 0.0033) + 0.22 \times (\text{altitude in meters} \times 0.0033)^2 - 0.48$  to subtract the adjustment from the measured Hb concentration at the relevant altitude (1451 m above the sea level) to get the sea-level value then categorized based on criteria of WHO cut off point, the results were expressed in g/dl (55,56).

To determine **malarial infection**, a rapid antigen whole blood test with the trade name (Care Start TM) malaria was used. Sample for the rapid diagnostic test (RDT) was collected immediately after determining the hemoglobin level, adolescents with hemoglobin <12 g/dl was considered for conducting RDT and presence of fever in the last two weeks. Bio-safety measures were taken such as the use of sterile gloves; alcohol/clean water during the collection of the specimen as well as a safe disposal system was employed (Used gloves and other materials are collected using boxes and transported to the health center for proper disposal(57).

**Stool samples:** Fresh Stool was collected by using a clean and labeled container from the study participants and microscopic examination was done to identify intestinal protozoa, eggs, and larvae of helminths by the direct smear examination. The direct smear examination was done by

the saline wet mount by mixing a small quantity (about 2 mg) of faces in a drop of saline placed on a clean glass slide (58).

### **Anthropometric measurements**

Height measurements were done using a wooden height measuring board with a sliding head bar. The subject was asked to stand straight on the leveled surface with heels together and their heads positioned and eyes looking straight ahead (Frankfort plane) without shoes. Heels, buttocks, shoulder blades should touch the vertical surface of the Studio meter. The moving headpiece of the Studio meter was applied to lower to rest flat on the top of the head and read to the nearest 0.1cm.

And the weight was measured using an electronic digital weight scale (Secca Germany) with light clothing and without shoes and then record to the nearest 0.1kg. Calibration was done every morning and before every weight measurement, the data collectors assured the scales reading exactly at zero. Weight scale was checked through known object weighing measured regularly. The same measures were conducted to given anthropometric measurements to avoid variability. Height and weight were measures twice and the average value was used for analysis(59).

**Dietary Diversity Score ( IDDS ):** It was conducted consuming adolescent girls within 24 hours from the nine food groups such as starch (cereals, tuber, and wheat), vegetables, fruits, fish, tubers, meat, honey, milk, egg, and legumes. Each food group had been counted only once resulting in a possible score of zero to nine. So that the study food groups were categorized into low dietary diversity ( $\leq 3$  food groups), medium dietary diversity score who consumed four and five food groups, and high dietary diversity ( $\geq 6$ ) (60).

**Wealth Index status:** Nineteen items used to assess household assets. The tool was adapted from the Ethiopian demographic and health survey (EDHS) and it was ranked as tertile (low, medium, and high)(3).

**Knowledge:** anemia related knowledge was assessed by using a pretested questionnaire. Adolescents in this study have been interviewed anemia related Knowledge questionnaire that had been adapted from assessing KAP FAO guidelines. It has ten questions that asked about

anemia, cause, symptom, iron-rich foods, and health consequences of anemia to children and pregnant. The answer to each question was analyzed as know and don't know. And finally from the total nine items for each correct answer were coded as 1 which is known and for each wrong answer 2 (don't know) score was given. The maximum attainable score will be nine and the minimum possible score is zero. The answers to each question changed to a percentage. An individual who scored 50% and above had been taken as good knowledge and adolescent girls who scored below 50% have been taken as poor knowledge(61,62).

#### **4.6.2. Data Collectors**

For the data collection purpose, eleven female data collectors (6 who have a degree in Nurses and 5 Medical laboratory technicians) who have clinical experiences and basic training with One who have a degree in Health officer and Medical laboratory technologist as the supervisor was seen the progress. Two-day training on the instrument, methods, how to fill the questionnaire, measuring of anthropometry, and how to take blood sample was given for data collectors and supervisors by the principal investigator.

### **4.7. Study variables**

#### **4.7.1. Dependent variable**

- Anemia status

#### **4.7.2. Independent variables**

- ❖ **Socio-demographic and economic characteristics:** age, marital status, family size, father and mother educational status, Living condition, and father and mother occupation.
- ❖ **Sanitation and environmental health related factors:** ITN utilization, Source of water and treat for drinking, availability of latrine, de-worming status, and frequency.
- ❖ **Knowledge of Anemia:** poor and good knowledge.
- ❖ **Health-related factors:** the history of malaria, history of parasitic infestations, Diarrhea, abortion, and Menstruation status (regularity, duration).
- ❖ **Nutritional-related factors:** dietary diversity such as consumption of fruits, vegetables, Dairy products, animal products per week, Frequency of meal per day as well as tea/ coffee consumption with a meal or within 30 minutes after a meal.
- ❖ **Anthropometric factors** (thinness and stunting) were included.

## 4.8. Operational Definitions

**School Adolescents:** are people aged 10-19 years who are attending high school (1).

**Iron deficiency anemia:** adolescent students that have inadequate iron in our body (serum iron concentration  $<37 \mu\text{g/L}$ )(63).

**Severe Anemia:** the hemoglobin level  $< 8\text{g/dL}$

**Moderate Anemia:** hemoglobin level  $8.0\text{-}10.9\text{g/dL}$

**Mild Anemia:** hemoglobin level  $11.0\text{-}11.9\text{g/dL}$

**Normal (Non anemic) :**hemoglobin level  $>12\text{g/dL}$ (1).

**Anemic:** defined by using the WHO classification of anemia as hemoglobin level  $<12 \text{ g/dl}$  (56).

**Undernutrition:** Thinness school adolescents with BMI for age result of  $< -2$  Z Score Normal  $-2$  to  $+1$  Z Score and overweight is  $>1$ Z Score Stunting (height for age ) is stunt  $<-2$  Z Score and Normal is  $>-2$  Z Score (64).

**Sanitation and environmental health related factors:** mean have variables - ITN utilization, Source of water, and treat for drinking, availability of latrine, de-worming status, and frequency.

**De-worming:** is anti-helmitic treatment given to children free of charge without stool examination periodically

**Proper use of latrine:** Availability of currently used/ open not filled, super structured latrine, with hand washing facility and soap.

**Menarche:** the first menstrual period in the life cycle of the adolescent.

**Menses:** discharging of blood from the uterus which occurs every month.

**Normal menstrual blood flow:** average duration of menstruation 3 -5 days.

**Heavy menstrual blood flow(Menorrhagia):** excessive menstrual blood loss with heavy menstrual bleeding ( $>6$  days).

**Amenorrhea:** absent of menstrual period for more than three monthly menstrual cycles.

**Dysmenorrhea:** severe and frequent menstrual cramps and pain associated with menstruation.

**Knowledge:** good knowledge means if adolescent girls responded  $\geq 50\%$  of knowledge questions whereas if  $<50\%$  of knowledge questions those having poor knowledge(62).

## 4.9. Data processing and analysis

Collected data were entered into Epi data 3.1 after coding and checking for completeness and consistency and exported to Statistical Package for Social Sciences (SPSS) software version 24.0 appropriate analyses were done. Descriptive statistics like frequency, Mean, Median, standard deviation (SD), and the percentage was used to give a clear picture of background information and determine the prevalence of anemia. The normality of continuous variables (anthropometric, food groups, and hemoglobin) was checked using graphic methods (Histograms with normality curves and QQ-plots) and models. Height and weight were transferred into WHO Anthro plus considering age to convert nutritional data into Z-score of indices HAZ and BAZ using the standard of WHO 2009 growth reference. According to this reference if adolescent girls had  $BAZ \leq -2SD$  considered as thinness, normal if BAZ between  $-2SD$  and  $+1$  and overweight was considered as if the  $BAZ \geq +2SD$  and if the respondents  $HAZ \leq -2SD$  was stunting (64).

Household wealth: principal component analysis (PCA) to construct wealth index. In order to construct a relative household's wealth index, a suite of several socio economic indicators were collected. A relative socio-economic status was constructed by dividing the resulting score into quintiles that indicate poorest, medium, and richest households. (3).

Bivariate and multivariate logistic regressions were used to assess the association of various determinant factors of anemia. Bivariate logistic regression was used to identify the presence of an association between independent variables and anemia. Multivariable logistic regression analysis was used to control the possible confounding effects of variables. In Bivariate logistic regression analysis all variables are significant at a p-value of 0.25 and 95% CI were entered into a multivariate logistic regression analysis model. Variables that are significant at p-value  $<0.05$  level and 95% CI are considered to be the determinant factors of anemia. An adjusted odds ratio with 95% CI was used for those variables which are found to be determinant factors of the anemia. The fitness of the model was checked by Hosmer Lemeshow goodness of fit test and depend on the model was considered fit if it is found to be insignificant ( $p >0.05$ ) and multicollinearity was checked using Variance Inflation Factor (VIF). And also the result is presented by proportion, percentage, means, figures, and table.

#### **4.10. Data quality control**

Questionnaires from English were translated to Amharic and again back-translated to English and for the assurance of data quality 5% pre-test was performed at semen bench high school adolescent girls (15 adolescent girls) to check consistency, validity, and completeness of data collection tool before the actual data collection period. The training was given for data collectors and supervisors. Continuous and supportive supervision was given. Both the supervisor and principal investigator were checking the completeness of collected data on daily basis. For additional better data quality management data was entered into Epi data 3.1 by preparing double entry verification. Weight Calibration was done every morning and before every weight measurement, the data collectors assured the scales reading exactly at zero.

Proper functioning of instruments, laboratory reagents, expiry date, and technical performance was checked by using quality control samples. For the malaria test, RDT result with blood film result by microscope and for Hemocue result with CBC machine was checked. Comparisons of Hemocue machines with CBC (Complete blood count) machine, Sysmex analyzer (Sysmex XS-500i, made in China) were done. This was just to be confident on the working instruments by themselves but not on technical issues behind the machines, that how they measure. Standard operating procedures (SOP) and manufacturer's instruction were strictly followed starting from sample collection up to result in reporting for laboratory activities. All laboratory procedures were handled by laboratory technologists. Before data analysis cleaning was done and also out layers were identified and managed.



#### **4.11. Ethical clearance**

Ethical clearance was obtained from the Ethical Review Board of Jimma university official letter of cooperation from Jimma University (IRB00059/2020) was given to Mizan Aman town education office and Mizan Aman Town health office than from Mizan Aman town education office letter was sent to each selected schools from which the data will collect. Then after explained the advantage of the study to each study participant. then we obtained written and signed informed consent from 18-19year old study participants and For adolescents < 18 years their parents/guardians gives their informed written and signed voluntary assent allowing their daughter to be part of the study one day before the data collection date. Privacy, confidentiality, and voluntarism are maintained at each step of the study process and it was given a unique code number. Participants confirmed as anemic and having an intestinal parasitic infection were linked to the hospital.

#### **4.12. Dissemination plan**

The findings of this study submitted to Jimma University Institute of Health and department of nutrition.

Besides the findings of the works may be present at different seminars and training organized by the Ministry of Health, partners, professional associations, and regional health bureau. Also, the results have disseminated through Publication in Peer review international journals.

## 5. Results

### 5.1. Socio-demographic and economic characteristics of the Study Participants

A total of Two hundred eighty-one adolescent girls (281) were interviewed in this study, yielded 93.7% response rate. The mean age of the respondents was  $15.85 \pm 1.74$  years. From these 86 (30.5%) were found in the age range of early adolescence age group and 66 (23.5%) of the respondents were found between late adolescence age group. Almost all (95.4%) of respondents were from government schools and 128 (45.6%) as well as 105(37.4%) students were from Grade nine and ten. forty-two (14.9%) of the adolescent girls were married. One hundred fifty-two (54.16%) of the adolescent girls were living with their parents. Regarding the religion of respondents, 103(36.7%) of them were Orthodox followed by protestant 83(29.5%).

Regarding parental education level, three fourth (29.9%) of adolescent girl fathers were attained college and above followed by high school (25.1%). And three fourth (29.5%) of adolescent girl mothers were attained high school level, seventeen (25.5%) adolescent girls' mothers were college and above and 31(11.3%) of adolescent girl's mothers were Illiterate.

Regarding the occupation of parents, 48% of fathers of adolescent girls were government employees, 34.2% of them were merchants and 7.4% of fathers were daily laborers. Around half (53.5%) of mothers were Housewife, whereas 37.1% of mothers were government employees. Eighty-five (30.2%) of adolescent girls' parents were with higher wealth status and 118 (42 %) were with low wealth status (table 2).

**Table 2:** Distribution of socio-demographic and economic characteristics among family of adolescent girls in Mizan Aman town, southwest Ethiopia, 2020. N=281

Variables (n=281)	Category	Frequency	Percentage (%)
Age category	Early adolescence	86	30.6
	Middle adolescence	129	45.9
	Late adolescence	66	23.5
Type of school	Governmental	268	95.4
	Private	13	4.6

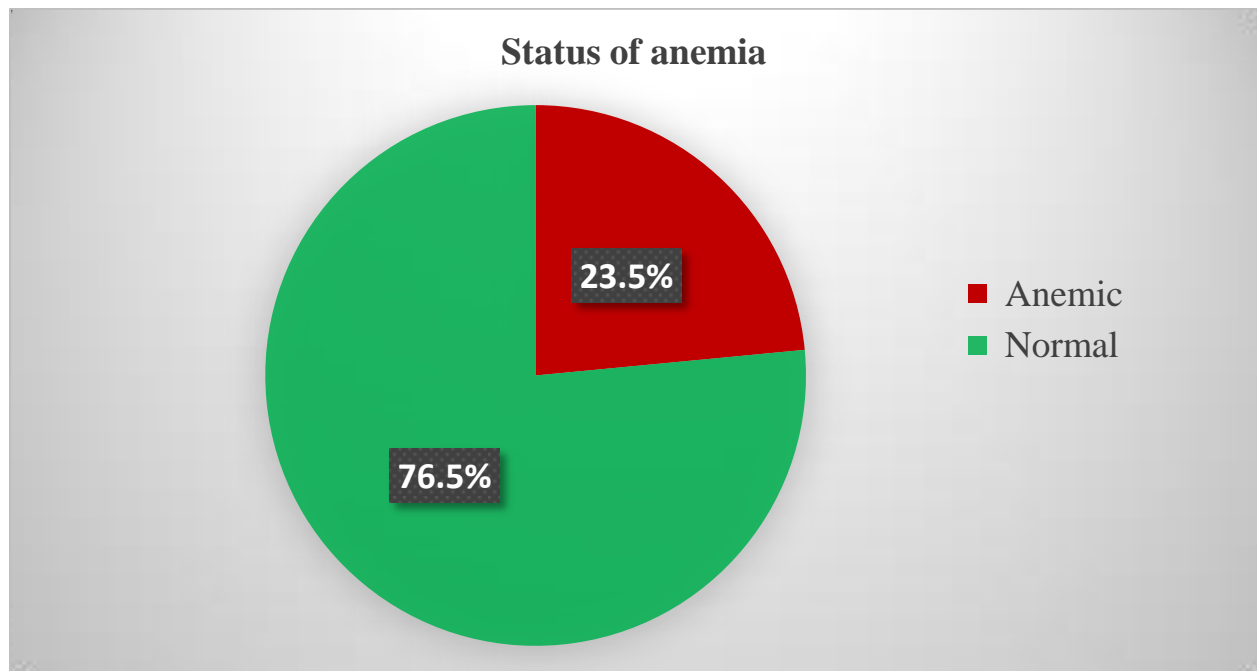
Religion	Orthodox	103	36.7
	Muslim	64	22.8
	Protestant	83	29.5
	Catholic	31	11.0
Ethnicity	Bench	82	29.2
	Amhara	73	26.0
	Oromo	63	22.4
	Keffa	52	18.5
	Others *	11	3.9
Living arrangement	Living with parents	151	54.1
	Living with relative	96	34.5
	Living with a friend	34	11.4
Marital status	Single	239	85.1
	Married	42	14.9
Educational status of Father	Illiterate	27	9.6
	Read and write	45	16
	Primary school	57	20.3
	Secondary school	68	24.2
	College and University	84	29.9
Educational status of Mother	Illiterate	34	12.1
	Read and write	41	14.6
	Primary school	55	19.6
	Secondary school	81	28.8
	College and University	70	24.9
Occupation of Father	Daily labor	21	7.5
	Merchant	101	35.9
	Government Employed	139	49.5
	Farmer	20	7.1
Occupation of Mother	Housewife	151	53.7
	Merchant	28	10
	Government Employed	102	36.3

Family size	>5	115	40.9
	≤ 5	166	59.1
Wealth index	Low	117	42.0
	Medium	78	27.8
	High	86	30.2

\*In the category of Ethnicity others include Hadiya, Tigre, Gurage and Wolayta

## 5.2 The prevalence of anemia among adolescent girls

The prevalence of anemia among adolescent girls in Mizan Aman high school was 23.5% with (95%CI: 18.9, 28.8). From this 13.2% was mild and 10.3% were moderate anemia. The hemoglobin level of the adolescent girls ranged from 8.2g/dl to 17.4g/dl with a mean ( $\pm$ SD) value of  $14.17 \pm 2.61$  g/dl. Seventy -three (52%) of adolescent girls with anemia were in the age group of mid age group, Where-as 13(19.7%) of them were in the age group late age group. About seventy-three percent of adolescent girls heard or having information about anemia and twenty-seven of them had no information about anemia.



**Figure 2:** prevalence of anemia among adolescent girls attending high school in Mizan Aman Town, Southwest Ethiopia, 2020.

### 5.3. Sanitation and environmental health related factors

One hundred thirty- six (48.4%) households’ main source of drinking water is protected springs. Twenty- nine percent of households get their water from the piped line inside their dwelling and public tap. Only 19% of households treat their water before drinking. Regarding the toilet facility, the Majority (93.2%) of households have latrine, however, most households (69%) latrine is non-improved and were not even had slabs or coverings. Forty- three (15.3%) of girls had a history of worm infestation within one month before and at the data collection period and 31(11%) of adolescent girls were treated for worm infestation within one month. Two hundred eighteen (77.6%) adolescent girls use ITN (Table 3).

**Table 3:** Sanitation and environmental health related factors among adolescent girl high school students in Mizan Aman Town, southwest Ethiopia, 2020

<b>Variables</b>	<b>Category</b>	<b>Frequency</b>	<b>Percent</b>
Source of water for drinking, washing, and cooking	Piped water source	81	28.8
	protected spring	136	48.4
	Unprotected spring	39	13.9
	River and pond	25	8.9
Treat water for drinking	Not treat	227	80.8
	Treat before drink	54	19.2
Type of latrine	Non-improved	195	69.4
	Improved	37	17.4
	Ventilated	49	13.2
Have ITN	Yes	63	22.4

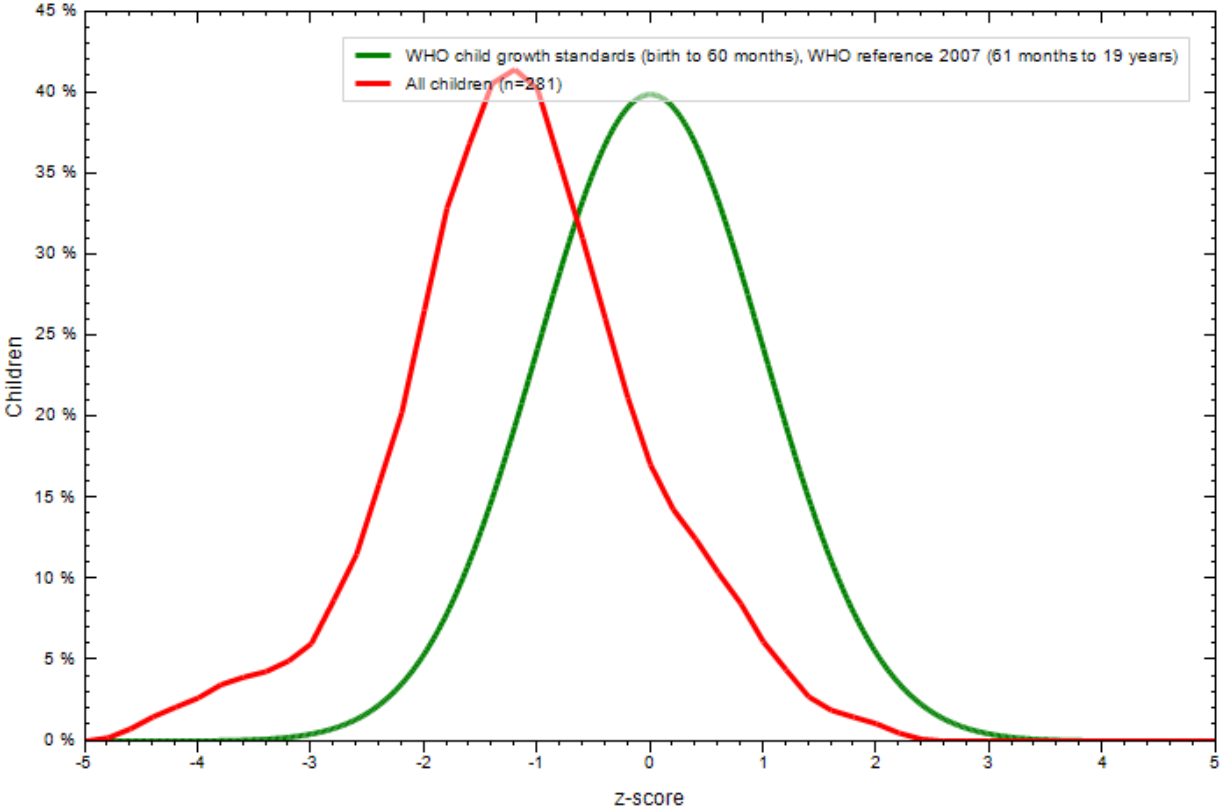
	No	218	77.6
Sleep in ITN	Yes	112	39.9
	No	169	60.1
took deworming	Yes	31	11
	No	250	89

#### **5.4. Health and anthropometric characteristics of adolescent girls**

Two hundred fifty- eight (91.8%) of participant adolescent girls started to see their first menses at the age of 13 to 17 years with a mean age of 14. Out of two hundred eighty-one girls, 48(17.1%) were on menstruation during the data collection period. Regarding the duration of menses in each cycle, Two hundred twelve (82.2%) adolescent girls five or less days during their menstruation cycle and 46 (17.8%) were greater than five days.

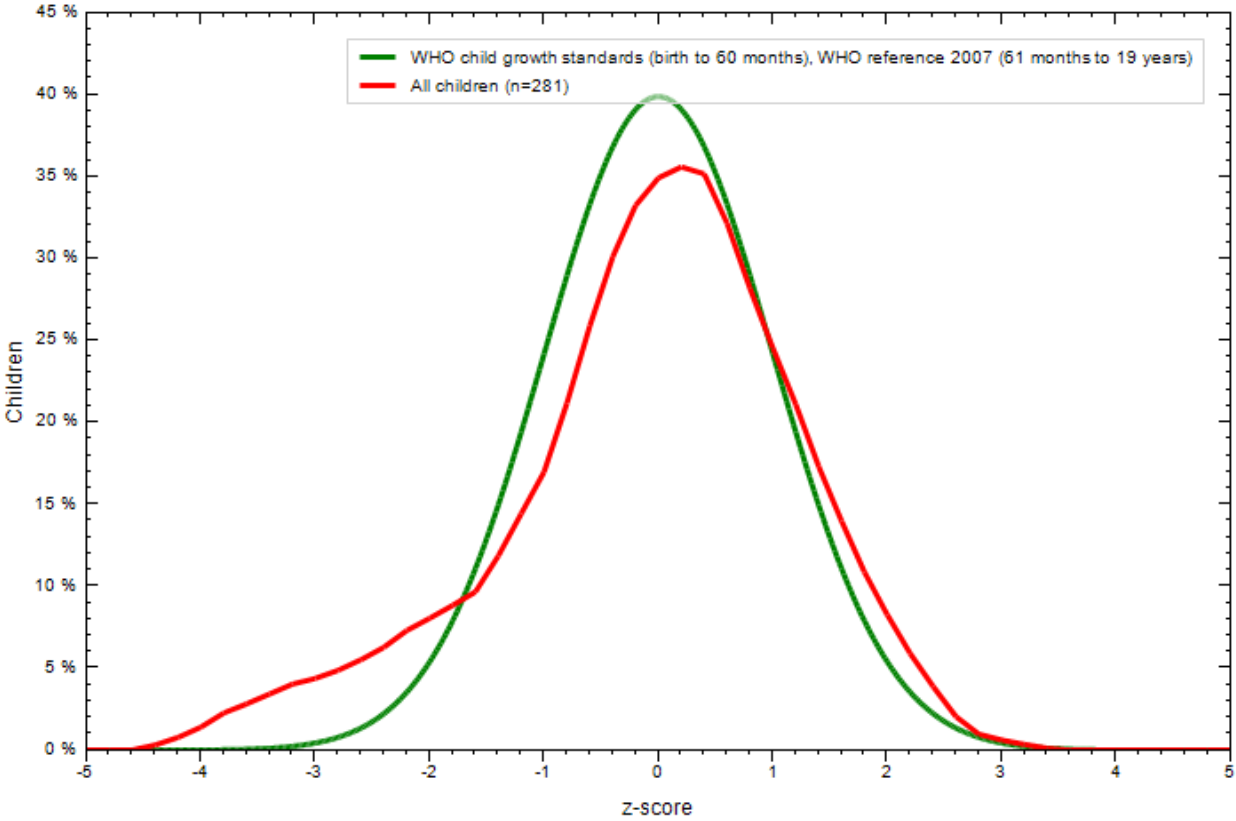
From the total participants, seventy- five (26.7%) respondents reported as they have fever within two weeks, and similarly forty -six girls reported as they had a history of malaria illness within one month prior to the data collection period. The mean height and weight of the adolescent girls were  $151.85 \pm 7.22$  cm and  $46.98 \pm 5.04$  kg respectively. The mean body mass index for age Z score was  $-0.93 \pm 1.26$  and the mean height for age Z score was  $-1.16 \pm 1.08$  respectively. Thinness was recorded in 27(9.6%) as well as twelve percent of adolescent girls were overweight. Stunting which is the chronic form of malnutrition seen in 49(17.4%) adolescent girls in the study area. Regarding diarrhea 32(11.4%) of the respondent had a history of Diarrhea within two weeks, from those forty -four percent of them were diarrhea without blood and fifty- six percent of them had Diarrhea with blood. Adolescent girls 7(2.5%) had History of Aborted and facing problem of abdominal pain and heavy bleeding (Table 4 and figure 5, 6).

The graph shows the distribution of height for age (HAZ), in-school adolescent girls, compared with the standard WHO. The graph skewed to the left the pick value seen in between(-3and 1) (Figure 4).



**Figure 3:** Height for age Z-scores of in high school adolescent girls, Mizan Aman Town, Southwest Ethiopia,2020.

The graph below shows the distribution of BMI for age Z-scores (BAZ) of high school adolescent girls compared with the WHO standard. The graph is skewed to the right, with the peak value seen in between (-4 and 3) (Figure 5).



**Figure 4:** BMI for age Z-scores of high school adolescent girls, Mizan Aman Town, Southwest Ethiopia, 2020.

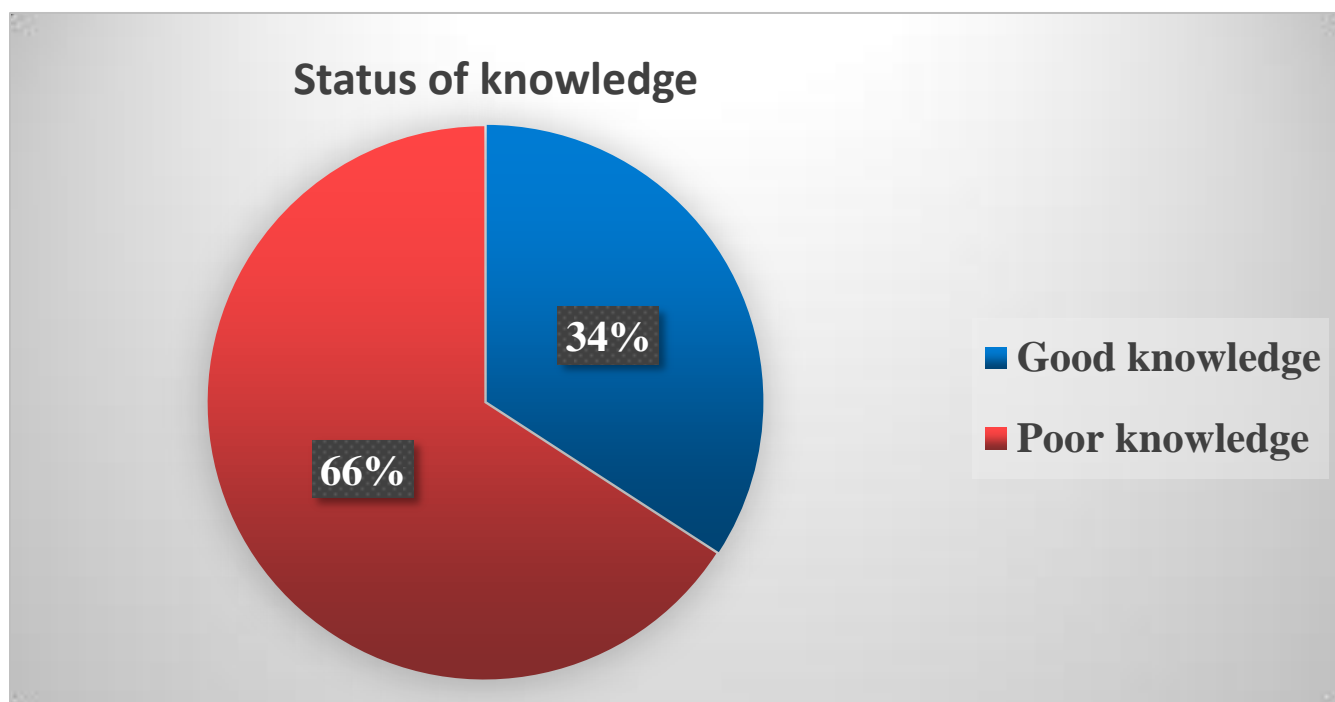


**Table 4:** Health related characteristics of the study participants among adolescent high school girls in Mizan Aman Town, Southwest Ethiopia,2020.

Variables		Category	Frequency	Percent
History of fever in the last two week		Yes	75	26.7
		No	206	73.3
History of malaria in the last one month		Yes	46	16.4
		No	235	83.6
Diarrhea in last two week		Yes	32	11.4
		No	249	88.6
Type of Diarrhea		Diarrhea without blood	14	43.8
		Diarrhea with blood	18	56.3
Worm infestation in last one month		Yes	43	15.3
		No	238	84.7
Nutritional status	Thinness	Wasting	27	9.6
		Normal	204	72.6
		Overweight	50	12.8
	Stunting	Stunted	49	7.4
		Normal	232	92.6
Status of menarche		Yes	258	91.8
		No	23	8.2
First attained menstruation		≤14	189	73.3
		>14	69	26.7
Duration of menses in each cycle		≤ 5	212	82.2
		>5	46	17.8

### 5.5. Knowledge about anemia among adolescent girls

Around three fourth (205) of adolescent girls heard about iron deficiency anemia. Sixty-two percent of them responded to weakness or less energy to know someone has anemia. Forty-five percent of adolescent girls responded that heavy bleeding and thirty- eight percent of adolescent girls responded that lack of iron in the diet or eating too little were the causes of iron deficiency anemia. Difficult of delivery 79(38.5%) and risk of dying during or after pregnancy 75 (36.6%) adolescent girls were responded about the consequence of anemia for pregnant women. Sixty - nine (33.7%) of adolescent girls responded that feeding iron-rich foods could be taken as the prevention methods of anemia. Regarding iron absorption and high school adolescent girls reported that coffee 54(26.3%) and tea 38(18.5%) decreased Iron absorption but red meat 76(36.7%) adolescent girls reported which was easily absorbable. Regarding knowledge of the adolescent girls 185(65.8%) study subjects had poor knowledge related to anemia(figure-6).



**Figure 6:** Knowledge related to anemia of study participants among adolescent high school girls in Mizan Aman, Southwest Ethiopia, 2020.

## 5.6. Characteristics of dietary practice

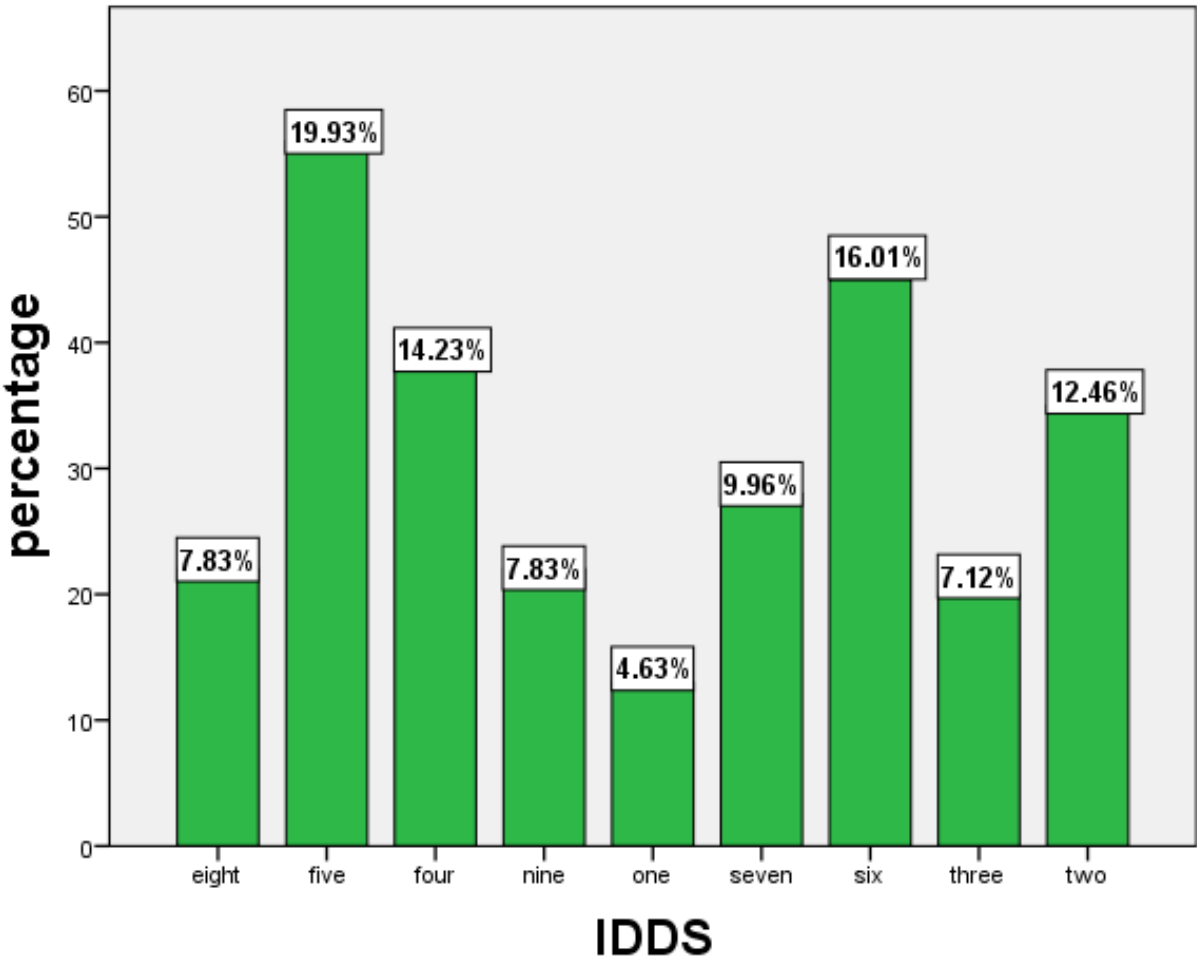
One hundred twenty- seven (45.2%) of adolescent girls consumed three times per day and three fourth (27.7%) of respondents girls eaten two and less times per day. Two hundred twenty- two (79%) respondent girls drank coffee/tea from those they drink at the time of right after consumed meals 118(53.2%) followed by 104(46.8%) drank during a meal. Regarding food 226 (80.4%) adolescent girls consumed starchy foods. More than half of the respondents consumed fruits, vegetables, eggs, and meat, and Thirty-five (23.1%) of individuals consumed sweets. Regarding IDDS, One hundred seventeen (41.6%) girls had high dietary diversity score of six and above food, groups score followed by ninety- six (34.2%) of the adolescent girls who had medium dietary diversity score who consumed four and five different food groups and sixty- eight (24.2%) had on the low dietary diversity score three and bellow food groups score. From the total nine food items which measured IDDS, did not consume meat (red meat or flesh meat), dark green vegetables, and organ meat showed statistical association with anemia by chi-square test ( $p<0.05$ ) (Table 5).

**Table 5:** Individual Dietary diversity and Dietary Pattern of the study participants among high school adolescent girls in MizanAman Town , Southwest Ethiopia, 2020.

<b>Variables (n= 281)</b>	<b>Category</b>	<b>Frequency</b>	<b>Percent</b>
Meal frequency	Less than two times	72	27.7
	Three times	127	45.2
	More than three	82	29.1
Drinking coffee/tea	Yes	222	79
	No	59	21
Average cup of coffee/tea drink	Two and less cups	107	48.2
	Three and more cups	115	51.8
Time of drink coffee/tea	During meal	104	46.8
	Right after meal	118	53.2

Category of IDDS	Low	68	24.2
	Medium	96	34.2
	High	117	41.6

The minimum dietary diversity score of adolescent girls was one (consumed only one food group) and the maximum dietary diversity score was nine out of nine food groups.



**Figure 7:** the percentage distribution of respondents on individual dietary diversity scores among adolescent girls' high school students in Mizan Aman Town, Southwest Ethiopia, 2020.

### 5.7. Intestinal and blood parasitic characteristics of study participants

Eighty (28.5 %) of the adolescent girls were positive for intestinal parasites. A total of four species of intestinal parasites were identified. Endameba histolotica 33(11.7%) was predominant followed by Giardia lamblia 24 (8.5%), Ascaris lumbricoid 17(6%), and hookworm 6(2.1%). From the total one hundred forty-one adolescents which of sixty-six of adolescent girls who're Hemoglobin <12 and who had fever seventy-five adolescents were tested for malaria using a rapid diagnostic test (RDT), and among the tested 29(10.3%) of adolescent girls had malaria. Among the identified specious Plasmodium vivax was the dominant 24(23.5%) and plasmodium falciparum infected adolescent girls were 6(4.9%) and for those positive for malaria and intestinal parasite were linked to the hospital (MTUTH) to take the medication (Table 6).

**Table 6:** blood and Stool investigation result of adolescent girl high school students in Mizan Aman Town, Southwest Ethiopia, 2020.

<b>Variables(n=281)</b>	<b>Category</b>	<b>Frequency</b>	<b>Percent</b>
<b>Ascaris lumbricoid</b>	Yes	17	6
	No	264	94
<b>Hookworm</b>	Yes	6	2.1
	No	275	97.9
<b>Ameoba histoletica</b>	Yes	33	11.7
	No	248	88.3
<b>Giardiasis</b>	Yes	24	8.5
	No	257	91.5
<b>Plasmodium vivax</b>	Yes	24	23.5
	No	78	76.5
<b>Plasmodium falciparum</b>	Yes	5	4.9
	No	97	95.1
<b>Hemoglobin status</b>	<12	66	23.5
	≥ 12	215	76.5

## 5.9. Factors associated with anemia

From Socio-demographic and economic characteristics: family size, father educational status, Living condition, and father occupation, From Sanitation and environmental health-related factors: ITN uses, deworming status, from Health-related factor: a history of malaria, history of parasitic infestations, Diarrhea and Menstruation duration, from Nutrition-related factors: dietary diversity score, tea/ coffee consumption. Anthropometric factors: thinness and stunting and knowledge status were entered in binary logistic regression analysis. From this

In bivariate analysis with  $P$ -value  $< 0.25$ , Father education, Living arrangement, Father Occupation, Family size, use of ITN, Wealth index, Duration of menstruation, IDDS are significantly associated with anemia among adolescent girls attending high school. Multivariable logistic regression analysis with  $P$ -value  $< 0.05$  indicated that father education, family size, wealth index, duration of menstruation, and IDDS were significant predictors of anemia among adolescent girls attending high school.

The odds of having anemia were twenty-seven percent times higher among illiterate fathers of adolescent girls compared to adolescent girls their father's educational level were College and Above (AOR=1.27;95% CI:0.67,5.70;  $P=0.014$ ). the odds of having anemia was 3.23 times higher among adolescent girls having a family size greater than five compared to adolescent girls who had family size less than or equal to five (AOR= 3.23; 95% CI: 1.13,5.78;  $p = 0.012$ ). Adolescent girls from low wealth status families were six times more likely to be anemic compared to those girls who had high wealth status families (AOR=6; 95% CI: 2.31,15.7; $p<0.001$ ). Similarly, the odds of having anemia were 2.63 times higher among adolescent girls having a duration of menses greater than five days compared to girls who had a duration of menses less than or equal to five days (AOR =2.63;95% CI: 1.03,6.67; $p= 0.043$ ). Additionally, the odds of having anemia was 3.27 times higher among adolescent girls Who had low IDDS compared to girls who had high IDDS(AOR=2.13;95% CI:1.16,8.43; $p=0.024$ )(Table7).

**Table 8:** Bivariable and Multivariable logistic regression model predicting of anemia among adolescent high school girls in Mizan Aman, Southwest Ethiopia, 2020.

Predictor	Category	Anemia status		COR 95%CI	AOR 95%CI	P-value
		Anemic (%)	Normal (%)			
Father Occupation	Daily labor	8(38.1)	13(61.9)	0.625(0.30 , 0.83) *	—	
	Merchant	17(16.8)	84(83.2)	0.52 (0.22,1.62)	—	
	Farmer	8(4.0)	12(6.0)	1.05(0.45 ,3.30)	—	
	Employed	33(23.7)	106(76.3)	1	—	
Father education	Illiterate	9(33.3)	18 (67.7)	1.60(1. 2,3.34)*	1.27(1.06,5.70)**	<b>0.014</b>
	Read and write	17 (38 )	28(62 )	1.94 (0.62,4.65)	1.670(0.20,3.77)	0.801
	Primary school	13 (23)	44(77)	0.95(0.30,2.24)	1.37 (0.38,4.35)	0.628
	Secondary school	7 (11)	61(89)	0.37(0.62,4.12)	0.83 (0.23,3.04)	0.829
	Collage and Above	20 (24)	64(76)	1	1	
Living arrangement	Living with relatives	24(25.0)	72(75.0)	1.07(0.52,1.67)	—	
	Living with friend	6(17.6)	28(82.4)	0.68(0.24,6.84)*	—	
	Live with parents	36(23.8)	115(76.2)	1	—	
Family size	>5	45(39.1)	70(60.9)	4.43(2.46,8.02)*	3.23(1.13,5.78)**	<b>0.012</b>
	≤ 5	21(12.7)	145(87.3)	1	1	
Use of ITN	No	45(20.6)	173(79.4)	0.52(0.28,0.97)*	—	
	Yes	21(33.3)	42 (66.7)	1	—	
Wealth Index	Low	40(34.2)	77(65.8)	5.1(2.17,5.11.2)*	6(2.31,15.7) **	<b>&lt;0.001</b>
	Medium	18(23.1)	60(76.9)	2.9(0.90,3.28)	2.40(0.15, 5.49)	0.380
	High	8(9.3)	78(90.7)	1	1	
Duration	>5 days	17(36.9)	29(63.1)	2.05(1.04,4.00)*	2.63(1.03, 6.67)**	<b>0.043</b>

menses	≤ 5 days	47(22.2)	165(77.8)	1	1	
IDDS	Low	26(38.2)	42(61.8)	2.28(1.60,6.98)*	2.13(1.16, 8.43)**	<b>0.024</b>
	Medium	15(15.6)	81(84.4)	0.68(0.15,4.38)*	1.26(0.22, 3.51)	0.290
	High	25(21.4)	92(78.6)	1	1	

**Key** \* = candidate variables at  $p \leq 0.25$  in Bivariate logistic regression \*\* predictor variables in Multivariate logistic regression at  $p < 0.05$ .

**N.B:** the Hosmer Lemeshow's goodness-of-fit test produce a chi-square of 5.95 with a p-value of 0.65.

## 6. DISCUSSION

The result of this study indicated that the overall prevalence of anemia among adolescent girls was 23.5%. According to the WHO criterion if, the prevalence of anemia within 20% to 39.9% to be considered as a moderate public health problem. So that the prevalence of anemia in adolescent girls in Mizan Aman Town is a moderate public health problem. Among adolescent girls who had anemia, the magnitude of mild and moderate anemia is 13.2% and 10.3%. The finding of this study showed that father education, family size, lower wealth index, duration of menstruation, and low dietary diversity score were independent significant predictors of anemia. The magnitude of this finding is Similar finding with that of reported in Aw-Barre refugee camp, Southeast Ethiopia,(65), Berhale district afar region (15), Demba northwest Ethiopia (22), research done in three districts of Ethiopia namely, Debrelibanose, Laygayint and Damotegale(49) And in Kenya (19). The prevalence of the current study result also higher than studies done in central Kerala, India (47), in rural western China (6), Bahirdar, Northern Ethiopia,(24). In hadero, Southwest Ethiopia, and Kebena garage zone (8,36). In contrast, the current study result is lower than studies conducted in Kashmir Pakistan (7), the eastern part of Nepal (66), And the Baglung municipality in Nepal (67). The difference might be due to the area difference, socio-economic difference, sample size difference and cultural behaviors including dietary habit differences.

Fathers' educational status is significantly associated with the prevalence of anemia among school adolescents in this study. School adolescents who had illiterate fathers were twenty-seven percent times more likely to be anemic as compared to school adolescents who had fathers were



collage and above level. similar studies were reported in Pakistan, Kenya, Mekelle, Kersa, Eastern Ethiopia adolescent girls whose father were either illiterate were developed anemia than their counterparts (7,9,19,41). In contrast to this finding, the study finding in Rwanda (33), China (6) showed that father educational status did not show significantly associated with anemia among adolescent girls. This might be due to the reason that a father who is educated is able to make informed decisions about his own family and so for his child as compared to his illiterate counterpart. This is because, in Ethiopia, most of the family decisions are made by the father and when they are educated and they might have the power to make decisions in matters related to adolescent health and the expected expenses, which affected the anemia prevalence. On the other side, the reason might be that educated fathers are more likely to have well-paid jobs and are also more likely to adopt healthier dietary behavior.

Adolescent girls who had a household family size five and more were significantly associated with anemia among high school adolescent girls. High school adolescent girls who had a family size five and more were 3.23 times more likely to be anemic as compared with high school adolescent girls from a family size of less than five. Similar studies were reported in Haldwani India, geddo, and bahrdar(24,35,38). But this finding is a contrast in Bhilwara(68). The reason might be due to the large size of the family that can be related to low care per family member and income constraint to obtain diets with a variety of foods rich in micronutrients such as iron. The reverse association was seen between wealth status and anemia, It is evident that girls from the poorest wealth status family were more prone to become anemic compared to those from the richest wealth status of the family. The odds of anemia were six times higher among adolescent girls whose families are under low wealth status than those who had high wealth status families. This finding also similar to a study conducted in Berhale afar region (17), Bhilwara, and Pakistan (7,68).the reason might be Adolescent girls of poor wealth status condition tend to consume poor iron-rich food sources, with lesser micronutrient content which might have resulted from a higher prevalence of anemia.

Adolescent girls who had menstrual flow for greater than five days were 2.63 times more likely to be anemic as compared to those adolescent girls with menstrual flow  $\leq 5$  days per each cycle.

This finding is in agreement with a study done in Pakistan, Tamil Nadu India, bahr dar and Hadero(5,7,8,24). This reason may be due to blood loss during menstruation time.

Another interesting finding of this study is a dietary diversification intake score were also found to be an independent predictor of anemia among adolescent girl students, low dietary diversification intake score was two times more likely to be anemic compared to those with a high dietary diversification intake score. This is consistent with the study done in. Hadero and Bhilwara, Southern Ethiopia as consumption of low diversified foods were associated with anemia among adolescent girls(8,68). This might be Poor dietary diversity leads to a deficiency of minerals, nutrients, and vitamins that may affect iron status then it can lead to anemia. dietary diversity is strongly associated with nutrient adequacy including iron adequacy this was consistent with a study conducted in Tigray north Ethiopia and Dembia northwest Ethiopia (9,22). this might be due to adolescents who consumed less quality diet are more likely to be anemic since the probability of nutrient adequacy increases as diet variety. Because the adolescent time is a special period with increased energy and nutrient requirements, so they need to receive an adequate variety of food groups on dietary diversification and are simple, cost-effective, and sustainable methods to alleviate the problem.

### **6.1. Limitation of the study**

Serum ferritin and foliate concentrations measurement were not included in the data which would be important in specifically suggesting the micronutrient responsible for the observed anemia.

The use of only 24 hours of dietary recall to assess dietary intake may not be reflective of the usual intake of the study subjects due to its inherent limitations.

Malarial infection was taken based on the recall history in the last one month and no laboratory tested during the data collection period “if they said no” it might compromise the reliability of the data.

## **7. CONCLUSION AND RECOMMENDATION**

### **7.1. Conclusion**

The result of this study indicated that the overall prevalence of anemia among high school adolescent girls in Mizan Aman Town is a moderate public health problem. Which should be required integrated governmental and NGO intervention to tackle the burden. This study also identified important Factors associated with anemia among adolescent girls in the study area. Among those important Factors associated with anemia were father education, family size, low wealth index, duration of menstruation, and low dietary diversity score. Therefore it is important knowing and managing of identified determinant factors, prevention, and control of root causes and nutrition-related problem-solving strategies is very important to control anemia among high school adolescent girls as well as they need more diversified diet and an iron-rich source of food.

## **7.2. Recommendation**

Based on the findings of this study, the prevalence of anemia among high school adolescent girls is a moderate public health problem. Based on this finding the following recommendations have been made.

### **Mizan Aman Town health offices**

- ✓ Should intensify health education on Cause, symptom, and prevention of anemia with the collaboration of different stakeholders based on WHO recommendation.

### **Health extension workers**

- ✓ Give comprehensive and routine counseling service in house to house nutrition education for families of adolescent girls focusing on diversified diet and iron-rich food sources such as a source of foods that decreasing and Increase iron absorption.

### **Mizan Aman Town Administrative Education Office and Schools**

- ✓ Need to develop a school nutrition club to promote the knowledge of adolescents on nutrition related to health.
- ✓ Each school works collaboratively with the parent-teacher association related to the nutritional and health of the student.

### **Parents and adolescents**

- ✓ Adolescents need to eat a diversified diet and a good source of iron foods.

### **Researchers**

- ✓ More extensive research needs to be done with a large sample size supported by foliate and ferritin laboratory tests in high school adolescent girls.
- ✓ In future researchers should conduct with more strong study design to know the etiology of anemia among high school adolescent girls.

## Reference

1. WHO. The global prevalence of anaemia in Geneva: World Health Organization; 2015.
2. Soundarya N. A review on anaemia – types , causes , symptoms and their treatments . 2018;1(1):10–7.
3. Survey H. Central Statistical Agency (CSA) [Ethiopia] and ICF. Ethiopia Demographic and Health Survey. 2016.
4. Alfaleh K, Hasanato R, Al-mandeel H. Prevalence of vitamin D deficiency in Saudi newborns at a tertiary care center. 2014;35(2):178–86.
5. davi jk fabiola dh. International journal of research in adolescent girls in selected school at Chennai,tamali nadi,india. 2019;10(2):1259–65.
6. Review U, Xi ZZ, Health P, Cheng Y, Qi M, Xi Q, et al. Prevalence and Associated Factors of Anemia Among Adolescent Girls in Rural Western of china. 2020;2(4):1–21.
7. Habib N, Abbasi SS, Aziz W. An Analysis of Societal Determinant of Anemia among Adolescent Girls in Azad Jammu and Kashmir , Pakistan. 2020;2(8):1–19.
8. Alemu T, Gebremedhin S. Prevalence and Predictors of Anaemia Among Adolescent Girls in Rural Hadero Tunto District , Southern Ethiopia : Community Based Study. 2020;9(1):16–24.
9. Gebremariam H, Seid O, Assefa H. Assessment of nutritional status and associated factors among school going adolescents of Mekelle City , Northern Ethiopia. 2015;4(1):118–24.
10. Kabatereine NB, Brooker S, Koukounari A, Kazibwe F, Tukahebwa EM, Fleming FM, et al. Impact of a national helminth control programme on infection and morbidity in Ugandan schoolchildren. 2017;030353(06):91–9.
11. Consultation WHOR. Prevention and Control of Iron Deficiency Anaemia in Women and Children Prevention and Control of Iron Deficiency Anaemia in Women and Children. 2015.
12. Database WHOG. Worldwide prevalence of anaemia. 2008.
13. Christian P, Smith ER. Adolescent Undernutrition: Global Burden, Physiology, and Nutritional Risks. *Ann Nutr Metab.* 2018;72(4):316–28.
14. Alem M, Enawgaw B, Gelaw A, Kena T, Seid M, Olkeba Y. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Azezo Health Center Gondar town , Northwest Ethiopia. 2013;1(3):137–44.
15. Anaemia and nutritional status of adolescent girls in Babile District, Eastern Ethiopia. 2016;(1):1–10.
16. Tesfaye M, Yemane T, Adisu W, Asres Y GL. Anemia and iron deficiency among school

adolescents: burden, severity, and determinant factors in southwest Ethiopia. *Adolescent health, medicine and therapeutics*. 2015;6:189–196.

17. Adem OS, Tadsse K, Gebremedhin A. Iron deficiency anaemia is moderate public health problem among school going adolescent girls in Berahle district , Afar , northeast Ethiopia. 2015;(1):10–6.
18. Iqbal K, Zafar T, Iqbal Z, Usman M, Bibi H. Effect of Iron Deficiency Anemia on Intellectual Performance of Primary School Children in Islamabad , Pakistan. 2015;14(3):287–91.
19. Nelima D. Prevalence and Determinants of Anaemia among Adolescent Girls in Secondary Schools in Yala Division Siaya District , Kenya. 2015;3(1):1–9.
20. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: A systematic analysis of population-representative data. *Lancet Glob Heal*. 2013;1(1):e16-25.
21. Mulugeta A, Hagos F, Stoecker B, Kruseman G, Linderhof V, Abraha Z, et al. Nutritional Status of Adolescent Girls from Rural Communities of Tigray, Northern Ethiopia. *Ethiop J Heal Dev*. 2019;23(1):6–11.
22. Gonete KA, Tariku A, Wami SD, Derso T. Prevalence and associated factors of anemia among adolescent girls attending high schools in Dembia District , Northwest. 2018;76(79):1–9.
23. Agency CS, Ababa A. Ethiopia Demographic and Health Survey. 2012
24. Mengistu G, Azage M, Gutema H. Iron Deficiency Anemia among In-School Adolescent Girls in Rural Area of Bahir Dar City Administration , North West Ethiopia. 2019;9(2):1–9.
25. Regasa RT. Anemia and its determinant of in-school adolescent girls from rural Ethiopia : a school based cross-sectional study. 2019;19(1):1–7.
26. Nery SV, Traub RJ, McCarthy JS, Clarke NE, Amaral S, Llewellyn S, et al. Wash for worms: A cluster-randomized controlled trial of the impact of a community integrated water, sanitation, and hygiene and deworming intervention on soil-transmitted helminth infections. *Am J Trop Med Hyg*. 2019;100(3):750–61.
27. Salam N, Azam S. Prevalence and distribution of soil-transmitted helminth infections in India. *BMC Public Health*. 2017;17(1).
28. Yimam Y, Degarege A, Erko B. Effect of anthelmintic treatment on helminth infection and related anaemia among school-age children in northwestern Ethiopia. *BMC Infect Dis* [Internet]. 2016;1–8. Available from: <http://dx.doi.org/10.1186/s12879-016-1956-6>
29. Molla E, Mamo H. Soil - transmitted helminth infections , anemia and undernutrition among schoolchildren in Yirgacheffee , South. *BMC Res Notes* [Internet]. 2018;1–7.

Available from: <https://doi.org/10.1186/s13104-018-3679-9>

30. Shaban L, Al-Taiar A, Rahman A, Al-Sabah R, Mojiminiyi O. Anemia and its associated factors among Adolescents in Kuwait. *Sci Rep [Internet]*. 2020;10(1):1–9. Available from: <http://dx.doi.org/10.1038/s41598-020-60816-7>
31. Kumar A, Goyal A, Verma N, Mahesh A. Study of anemia among adolescent school girls and young adults Study of anemia among adolescent school girls and young adults. 2018;5(4):1–3.
32. Development DN. Plenary Session I Nepal Graduation from LDC to Developing Country Status. 2016;1–297.
33. St A, Clinic T. Assessment of Anaemia in Adolescent Girls Aged between 10-19 Years Old Assessment of Anaemia in Adolescent Girls Aged between 10-19 Years Old Attending St Therese Clinic. 2019;(6):1–4.
34. Poyyamozi JS, Rushender R, Reddy GMM. Prevalence and factors influencing anaemia among urban adolescent females , a cross sectional study. 2018;5(3):976–81.
35. Shaka MF, Wondimagegne YA. Anemia , a moderate public health concern among adolescents in South Ethiopia. 2018;26:1–14.
36. Shiferaw S, Asefa F. Anemia and Its Relationship with Academic Performance among Adolescent Anemia and Its Relationship with Academic Performance among Adolescent School Girls in Kebena District , Southwest Ethiopia. 2017;2(3):1–14.
37. Development C, Hall A, Bobrow E, Brooker S, Jukes M, Nokes K, et al. Anaemia in schoolchildren in eight countries in Africa and Asia. 2015;4(3):749-56.
38. Goyal N, Rawat CMS, Jha SK. Prevalence of anaemia among school adolescent girls . 2015;27(03):1–4.
39. Mokhtar A, Elsoadaa S. Prevalence and Risk Factors of Anemia among a Sample of Pregnant Females Attending Primary Health Care Centers in Makkah , Saudi Arabia Prevalence and Risk Factors of Anemia among a Sample of Pregnant Females Attending Primary Health Care Centers in Makka. 2016;3(2):1–15.
40. Kane RL. Common Syndromes in Older Adults Related to Primary and Secondary Prevention. 2017;
41. Mesfin F, Berhane Y, Worku A. Anemia among Primary School Children in Eastern Ethiopia. 2015; 10(4):1-10
42. Mboera LEG, Bwana VM, Rumisha SF, Malima RC, Mlozi MRS, Mayala BK, et al. Malaria , anaemia and nutritional status among schoolchildren in relation to ecosystems , livelihoods and health systems in Kilosa District in central Tanzania. *BMC Public Health [Internet]*. 2015;1–9. Available from: <http://dx.doi.org/10.1186/s12889-015-1932>
43. Legason ID, Atiku A, Ssenyonga R, Olupot-olupot P, Barugahare JB. Prevalence of Anaemia and Associated Risk Factors among Children in North-western Uganda : A Cross

Sectional Study. 2017;17(1):1–10.

44. Desalegn A, Mossie A, Gedefaw L. Nutritional Iron Deficiency Anemia : Magnitude and Its Predictors among School Age Children , Southwest Ethiopia : A Community Based Cross-Sectional Study. 2014;9(12):1–13.
45. Goyal N, Rawat CMS. Original Research Article A study of anaemia and its correlates among adolescent girls in schools of Haldwani , India. 2018;6(10):3320–6.
46. Ahankari AS, Fogarty AW. Ahankari AS, Tata LJ, Fogarty AW. Weight, height, and midupper arm circumference are associated with haemoglobin levels in adolescent girls living in India: 2019;2(4):1–5.
47. Sciences B, Sci B. Anaemia a Health Burden among Rural Adolescent Girls in District Karnal : Prevalence and Coorelates. 2017;4(7):34–41.
48. Barugahara ei\*<sup>1</sup>, <sup>2</sup> kj and wg. prevalence and risk factors of nutritional anaemia among female school children in masindi district, western uganda. 2015;13(3):1-14
49. Gebreyesus SH, Endris BS, Beyene GT, Farah AM, Elias F, Bekele HN. Anaemia among adolescent girls in three districts in Ethiopia. 2019;19(1):1–11.
50. Engidaye G, Melku M, Yalew A, Getaneh Z, Asrie F. Under nutrition , maternal anemia and household food insecurity are risk factors of anemia among preschool aged children in Menz Gera Midir district , Eastern Amhara , Ethiopia : a community based cross-sectional study. 2019;19(1):1–11.
51. Singh M, Honnakamble RA, Rajoura OP, Singh M. Knowledge , Attitude and Practice Change about Anemia after Intensive Health Education among Adolescent School Girls of Delhi. 2019;9(3):71–3.
52. Gebreyesus SH, Endris BS, Beyene GT, Farah AM, Elias F, Bekele HN. Anaemia among adolescent girls in three districts in Ethiopia. 2019;19(92):1–11.
53. mizan aman Town report. 2018.
54. Hussein FM, Ahmed AY, Muhammed OS. Household food insecurity access scale and dietary diversity score as a proxy indicator of nutritional status among people living with HIV/AIDS, Bahir Dar, Ethiopia, 2018;13(6):1–9.
55. Cheesbrough M. district labratory practice second edition, part two. 2010.
56. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. 2013. 1–6 p.
57. gaidline for malaria diagnosis and mamagment plan in US and Ethiopia. 2017;
58. WHO. Helminth control in school-age children Helminth control in school age children. 2011;
59. physial status use and interpretation of anthropometry. 2008.
60. FAO,THE STATE OF WORLD FISHERIES AND AQUA CULTURE. 2018.



61. FAO Guidelines for assessing nutrition- IDA related Knowledge , Attitudes and Practices. 2017.
62. Sharmila P, Kumar MA, Rajagopala S. Knowledge , Attitude and Practices ( KAP ) related to Pandu Roga ( Iron Deficiency Anaemia ) among Adolescent Girls attending Ayurveda Tertiary Care Hospital and Nearby Schools - A Survey. 2019;4(4):154–9.
63. Note T. NanoDrop One / One C and Multiskan Sky spectrophotometers A theoretical and practical guide for spectrophotometric determination of protein concentrations at 280 nm. 2013.
64. WHO AnthroPlus Software for assessing growth of children and adolescents. Geneva:WHO. 2009. 1–45 p.
65. Tadege M, Id E, Wassie MM, Teferra AS. Anemia and associated factors among adolescent girls living in Aw-Barre refugee camp , Somali regional state , Southeast. 2018;2(5):1–12.
66. Sciences M, Mar J, Kanodia P, Bhatta M, Singh RR, Bhatta NK, et al. A study of anemia among adolescent girls in eastern part of Nepal. 2016;0657(1):19–22.
67. Journal G, Medicinepublic OF. Prevalence of anaemia and its associated factors among school adolescent girls in Baglung municipality , Nepal. 2018;7(5):1–8.
68. Choudary MK, Gupta M, Saxena R, Uppadhaya SK. A study on socio demographic determinant causing anemia in adolescent in RVRS medical college,bhilwara. 2019;3(2):60–3.

### **Annex-1: Participant Information Sheet and Consent Form for parents/students**

Hello, my name is \_\_\_\_\_. I am working as a data collector for the study being conducted in this school by Mr. G/Michael Birhanu who is studying for his Master's degree in Human Nutrition at faculty of public health, Jimma University, I kindly request you to lend me your attention to explain to you about the study and being selected as the study participant.

**The study/project title:** Anemia and its associated factors among high school adolescent girls in Mizan Aman town, south west Ethiopia.

**Purpose/aim of the study:** The findings of this study can be of a paramount importance for the town health office to plan intervention programs to prevent and reduce anemia among school adolescents and others; there by improve adolescent health and survival in general. Moreover, this study helps as thesis for the partial fulfillment of requirements for a Master's of Human Nutrition for the principal investigator.

**Procedure and duration:** I will be interviewing you using a questionnaire so that you will provide me with pertinent data that is helpful for the study. I will measure your weight, height and I will also take a drop of blood from your finger tip. The interview will take about 10-20 minutes. So, I kindly request you to spare me this time for the interview.

**Risks and benefits:** The risk of being participant in this study is very minimal, but only taking few minutes from your time and very minimal pain while pricking your finger tip. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for the local health planners. In case you are found to be anemic we will counsel you and if severely anemic we will link you to the nearby health facility for further assessment and proper medical care.

**Confidentiality:** The information you will provide us will be confidential. There will be no information that will identify you in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual persons or housing. The questionnaire will be coded to exclude showing names.

**Rights:** Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

**Contact address:** If there are any questions or enquires any time about the study or the procedures, please contact us by the following address.

The principal investigator: Mr. G/Michael Birhanu Mobile: +251-945049045, Email address: [gebremichealbirhanu12@gmail.com](mailto:gebremichealbirhanu12@gmail.com)

Declaration of informed voluntary consent: I have read/ was read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I will informed that my son/daughter have the right to withdraw from the study at any time or not to answer any question that he/she does not want to answer. Therefore, I on behalf of my son/daughter declare my voluntary consent to participate in this study with my initials (signature).

Name and signature of parent/guardian/student: \_\_\_\_\_ .sig. \_\_\_\_\_ date \_\_\_\_\_

Name and signature of data collector . \_\_\_\_\_ .sig. \_\_\_\_\_ date \_\_\_\_\_

### Annex-2: English Questionnaire

Code \_\_\_\_\_ class \_\_\_\_\_ section \_\_\_\_\_ Name of school \_\_\_\_\_ Date \_\_\_\_\_

<b>Section -1: Socio –economic Characteristics</b>			
<b>Q.NO</b>	<b>QUESTION</b>	<b>RESPONSE WITH THEIR CODE</b>	<b>SKIP</b>
101	How old are you?	1. Age ( in year)_____	
102	What is your grade attending now?	1. Grade _____	
103	Type of school	1. Governmental 2. private	
104	Religion	1. Muslim 2. Orthodox 3. catholic 4. protestant 5. other _____	
105	Ethnicity	1. Bench 2. Amhara 3. kaffa 4. Oromo 5. other _____	
106	What is your current Marital status	1. Single 2. Married 3. Living together 4. Separated	

		5. Divorced Widowed	
107	What is your living arrangement	1. Living with parents / partners 2. Living with relative 3. Living with friends in rental house 4. Living alone in rented house 5.others (Specify)_____	
108	Educational status of father	1.Illiterate 2. Read and write 3.Primary school/1-8/ 4. High school/9-12/ 5.College and university	
109	Educational status of mother	1.Illiterate 2. Read and write 3.Primary school/1-8/ 4. High school/9-12/ 5.College and university	
110	Occupation of father	1. Daily laborer 2. Merchant 3. Private organization Employed 4. Government employee 5. Farmer 6. Unemployed Others (specify)_____	
110	Occupation of Mother	1. House wife 2. Merchant	

		3. private organization Employed 4. Government employee 5. Farmer Others (specify)_____	
111	Which explains about your family	6. Both parent alive 7. Father alive 8. Mother alive Both parent died	
112	What is the total number of family members currently living in your house? (including all individuals will stay and stayed for greater than 6month)	Family size_____	

**Household socio-economic status (Wealth Index)**

From the following assets which do you have?

113	Own house	1. Yes 2. No	
114	Functioning Flat screen Television	1. Yes 2. No	
115	Radio/ tape recorder	1. Yes 2. No	
116	Functioning DVD/CD player	1. Yes 2. No	
117	Sofa	1. Yes 2. No	
118	Table and chair	1. Yes 2. No	
119	Mobile telephone	1. Yes 2. No	
120	Computer	1. Yes 2. No	
121	Video camera or Digital Camera	1. Yes 2. No	
122	Electric stove	1. Yes 2. No	
123	Electric Mitad	1. Yes 2. No	
124	Gas stove	1. Yes 2. No	
125	Refrigerator	1. Yes 2. No	

126	Laundry machine	1. Yes 2. No	
127	Generator	1. Yes 2. No	
128	Car	1. Yes 2. No	
129	Bicycle/motorcycle	1. Yes 2. No	
130	Cart/Gari	1. Yes 2. No	
131	Bajaj	1. Yes 2. No	
<b>Section -2: Questions related to Sanitation and environmental health activity</b>			
201	What is the main source of drinking water for members of your household?	1. Piped water/supply water 1.1.own piped 1.2. Public tap/stand pipe 2. Dug well 2.1 protected well 2.2. un protected well 3. River /Pond/lake/ Dam 4. Rain water 5. bottle water 6. Other (specify)_____	
202	Do you do anything to the water to make it safer to drink?	1.Yes 2. No 3.Do not know	If 2 Go to Q 204
203	What do you do to make the water safer to drink? Anything else?	1. Boil 2. Add bleach/chlorine/water guard/pur/bishangari /aqua tabs 3. Strain through a cloth 4. Bio sand /composite/ceramic pot filter 5. let it stand and settle	

		6. don't know other (specify)_____	
204	What is the main source of water used by your household for other purposes such as cooking and hand washing?	1. Piped water/supply water 1.1.own piped 1.2. Public tap/stand pipe 2. Dug well 2.1 protected well 2.2. un protected well 3. River /Pond/lake/ Dam 4. Rain water 5. bottle water 6. Other (specify)_____	
205	Do you have toilet facilities?	1. Yes 2. No 3. Do not know	<b>If 2 go to Q 207</b>
206	If yes, What kind of toilet facility do members of your house usually use?	1. flush toilet 2. ventilated 3. Improved 4. Non improved 5. no facility /field other (specify)_____	
207	Do you have insect side treated bed net (ITN)?	1. Yes      2.No	
208	Do you sleep under the ITN?	1. Yes      2.No	
209	De-worming in the last one month?	1. Yes 2.No	

		3. Don't know	
<b>SECTION-3: Questions on health related factors</b>			
301	History of fever in the last two weeks?	1.Yes      2.No	
302	History of malaria in the last one month?	1.Yes 2.No	
303	Does you have diarrhea in the last two weeks?	1. Yes      2.No	
304	If yes Question number 302 what type of diarrhea?	1. Diarrhea without blood 2. Diarrhea with blood	
305	History of worm infestation in the last one month?	1.Yes 2.No	
306	Ever attained menarche?	1.Yes 2.No	If 2 Go to Q 401
307	How old were you when you first attained Menstruation?	1.Age in year_____	
308	How long days your blood flows in each menses?	_____Days	
310	Is your menstruation come by keeping your time (monthly)?		
311	Do you have Currently Menstruation?	1.Yes 2.No	If 1 Go to Q 114
312	Are you Currently pregnant?	1.Yes 2.No	
313	Have you ever been aborted?	1.Yes 2.No	If 2 Go to Q 401
314	If yes, What problems did you face during or following that particular abortion? ( <b>More than one answer</b> )	1.Heavy bleeding 2. Abdominal pain	



	<b>is possible).</b>	3. Genital/uterine trauma 4 .None	
315	Did you visit to health Institution provider after that particular induced abortion?	1.Yes 2.No	If 2 Go to Q 401
316	If yes, What was the main reason for visiting to the health institution? <b>(More than one answer is possible)</b>	1.Heavy bleeding 2. Abdominal pain 3 .Vaginal discharge 4. Fever 5. Incomplete abortion 6 .others Specify_____	

**SECTION-4 : Question related to knowledge**

Now I will ask you some general questions about anemia

401	Did you heard of about iron Deficiency anemia?	1. yes 2. no	If 2 ,skip to Section 5
402	If yes, how can you know someone Who has anemia?	1.More likely to become sick 2. Paleness /pallor 3.Less energy/weakness 4. Spoon nails or bent nails 5. I don't know	
403	Did know you the consequences of iron deficiency anemia for infants and young children?	1. Delay of mental and physical development. 2.weaknes and senses of fainting 3. Other_____	
404	What are the causes of iron deficiency anemia?	1. Lack of iron in the diet/eat too little, not much 2. Sickness/infection (malaria, hookworm infection, other infection like HIV/AIDS)	

		3. Heavy bleeding during menstruation 4. Other _____ 5. Don't know	
405	Do you know the consequence of anemia for pregnant women?	1. Risk of dying during or after pregnancy 2. Difficult delivery 3. Others _____ 4. I don't know	
406	Do you mention the prevention methods of anemia?	1. Eat iron rich foods / diet 2. Eat /give vitamin c rich foods during or after meals 3. Take iron supplements if prescribed 4. Treat other causes of anemia( worms, malaria) 5. Continue breast feeding (for infants 6-23 months years old ) 6. I don't know	
407	Can you mention iron rich foods Which are easily absorbable?	1. Organ meats(liver, kidney and heart) 2. Flesh meat (lamb. Goat, chicken) 3. Legumes (beans, peas, chick, soya beans peas and lentils) 4. Vitamin c rich foods( spinach, pumpkin ) 5. Red meat 6. Don't know	
408	can you mention foods increase Iron absorption?	1. Vitamin c foods (fresh citrus fruits orange, lemons etc 2. Others 3. Don't know	
409	Can you mention foods that Decrease iron absorption?	1. Coffee 2. Tea 3. Other _____	

4. Don't know

**Section -5: Questions related to dietary diversity (24 hour recall)**

I would like to ask you about the types of foods that you feed from sunrise yesterday to sunrise today with in 24 hour, whether at home or outside the home. Read the list of foods below and place a one in the box if you ate the food in question, place a mark in the box if a child didn't

	<b>Food group</b>	<b>Examples</b>	<b>mark</b>	
501	Starchy staples (grain ,Cereals,white roots & tubers)	Maize, teff, rice, wheat, sorghum, or any other grains or foods made from these (e.g. Injera, bread, noodles, pasta ,macaroni, kinche, rice, atmit, bread, local pasty & White potatoes, sweet potato, carrot, or other foods made from roots like godore, enset.	<b>1.Yes</b> <b>2. No</b>	
502	Vitamin A rich fruits, vegetables & tuber	ripe mango, apricot (fresh or dried), ripe papaya, dried peach, and fruit juice made from these, carrot, or sweet potato that are orange inside & other locally available vitamin A rich vegetables (e.g. red sweet pepper)	<b>1.Yes</b> <b>2. No</b>	
503	Other fruits and vegetables	Other vegetables (e.g. tomato, onion, eggplant) <i>other locally available vegetables</i> other fruits, including wild fruits that fruit juice.	<b>1.Yes</b> <b>2. No</b>	
504	Dark green leafy Vegetables	Wild forms and locally available vitamin A rich leaves such as Lettuce, cassava leaves, spinach , kale.	<b>1.Yes</b> <b>2. No</b>	
505	Meat, poultry ,fish and sea food	liver, kidney, heart or other organ meats or blood-based foods beef, pork, lamb, goat game and chicken .	<b>1.Yes</b> <b>2. No</b>	
506	Eggs	Eggs	<b>1.Yes</b> <b>2. No</b>	
506	Legumes, nuts and seeds	Dried beans, dried peas lentils, nuts, seeds or foods made from these ( eg. shiro wet, kik wet, misir wet, shimbrakolo, bakelaashuk,	<b>1.Yes</b> <b>2. No</b>	

		adenguare, boloke).		
507	Milk and milk products Milk	Milk, cheese, yogurt or other milk products like aguata, arera.	<b>1. Yes</b> <b>2. No</b>	
508	Oils and fats	Oils and fats	<b>1. Yes</b> <b>2. No</b>	
509	Sweets	Any Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	<b>1. Yes</b> <b>2. No</b>	
510	How many times you eat per day?	1. Once 2. Two times 3. Three times 4. More		
511	Do you drink Coffee/tea?	1. Yes    2. No		
512	If yes average how many cups of coffee do you drink per day	_____ Cups		
513	When do you drink coffee or tea?	1. Two hours or more before a meal 2. Right before a meal 3. During the meal 4. Right after a meal 5. Two hours or more after a meal 6. I don't know		

**SECTION -6: measurement of anthropometric, hemoglobin and result of stool examination**

		Measurement 1	Measurement 2	Average
601	<b>Height the respondent</b>	_____ cm	_____ cm	_____ cm
602	<b>Weight of the respondent</b>	-----kg	-----kg	-----kg
603	<b>BMI</b>	_____		
604	<b>MUAC</b>	_____ cm	_____ cm	_____ cm

605	<b>Hemoglobin</b>	_____g/dl		
606	<b>RDT Result</b>	Positive	Negative	Type _____
607	<b>Result of stool examination</b>	stool not examined or Not valid		Positive & Type
				Negative

**THANK YOU**

**Annex-3. Amharic version of the questioner**

**ጅግ ዩኒቨርሲቲ ጤና ኢንስቲትዩት የ ስነ-ህዝብ እና ጤና ትምህርት ክፍል ከጤና ጋር የተያያዘ ጥናታዊ ፅሁፍ እንደምንደረፍ/ዋለ \_\_\_\_\_ እባላለሁ።**

በጅግ ዩኒቨርሲቲ ጤና ሳይንስ ኢንስቲትዩት ጤና ትምህርት ክፍል በስርዓተ ምግብ የ 2ኛ ዓመት የማስትሬት ድግሪ ተመራቂት ማረጋገጫ። በአሁኑ ሰዓት ሚዛን ከተማ እድሜያቸው ከአስር ዓመት እስከ አስራ ስድስት ዓመት ዕድሜ ለሚሆኑ ፍተሚያዎች እና ወላጆች ቻቸው ስለደምጣኑ እና ለደምጣኑ ስተያያዥነት ያላቸውን ነገሮች ለመለየት በማጥናት ላይ እገኛለሁ።

**የጥናቱ አላማ፡-** የልጆች የደምጣኑ እና ለደምጣኑ ስተያያዥነት ያላቸውን ነገሮች ለመለየት ነው።

**የጎንዮሽ ጉዳት፡-** በዚህ ጥናት መሳተፍ በርሶ ምሆን በልጅ ወይም ለደምጣኑ አይነት ጉዳት አያመጣም።

**ጥቅማ ጥቅም፡-** በዚህ ጥናት መሳተፍ ምንም ዓይነት ገንዘብ አያስገኝም። ከአንተ ጋር የምናገኘው መረጃ ከልጆች ክብር ደት መጨመር ጋር ተያይዞ ወይም ጤና ጥራት ለልጆች ጥራት ለማረጋገጥ ነው። እቅድ ለማድገም ይረዳል። ስለዚህ ይህንን አስመልክቶ የተወሰኑ ጥያቄዎችን ልጤቅዎት እወዳለሁ። የእርስዎ በእውነት ላይ የተመሰረተ መልስ ለዚህ ጥናት መሳተፍ አስተዋፅኦ ያደርጋል። እርስዎም የሚሰጡት መረጃ ከአጥኚውና ቃለ መጠይቅ አድራጊው በስተቀር በማንኛውም መልኩ ለሌላ

3ኛ ወገን ተላልፎ አይሰጥም። በሙሉ ፈቃደኝነት እንዲሰተፉ እየጠየቅሁ ያለ መሳተፍ ወይም በማንኛውም ጊዜ ራስ

ዎንከጥናቱ የማግለል ሙሉ ሙሉ ብትክለዎት። በማንኛውም ጊዜ ጥያቄ ካለዎት በሚከተለው አድራሻ ይጻፉት ይቻላል።  
ለሌሎች ጥያቄዎችን ለመመለስ አስርደቁ ያህል ጊዜ ያስፈልጋል።

ሞባይል: ስልክ: 09 45049045

ኢሜል: gebremichealbirhanu12@gmail.com

**የስምምነት መግለጫ ፎርም**

ጅማ ዩኒቨርሲቲ ጤና ኢንስቲትዩት የስነምግብ እና ጤና ትምህርት ክፍል በድህረ ምረቃ ፕሮግራም ከዚህ በታች የተገለጸው ፤ የዚህ ጥናት ዓላማ በደንብ የተብራራ ሲሆን የጥናቱን ምዕላማ ተረድቻለሁ። በዚህ ጥናት ላይ መሳተፍ በሙሉ ፈቃደኝነት ላይ የተመሰረተ መሆኑን በሚገባ የተረዳሁ ሲሆን በማንኛውም ጊዜ ከጥናቱ ሴንዩር ላይ የማግለል ሙሉ ብትክን ያለኝ አውቄ አለሁ። ስለሆነም የምሰጠው መረጃ እስከተጠበቀ ድረስ በዚህ ጥናት ላይ መሳተፍ ተስማምቻለሁ። በዚህ ጥናት ላይ መሳተፍ ስምምነቴን ስንገልፅ ለምጥቀው ጥያቄ በእውነት ላይ የተመሰረተ መልስ መስጠት የተስማማሁ መሆኔን አረጋግጣለሁ።

የመረጃ ሰጪው ስም. \_\_\_\_\_ ፊርማ. \_\_\_\_\_ ቀን. \_\_\_\_\_

የአጥኚው ስም. \_\_\_\_\_ ፊርማ. \_\_\_\_\_ ቀን. \_\_\_\_\_

**ለአሳዳጊ ቤተሰብ የስምምነት መግለጫ ፎርም**

ጅማ ዩኒቨርሲቲ ጤና ኢንስቲትዩት የስነ-ምግብ እና ጤና ትምህርት ክፍል በድህረ ምረቃ ፕሮግራም ከዚህ በታች የተገለጸው ፤ የዚህ ጥናት ዓላማ በደንብ የተብራራ ሲሆን የጥናቱን ምዕላማ ተረድቻለሁ። በዚህ ጥናት ላይ ልጄ/ተማሪዬ እንዲሳተፍ በሙሉ ፈቃደኝነት ላይ የተመሰረተ ኩሙሆኑን በሚገባ የተረዳለሁ። ስለሆነም ልጄ/ተማሪዬ የምሰጠው መረጃ እስከተጠበቀ ድረስ በዚህ ጥናት እንዲሳተፍ ተስማማሁ መሆኔን አረጋግጣለሁ።

የወሊጅ/ ያሳዳጊ/ የተማሪ ስም. \_\_\_\_\_ ፊርማ. \_\_\_\_\_ ቀን. \_\_\_\_\_

የመረጃ ሰጪ ብሳቢው ስም. \_\_\_\_\_ ፊርማ. \_\_\_\_\_ ቀን. \_\_\_\_\_

የተሳታፊ መለያ ቁጥር ----- ክፍል ----- የክፍል አይነት ----- የት/ትቤቱ ስም -----

ተ.ቁ	ጥያቄ	መልስናኮድ	ዝላል
<b>ክፍል -1:ስለማህበረሰባዊጉዳዮችንበተመለከተ</b>			
101	ዕድሜ	_____	
102	የትምህርትደረጃ	_____	
103	ሀይማኖት	1. ሙስሊም 2. ኦርቶዶክስ 3. ፕሮቴስታንት 4. ካቶሊክ 5. ሌላካለይጠቀስ.....	
104	የትምህርትቤቱአይነት	1. የመንግስት/ቤት 2. የግልት/ቤት	
105	ብሔረሰብ	1. ቤንቸ 2. አማራ 3. ኦሮሞ 4. ክፍ 5. ሌላካለይጠቀስ.....	
106	የጋብቻሁኔታ	1. ያገባች 2. ያላገባች 3. ሌላ_____	
107	አሁንከማንጋርነዉምትኖረዉ	1. ከቤተሰቦቼጋር 2. ከዘመዶቼጋር 3. ከቤተሰብተላይቼ 4. ሌላ_____	
108	የአባት/አሳዳጊ የትምህርት ሁኔታ	1. ማንበብእናመፃፍማትችል 2. ማንበብእናመፃፍየሚችል 3. አንደኛደረጃ(1-8) 4. ሁለተኛደረጃ(9-12) 5. ከ 12 በሊይከለጅናዩኒቨርሲቲ	
109	የእናት/አሳዳጊ የትምህርት ሁኔታ	1. ማንበብእናመፃፍየማትችል 2. ማንበብእናመፃፍየማትችል 3. አንደኛደረጃ(1-8)	

		4. ሁለተኛ ደረጃ (9-12) 5. ከ 12 በሊይ ከሌሎች የሚከተሉት	
110	የአባት ሽራ ወይም የአሳዳጊ የሥራ ሁኔታ	1. የቀን ሰራተኛ 2. ነጋዳ 3. የመንግስት ሰራተኛ 4. ሌላ ከሌለው ጠቀስ _____	
111	የእናት ሽራ ወይም የአሳዳጊ ሽራ ሁኔታ	1. የቤት እመቤት 2. ነጋዳ 3. የመንግስት ሰራተኛ 4. የቀን ሰራተኛ 5. ሌላ ከሌለው ጠቀስ _____	
112	እርሶ ምንጩ ምን ዓይነት ጥብብ ዘንግ ስንት ነው	_____	
113	በአማካይ በብር በወር ምን ያህል ገቢ ያላቸዋል	_____	
<b>የቤት ንብረት ሁኔታ ቤታችሁ ውስጥ ከዙሀን ቤታችሁ ከተዘረዘሩት መካከል ምን ምን አሉባቸው (አለን ወይም የለም በሚል ወቅታዊነት ይጻፉ)</b>			
	<b>ንብረት</b>	<b>አለ=1</b>	<b>የለም=2</b>
114	የግልቤት	1	2
115	የሚሰራ ተሽከርካሪ	1	2
116	የሚሰራ ሬዲዮ/ቴሌቪዥን/ዲቪዥን	1	2
117	ሰፊ	1	2
118	የእጅ ስልክ	1	2
119	ኮምፒውተር	1	2
120	ቪዲዮ ካሜራ ወይም ዲጂታል ካሜራ	1	2
121	የኤሌክትሮኒክ እቃዎች	1	2
122	የኤሌክትሮኒክ ምጣኔ	1	2
123	የጋዝ እቃዎች	1	2
124	ፍራጅ	1	2
125	ማጠባለያ ማሽን	1	2
126	መኪና	1	2



127	ሞተር ሳይክል	1	2	
128	ጋሪ	1	2	
129	ባጃጅ	1	2	
<b>ክፍል -2 አክባቢያዊንጽሀና፣ አጠቃቀም ና አያያዝ (የመጠጥውሃን፣ የሽንትቤትአይነት) መረጃን በተማለከተ</b>				
201	ለቤተሰብዎ የመጠጥ አገልግሎት የሚውልውሃ ዋና ምንጭ ምን ይደንገው?	1. የየቧንቧ ውሃ 1.1 በመኖሪያ ግቢው ስጥ 1.2. የቦኖ ውሃ 2. ከምንጭ 2.1. የተከለለ ምንጭ 2.2. ያልተከለለ ምንጭ 3. ከኩሬ፣ የጉድጓድ ውሃ፣ ሀይቅ፣ ወንዝ 4 የዝናብ ውሃ 5. የታሸገ ውሃ 6. ሌላ ካለ ይገለጽ -----		
202	ውሃውን ከመጠጥ ታችሁ በፊት ውሃውን ከጀርም ለማንፃፅ ምን ተጠቀማችሁ?	1. አፈላላው 2. በረኪና/ውሃ አጋር/ውሃ ማከሚያ እንክብል 3. በነጠላ/በልብ ስማጣራት 4. ባሽቆ ማጣራት 5. ለፀሃይ ማጋለጥ 6. በማዝቀጥ አላውቅ ምን እንደተደረገ 7. ሌላ ካለ ይገለጹ		
203	ለቤተሰብዎ ለምግብ ማብሰያና ለእጥበት አገልግሎት የሚውልውሃ ዋና ምንጭ ምን ይደንገው?	1. የየቧንቧ ውሃ 1.1 በመኖሪያ ግቢው ስጥ 1.2. የቦኖ ውሃ 2. ከምንጭ 2.1. የተከለለ ምንጭ 2.2. ያልተከለለ ምንጭ 3. ከኩሬ፣ የጉድጓድ ውሃ፣ ሀይቅ፣ ወንዝ 4 የዝናብ ውሃ		

		5.የታሸገውሃ 6.ሌላካለይገለጽ_____	
204	ቤትዎምንኣይነትሽንትቤትኣለው?	1.ውሃያለውሽንትቤት 2.የተሻሻለየጉድጓድሽንትቤት 3.ወደቆሻሻማስወገጃቱበየሚያመራ 4.የጉድጓድሽንትቤትበሲሚንቶየተሰራ 5.በጫካ/በሜዳላይ 6.ሌላካለይገለጽ_____	
205	በቤቱውስጥኣጎበርኣለ	1. ኣዎ      2. የለኝም	
206	ኣጎበርተጠቃሚኖት	2. ኣዎ      2. ኣልጠቀምም	
207	ባለፉትኣንድወርውስጥየትላትልመድሃኒት(ዲዎረሚንግ ) ወስደ ሽ ነበር	1. ኣዎ 2. ኣልወሰድኩም 3. ኣላውቀውም	
<b>ክፍሉ-3፤ጤናነክጉዲዮች</b>			
301	ባለፉትሁለትሳምንታትውስጥትኩሳት ኖሮባት/ሽያውቃል	1.ኣዎ 2. ኣልታመምኩም 3. ኣላወኩም	
302	ባለፈውኣንድወርውስጥበወባታመሽነበር	1.ኣዎ 2. የለም	
303	ባለፉትሁለትሳምንታትውስጥተቆማጥ ነበረሽ	1.ኣዎ 2. የለም	
304	ከነበረሽ ምን ኣይነትነው	1 ደምየቀላቀለ 2 .ውሃመሳይ(ደምየሌለው )	
305	ባለፈውኣንድወርውስጥበሆድትላትልታመሽነበር	1.ኣዎ 2. ኣልታመምኩም	
306	የወርኣበባማየትጀምረሻል	1. ጀምረያለሁ 2. ኣልጀመርኩም	
307	ለመጀመሪያጊዜየወርኣበባስታይኢዴሜሽስንት ነበር	-----ዓመት	
308	የወርኣበባሽለስንትቀንይቆያል(ይፈሳል)	-----	

309	የወርአበባሽጊዘውንጠብቆነውሚመጣው	1. አዎ 2. አይደለም	
310	አሁንላይየወርአበባላይነሽ	1. አዎ 2. የለም	
311	የወርአበባሽከሌለአሁንእርጉዝነሽ	1. አዎ 2. አይደለም	
312	እርግዝናአስወርደሽታውቅያለሽ	1. አዎ 2. አላውቅም	
313	በውርጃውምክኒያትምንችግርአጋጠመሽ	1.ደም መፍሰስ 2.ከፍተኛ ሆድህመም 3.የማህፀን ቁስለት 4.ትኩሳት ( ኢንፈክሽን ) 5.የልወጣ እርግዝና 6.አላጋጠመኝም	
<b>ክፍል-4፤ ደምማነስ እና ተያያዥ ጉዳዮች የሆኑትን እዉቀት መለኪያ መጠይቅ</b>			
401	ስለደምማነስ ሰምተሽ ታዉቂያለሽ	1. አዎ 2. አላውቅም	
402	መልስሽ አዎ ከሆነ አንድ ሰዉ የደምማነስ መኖሩን እንዳትማወቅ ትችያለሽ	1. የአቅም ማነስ/ዴካም 2. ሰዉነት መገርጣት (ቢጫ መሆን) 3. ጠፍር የማንኪያ አይነት ቅርፅ መሆን 4. ብዙ ጊዘ መታመም 5. አላዉቅም	
403	የደምማነስ በህፃን ልጆች እና በታዳጊ ልጆች ጤና ላይ የሚያሰከት ለውጥ ሰምን ድንገት	1. የአካሌና የአዕምሮ ስጋት መሆን 2. የአቅም ማነስ/ዴካም ፡ ራስ ህንጻ ሰጥ 3. ሌላ ካለ ይገለጽ _____ 4. አላዉቀውም	
404	የደምማነስ መንስኤዎችን ታዉቅያለሽ	1. የብረት እጥረት/በጣም ጥቂት መመገብ ፡ ጭራሹን ያለ መመገብ 2. ህመም/ እንጨክሽን ( ትላትል እና ሌላ አንድ	

		HIV AIDS፣ተቢ) 3. በወርአበባገዛከባዴየሆነየደምመፍሰስ 4. አሊዉቅም	
405	የደምማነስበነፍሰጡርእናቶችሊይየሚያስከት ለዉንተፅእኖታዉቂያለሽ	1. በእርግዜናዉይምከእርግዜናበኋላለምትሉያ ጋዳግይችላል 2. በወሊድጊዘመቸገር 3. ሌላካለይገለጽ _____ 4. አሊዉቅም	
406	የደምማነስመከሊከያመንገድችንመጥቀስትች ያለሽ	1. በብረትየበሆፀገምግብመመገብ 2. ከምግብጋርእናከምግብበኋሊበሽታሚንሲየ በለፀገምግብመመገብ 3. በሀኪምየታዘዘተጨማሪአይረንመዉሰድ 4. ላሊመንስዎችንማከም(የትላትል፣ወባ) 5. ያለማቋረጥጡትማጥባት( ከ 6-23 ወርእዴሜሊለሕፃናት) 6. አሊዉቅም	
407	በብረትየበለፀገእናበቀሊሉዉደሰዉነታችንመ ወሃድየሚችሉምግቦችንሉጠቅሱሉኝይችሉሉ	1.የጉበትስጋ፣የኩሊሉትስጋእናስጋንመመገብ 2. የበግ፣የፍየሌእናየድረስጋንመመገብ 3. ባቄላመሰሌጥራጥሬ(ባቄሊ፣አተር፣ሽንብራእ ናአኩሪአተርየመሰሰለትንመመገብ 4. በሽይታሚንሲየበለፀገፍራፍሬዎችን(ደባ፣ስ ፒናች) መመገብ 5. ቀይስጋንመመገብ 6. አሊዉቅም	
408	በሰዉንታችንዉሰጥብረትን (አይረን) ዉህቶትእንዲጨምርየሚያግዙምግቦችንያዉ ቃሉ	1. በሽይታሚንሲየበሆፀገምግቦች (ትኩስብረቱካን፣ልሚ) 2. ሌሎችካሉይጥቀሱ _____ 3. አሊዉቅም	
409	በሰዉንታችንዉሰጥብረትን(አይረን ) ዉህይትእንዲቀንስየሚያደርጉምግቦችንያዉቃ	1. ቡና	

	ሉ	2. ሻይ 3. ሌላካለ 4. አላዉቅም		
410	ደምማነስበተማሪዎችላይከበዛበህብረተሰቡላይደሚያመጣውችግር			
<b>ክፍል5፤በ24ሰዓትዉሰጥተመገቡትንየምግብአይነትይግለፁቤትዉሰጥምከቤትዉጨምየተመገቡትንያጠቃልላል፣አዎከሆነ 1 አይደምከሆነ 2ንይጠቀሙ</b>			አዎ 1	አልተመገቡትም 2
501	ጥራጥሬእናስራስር	ማንኛዉምበቆል፣ጤፍ፣ፋዜ፣ዲጉሳ፣እንጀራ፣ዲቦ፣ገንፎ፣አጥሚት፣ፓሰቲኒ፣ብስኩት(ቤትዉሰጥተዘጋጀ)፣ቂጣ፣ቅንጫ፣ድንች፣ቆጭ	1.	2
502	አረንጋዳቅጠሊቅጠልች	ጥቁርወይንምየሃበሻጎመን፣ቆሰጣ፣ሰሊጣ	1	2
503	በሻይታሚን A የበለፀጉምግቦችናፍራፍሬዎች	ደባ፣ካሮት፣ሰካርዲንች(ዉሰጥቤጫየሆነ)፣በርበሬ፣የበሰሆማንጎ፣የበሰሆፓፓያበጁስመሌክምቢሆን	1	2
504	ላሊፍራፍሬዎችንናላላቅጠሊቅጠሎች	ኮክ፣አቮካድ፣ቲማቲም፣ቀይሽንኩርት፣ነጭሽንኩርትእናምየመሳሰሉት	1	2
505	የአርጋንስጋ	ኩሊሉት ፣ጉበት፣ ሌብእናላልችም	1	2
506	እርጥብስጋ፣ አሳእናየባህርሊይምግቦች	የአሳማስጋ፣የበሬስጋ፣ የፍየልስጋ ፣የድሮስጋ፣የአዕዋፍስጋ ፣ አሳእናየአሳምግቦች .	1	2
507	እንቁላል	እንቁላል	1	2
508	ወተትእናየወተትአስተዋፅዖ	ወተት፣ እርጎ፣ አይብ ፣ አጎት፣ አሬራ	1	2
509	ጣፋጭምግቦች	ቸኮላት፣ ኩኪስ ፣ ኬክ፣ ከረሚላ ፣ስካር፣ ማር ፣ ለስሊሳመጠጥኮካ፣ ሚርንዲ፣ ጣፋጭምግቦች	1	2
510	በቀንስንት ጊዘ ትመገባለህ	1. አንድጊዘ                      2. ሁለትጊዘ 3. ሶስትጊዘ                      4. ከአራትጊዘበሊይ		
511	ቡናትጠጨያለሽ	1.አዎ 2. አልጠጣም		
512	መሌስሽአዎከሆነ በየቀኑበአማካኝስንትስኒቡናትጠጨያለሽ	-----		
513	መቼመቼነዉቡናወይምሻይ	1. ከምግብበሬትሁለትሰዓትወይምከዚበሊይ		

	ምጠጨፌ	2. ከምግብበፊት 3. በምግብሰዓት 4. ከምግብበኋላ 5. ከምግብበኋላሁለትሰዓትወይምከዚበለይ 6. አላዉቀም		
<b>ክፍል -6:አካላዊልኬት፣የደምእናየሰገራምርመራውጤትመመዝገቢያ</b>				
601	ቁመት	Measurement -1 _____ሴ.ሜ	Measurement -2 _____ሴ.ሜ	Average _____ሴ.ሜ
602	ክብደት	_____ኪ.ግ	_____ሴ.ሜ	_____ሴ.ሜ
603	MUAC	_____ሴ.ሜ	_____ሴ.ሜ	_____ሴ.ሜ
604	BMI	_____		
605	ሄሞግሎቢን(hemoglobin)	_____ግ/ዳሉ		
606	የአርዲቲ(RDT) ውጤት	_____		
607	የሰገራምርመራውጤት(stool )	_____		

**ለተደረገልኝትብብርበጣምአድርጌአመሰግናለሁኝ!!**

**ANNEX -4: Standard operating procedures (SOP)**

HemoCue®Hemoglobin test by Medical Laboratory Technologists.(Cheesbrough, 2006; Sanchis-Gomar et al., 2014). Standard procedures used were as follows:

1. The name of the lab technician & code of the volunteer were recorded at the top of form.
2. After start-up, the holder should be in its loading position. The display will show three flashing dashes and the Hemo cue symbols.
3. Make sure the client’s hand is warm and relaxed. Use only the middle or ring finger for sampling. Avoid fingers with ring on.
4. Clean with disinfectant and allow drying.
5. Using your thumb, lightly press the finger from the top of the knuckle towards the tip.

This stimulates the blood flow towards the sampling point.

6. For best blood flow and less pain, sample the side of the fingertip. Not in the center.
7. Whilst lightly pressing toward the fingertip until another drop of blood appears.
8. Wipe away the first two drops of blood.
9. Re-apply light pressure towards the fingertip until another drop of blood appears.
10. When the blood drop is large enough, fill the microcuvette in one continuous process.
11. Wipe out excess blood on the outside of the microcuvette during this procedure.
12. Look for air bubbles in the filled microcuvette. If present, take a new sample.
13. Place the filled microcuvette in the cuvette holder. This should be performed within 10 minutes after filling the microcuvette.
14. Push the cubette holder to its measuring position
15. After 15-60 seconds, the Hb value of the sample is displayed. The result will remain on the display as long as the cuvette holder is in the measuring position.
16. Discarding of the lancet with an open container was made and read the result immediately . After Results were taken from the display it will adjusted for mizanaman altitude (1451m), then documented on the questionnaire of each participant.

#### **ANNEX-5: Variables which are entered in to Bivariate Logistic Regression Model**

<b>Predictor</b>	<b>Category</b>	<b>Anemia status</b>		<b>COR 95%CI</b>	<b>P – value</b>
		<b>Anemic (%)</b>	<b>Normal ( %)</b>		
Father Occupation	Daily labor	8(38.1)	13(61.9)	1.98(1.09,6.45) *	0.024
	Merchant	17(16.8)	84(83.2)	0.65(0.35,1.18)*	0.053
	Farmer	8(4.0)	12(6.0)	2.14(0.26,3.24)	0.901
	Employed	33(23.7)	106(76.3)	1	
Father education	Illiterate	9(33.3)	18 (67.7)	1.60(1. 2,3.34)*	0.010

	Reade and write	17 (38 .0)	28(62.0 )	1.94 (0.62,4.65)	0.308
	Primary school	13 (23.0)	44(77.0)	0.95(0.30,2.24)	0.704
	Secondary school	7 (11.0)	61(89.0)	0.37(0.62,4.12)	0.329
	Collage and Above	20 (24.0)	64(76.0)	1	
Living arrangement	Living with relatives	24(25.0)	72(75.0)	1.07(0.52,1.67)*	0.128
	Living with friend	6(17.6)	28(82.4)	0.68(0.24,6.84)*	0.152
	Live with parents	36(23.8)	115(76.2)	1	
Family size	>5	45(39.1)	70(60.9)	4.43(2.46,8.02)*	0.063
	≤ 5	21(12.7)	145(87.3)	1	
deworming status	No	55(22.5)	190(77.5)	0.65(0.31,1.42)	0.287
	Yes	11(30.6)	25(69.4)	1	
Use of ITN	No	45(20.6)	173(79.4)	0.52(0.28,0.97)*	0.038
	Yes	21(33.3)	42 (66.7)	1	
Hx malaria	No	29(21.3)	107(78.7)	0.78(0.45,1.35)	0.372
	Yes	37(25.5)	108(74.5)	1	
Hx of IP	Yes	11(25.6)	32(74.4)	1.14(0.54,2.42)	0.725
	No	55(23.1)	183(76.9)	1	
Diarrhea	Yes	11(34.4)	21(65.6)	1.85(0.84,4.06)	0.271
	No	55(22.1)	194(77.9)	1	
Thinness	Thinness	5(18.5)	22(81.5)	0.78(0.28,2.18)	0.641
	Over wt	15(30.0)	35(70.0)	1.47(0.17,1.67)	0.284
	Normal	46(22.5)	158(77.5)	1	
stunting	stunted	12(25.0)	37(75.0)	1.07(0.52,2.19)	0.861
	Normal	54(40.9)	178(59.1)	1	
knowledge status	Poor knowledge	44(22.3)	153(77.7)	0.81(0.68,2.23)	0.486



	Good knowledge	22(26.2)	62(73.8)	1	
Wealth Index	Low	40(34.2)	77(65.8)	5.1(2.17,5.11.2)*	<0.001
	Medium	18(23.1)	60(76.9)	2.9(0.90,3.28)*	0.021
	High	8(9.3)	78(90.7)	1	
Duration menses	>5 days	17(36.9)	29(63.1)	2.05(1.04,4.00)*	0.038
	≤ 5 days	47(22.2)	165(77.8)	1	
Drink coffee/tea	Yes	59(27)	163(73)	2,69(0.16,6.25)	0.263
	No	7(11.9)	52(88.1)	1	
IDDS	Low	26(38.2)	42(61.8)	2.28(1.60,6.98)*	0.004
	Medium	15(15.6)	81(84.4)	0.68(0.15,4.38)*	0.014
	High	25(21.4)	92(78.6)	1	

## **ASSURANCE OF PRINCIPAL INVESTIGATOR**

The under signed agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Faculty of Public Health in effect at the time of grant is forwarded as the result of this application.

Name of the student: G/Michael Birhanu

Date.          Signature \_\_\_\_\_

## **FOR APPROVAL OF THE ADVISOR**

**1. Name of the advisor: Mr. Melese Sinaga**

Date \_\_\_\_\_          Signature \_\_\_\_\_

**2. Name of the advisor: Mrs. Rediet Kidane**

Date \_\_\_\_\_          Signature \_\_\_\_\_

