Prevalence and Predictors of Anemia among Adolescent girls in Rural Hadero district, Southern Ethiopia, Community Based Cross-sectional Study

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Abstract

Abstract Background: Anemia is the most common nutritional problem in adolescent girls and it has negative consequence on cognition, work performance and economic productivity. However, in the developing world there is limited evidence regarding the magnitude and determinants of anemia among adolescent girls. The current study highlights the burden of and factors associated with anemia in adolescent girls in Hadero district, Southern Ethiopia. Methods: A community based cross-sectional study was conducted in January, 2016 among adolescent girls 10-19 years old. A total of 407 subjects were selected using multistage cluster sampling technique. Hemoglobin level was determined from capillary blood using the HemoCue method. Factors associated with anemia (give the operational definition in bracket) were identified using bivariate and multivariate binary logistic regression analysis. The outputs of analyses are presented using adjusted Odds Ratio (AOR) with 95% Confidence Interval (CI). Result: The mean (±SD) of hemoglobin concentration adjusted for altitude was 13.7 + 1.2and ranged from 8 to 16.6g/dl. The overall prevalence of anemia was 15.2% (95%CI: 11.68%, 18.72%). Out of the total 400 adolescent girls 13.7% [95% CI: 10.33%, 17.06%] and 1.5% [95%CI: 0.3%, 2.7%] had mild and moderate anemia, respectively. low dietary diversity, (AOR=3.6, 95 % CI: 1.7, 7.7), long menstrual duration (AOR=6.4, 95%CI: 1.55, 27.0), malaria attack history (AOR=3.2, 95%CI: 1.4, 7.2) and over loaded physical work load (AOR=4.0, 95%CI: 1.7, 9.5), large family size (AOR=0.37,95% CI:0.16, 0.92) and low altitude (AOR=3.2, 95%CI: 1.23, 8.3) were significantly associated with anemia. Furthermore, prevalence of stunting and thinness were 21.3% and 16.5 % respectively. Conclusion : Anemia is a mild public health problem in the study area; increasing dietary diversity, Insecticide Treated Bed nets (ITNs) utilization and adolescent nutrition education are important strategies to reduce the burden of anemia.

Background

World Health Organization (WHO) defines 'adolescents' as individuals in the age group of 10-19 years. The transition from childhood to adulthood that normally begins with the onset of signs of puberty is characterized by important dramatic physical, sexual, psychological and social developmental changes, all taking place at the same time. In addition to opportunities for development this transition poses risks to their health and wellbeing[1].

Anemia is a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body’s physiologic needs. Specific physiologic needs vary with a person’s age, gender, residential elevation above sea level (altitude), smoking behavior, and different stages of pregnancy. Iron deficiency is thought to be the most common cause of anemia globally [2]. Iron deficiency is the most common and widespread nutritional disorder in the world. As well as affecting a large number of children and women in developing countries, it is the only nutrient deficiency which is also significantly prevalent in industrialized countries manly due to iron deficiency, and in resource poor areas, this is frequently exacerbated by infectious diseases [3].

Anemia is a major global public health problem with serious consequences for human health and development. The widespread prevalence of anemia, both in the developed and developing worlds is a great cause for concern [4]. Globally, anemia affects 1.62 billion people that corresponds to 24.8% of the population, prevalence of anemia worldwide; in preschool age 47.4%, school age children 47.4%, pregnant women 41.8% and non pregnant women 30.2%. Its damage is more heavily felt in the developing countries (especially those of Sub-Saharan Africa and South East Asia), where its links with poverty are more visible. For that reason, there are almost no countries where anemia is not at least a mild public health problem [5].

A Study had done in34 low-and-middle-income countries among adolescent and young women**.** From Sub-Saharan Africa, 12 countries in the study had prevalence of anemia at or above 40%. i,e, Ghana 61.5%,Mali 60.5%, Benin 61.2% Senegal 57.3%, Burkina Faso 53.5%, Guinea 53% and from Asian and South East Asian India had the height prevalence 56.1% followed by Cambodia 45.5% and also from Latin America counties Hattie had 47.9% followed by Bolivia 37.7%. The prevalence of anemia among young women between ages 15 and 24 is a public health concern in all 34 countries studied. Moreover, anemia is a severe public health concern in sixteen countries: the highest prevalence rate is 61.52% of young women in Ghana [6].

In Ethiopia the national level survey reported that 17% of Ethiopian women age 15-49 are anemic, A higher proportion of pregnant women are anemic (22 %) than women who are breastfeeding (19%) and women who are neither pregnant nor breastfeeding (15 %) [7].

The study result from 9 administrative regions of Ethiopia revealed that the prevalence rate of clinical anemia (11.3%), anemia (30.4%), ID (iron deficiency) and IDA were 49.7% and 17.0% respectively [8].In other study in southern Ethiopia, Sidama Zone in reproductive age group show that the prevalence of anemia (31.6%), iron deficiency (ID) and ID anemia were 17.4% and 8.7%, respectively [9]. In small studies in Tigray and Afar the prevalence of anemia among adolescent girls were also found 7.1% [10] and 22.8% [11]The majority of studies consistently agreed anemia is public health problem in Ethiopia.

The global burden of disease ranked iron deficiency anemia as the third leading cause of loss of disability adjusted life years (DALYs) for adolescent by sex [12]. Iron deficient school going adolescent females both anemic and non anemic had low scholastic performance in the form of low score in mathematics and verbal learning, attention, mental balance, and recognition component of multi component test along with low IQ scores than their non iron deficient comparers[13]. Evidence for a causal relationship between iron deficiency and a variety of functional consequences with economic implications (motor and mental impairment in children and low work productivity in adults) show in economic terms for 10 developing countries suggest that the median value of annual physical productivity losses due to iron deficiency is around $2.32 per capita, or 0.57% of GDP. Median total losses (physical and cognitive combined) are $16.78 per capita, 4.05% of GDP [14].

A Study in Latin American show that if pregnancy occurs during adolescence, anemia can not only increase maternal morbidity and mortality, but it also increases the incidence of poor birth outcomes in the infant (e.g., low birth weight, and prematurity) and also negative impact on infant iron status [15.] Lancet Series confirms that anemia is a risk factor for maternal deaths, most likely due to hemorrhage, the leading cause of maternal deaths (23%) of total deaths[16.]

About half of the global burden of anemia is due to iron deficiency and iron deficiency anemia account for most of the anemia that occur in underprivileged environment, causes include an inadequate dietary intake of bio available iron, inadequate dietary iron, during periods of increased iron requirements (such as pregnancy and infancy, adolescent) [17].

Therefore, this study was conducted to assess nutritional status, prevalence and predictors among rural adolescent girls Hadero, southern Ethiopia.

Methods And Materials

Haderotunto district is one of the 7 districts which are found in Kembata Tembaro Zone. The district has 14 rural kebeles and two urban kebeles (Keble is the smallest administrative structure in Ethiopia). Based on projection from 2007 Population and Housing Census report, the total population in 2014/15 is estimated to be 127,059. Most of the people depend on traditional subsistence agriculture for living. The main crops produced in the district are maize, wheat and teff. There was no study conducted in the district on prevalence and associated factor of anemia. Most part of the district ecological status is mid land and the rest are high and low land.

A community based cross-sectional study with both descriptive and analytic elements was conducted among adolescent girls between the age group of 10-19 years, January, 2016.

Adolescent girl's age 10-19 years residing in selected 6 kebeles recruited for study.

Sample size determination

Sample size was determined using single and double population proportion formula. Calculated by assuming the prevalence of anemia among adolescents' girls to be 7.1% that was taken from previous study [10], with 95% confidence level, 3.7% margin of error and design effect of 2.

$$n = \frac{(Z_{1-\alpha/2})^2\, p\,(1-P)}{d^2}$$ n= 407adolescent girls.

The sample size calculation for second objective, double population proportion formula used with Epi info version 7 software, with the assumption of 95% CL, 80% power, 1:1 ratio of control to case. For adequacy, representativeness and to meet the objective, the first sample size which was **407** adolescent

girls was recruited. In order to, assess the prevalence and associated factors of anemia among adolescent girls.

Sampling technique:

All kebeles in the Woreda were listed and stratified into three ecological zones: lowland, midland and highland. For each stratum two kebeles were selected at random. Then sample size was allocated to the strata proportional to the population size. A sampling frame of adolescent girls were generated by identifying the number of adolescent girls living in each kebele using community health information system from each health post their respective kebeles. Then simple random sampling method was used to select 10-19 year adolescent girls from the frame.

Data collection

Structured and pretested questionnaire was used to collect data. The socio-demographic aspect of the questionnaire was taken from Ethiopian Demographic Health Survey (EDHS) 2011[7] and household dietary diversity (DD) was measured by using Food and Nutrition Technical Assistance (FANTA) III tool and the DD was asked by using 24 hour recall method [18],and questionnaire was developed in English and later translated into Amharic .The data collection was conducted by 4 clinical nurses, 1 laboratory technician and 1 laboratory technologist from the existing health system. The close follows up done by the very experienced supervisors. Altitude was measured at center of the Keble using GPS.

House hold wealth index was calculated as composite based on 18 variables like, own agricultural land, own live stock, construction materials used for houses, sanitations and water facility, electricity, referigrator,bed ,television. The score ranked in to 5(poorest, poorer, middle, richer and richest).

Blood hemoglobin concentration was measured from Capillary blood using a HemoCue Hb 301 was recorded, done by experienced laboratory Technologists.

Measurements of height and weight were taken according to the WHO's guideline. Height-for-age z-scores (HAZ) and BMI for age z-scores (BMIZ) used and interpreted using age and sex specific cut off points recommended by WHO/CDC [20]. WHO reference 2007 used for interpretation [21] and WHO antroplus software used for generating anthropometric data [22]

Data management and analysis

Data were checked manually for its completeness and consistency, entered into Statistical Package for the Social Sciences (SPSS) versions 20.0 software, and cleaned by the principal investigator. Data were described and summarized using frequency, percentage, tables, graphs and measures of central tendency and dispersion. Bi-vitiate and multivariable logistic regression were applied to assess the association of socio-demographic and other independent factors with anemia. The outputs of the regression analysis were given with crude odds ratio (COR) and adjusted odds ratio (AOR) with their respective confidence

intervals. Criteria for exporting variables to the multivariate model were *p*-value less than 0.25. Variables with *P*-value less than 0.05 were used to declare statistically significant association.

Ethical considerations

Ethical clearance was obtained from Institutional review board (IRB) of Hawassa University College of Medicine and Health Science and formal letters was written to concerned bodies. A written informed consent and assent had been taken from the parents and adolescent girls, respectively. Those who weren't willing to participate had been given the right to do so. Confidentiality had been ensured. For moderate anemic adolescent girls linked the health facility for supplementation and for mild anemia Nutritional counseling was given.

Results

Socio demographic characteristics

Of 407 adolescent girls recruited for the study, 400 (98.2%) of them participated voluntarily and as described in the method section the respondents were selected from 6 kebels. Most of the respondents, 393 (98.0%), were rural residents. About 129 (31.6%), 167 (41.0%), and 111(27.3%) were selected from high, middle and lowlands, respectively. The altitude of the Kebeles included in the study ranged from 1518 to 2450 meters above sea level.

The mean (±SD) age of the adolescent girls was 15.1 (±2.8 SD) years. About 167 (41.8%) were in the early adolescent age group of 10-14years, while 233(58.3%) were in the late adolescent age group of 15-19 years. As the educational background of the adolescent girls is concerned, 372(93.0%) had attended formal education, of which were 327(81.8%), and 45(11.3%) had attained primary and secondary education respectively, while the rest 28 (7.0%) were illiterates (see Table 2).

Majority, 384 (96.0%) of the study subject were single (unmarried). Regarding father educational status, illiterate fathers took the highest proportion, 213(53.3%) and, while the rest 129(32.3%) and 58(14.5%) were attended primary and secondary or above school, respectively. The majority of 333(83.3%) of father`s occupation were farming and followed by merchant 48(12%), the rest 11(2.8%) were civil servants. More than half, 264(66.0%) of the respondents mothers had not attained formal education who were illiterate. The rest 112(28.0%), and 24(6.0%) had attained formal education in primary and secondary or above, respectively. Higher proportion 310 (77.5%) of mothers were not involved in income generating activity (IGA), while the remaining 90 (22.5%) had income generating activity.

The median family size of the respondents was 7.0 ranged from 3 to 13. Majority of the respondent, 162(40.5%) had 6-7 family size, about 97(24.3%) of the respondent had <5 family size, while the rest 141(35.3%) of the study participant had 8 or above family size respectively. Higher proportion of respondents 386(96.5%) were Protestant by religion and the rest 11(2.8%) of the study subjects were Orthodox by religion.

Knowledge about anemia

As described in the methods section, knowledge towards anemia was assessed using composite index. Only 29 (7.3%) adolescent girls had good knowledge regarding anemia and 79 (19.9%) of the study participant had average knowledge, while the rest 289 (72.8%) of study subject had poor knowledge regarding anemia.

Dietary intake of adolescents

Based on FANTA score household DDS were calculated out of 12 food groups. The mean (±SD) household DDS was 4.09 (±1.05) and ranged from 2 to 7. Based on the cutoff points recommended by FAO, the majority 242 (60.5%) had medium DD, 115 (28.75%) Of the study subjects had low and the remaining 43 (10.75%) had high DD. Most of the adolescent girls, 347(86.8%) ate food made from root and followed by 295(73.8%) of cereals, 235(58.8%) of milk and milk product, 180 (45.0%) of legumes, 114(28.5%) of oil or butter, 58(14. 5%) of eggs, 34(8.5%) of meat and no one ate fresh or dried fish.

The dietary intake pattern was also assessed using food frequency method. The mean (±SD) frequency of flesh food consumption per week was 1.36 (±0.54). Among the adolescent girls, 266(66.5%) of they had not eaten meat in the preceding week, while the rest 123(30.8%) and 12(3.0%) had eaten 1-2times and ≥3 times per week, respectively. More than half, 214 (53.5%) respondent ate greens leafy vegetables ≥3times per week, about 141(35.3%) of the study participant had eaten green leafy vegetable 1-2 times per week, while the rest 45(11.3%) of the respondents had not eaten green leafy vegetables per week. The mean (±SD) frequency of consumption of green leaf vegetable per week was 2.42(± 0.68). More than half, 225(56.3%) of the respondent had eaten legumes ≥ 3times per week, 134 (33.6%) the study subjects reported that as they ate legumes 1-2 times per week ,while the rest 40 (10.0%) adolescent girls had not eaten legumes per week.

The respondents were asked to describe their staple diet; most respondents mentioned maize based (180(45%)) and root based (133(33.3%)) foods; while Enset and teff based foods were mentioned by 65(16.3%) and 21(5.3%) of the respondents, respectively (see table 4).

Regarding adolescent dietary frequency, meal frequency was 3-4 times per day for the majority of adolescent girls 390 (97.5%), but 10 (2.5%) of the adolescent girls reported that they eat only 1-2 times a day. Furthermore, the study participant asked to describe the yesterday feeding frequency, only 26 (6.5%) of the adolescent girls mentioned, as they ate 1-2 times per day, while the rest 374 (93.5%) of study participant ate 3-4 times per day.

Of 400 study subjects, 284 (71.0%) of the respondents had coffee drinking habit after meals, of which 196 (70.0%) consumed 2-4 cup, 52 (18.6%) and 32 (11.4%) of the respondents had consumed less than 2 cup and greater than 4 cup of coffee, respectively.

Prevalence of stunting and thinness among adolescents

Nutritional status of adolescent girls was evaluated by using BMI-for-age and height-for-age, the mean (±SD) z-scores for the two indices were -0.70±1.30, and -0.51±1.37, respectively. Out of the study participant, 66(16.5%) had BMI-for-age less than -2SD, they were thinness, and 85 (21.3%) of the respondent had height-for-age less than -2SD, indicating stunted.

Prevalence of Anemia

The mean (±SD) of hemoglobin concentration adjusted for altitude was 13.7±1.2 and ranged from 8.0 to 16.6 g/dl. The overall prevalence of anemia was 15.2% [95% CI: 11.7%, 18.7%]. Out of the total 400 adolescent girls 13.7% [95% CI: 10.3%, 17.1%] and 1.5% [95%CI: 0.3%, 2.7%] had mild and moderate anemia, respectively. But there was no severe anemia case in this study.

Factors association with anemia

The prevalence of anemia was higher in the lower altitude group than in the higher altitude groups. As altitude increases, the odds of anemia tend to decline The odds of being anemic were 3.2(1.23,8.3) times higher among adolescent girls living low altitude.

The prevalence of anemia was higher among those who had low dietary diversity, as compare to their counterparts. Taking medium DD group as a reference, the odds were (AOR=3.6, 95 % CI: 1.7, 7.7), 3.6times increased in the low DD category. Similarly, the proportion of anemia was higher among those who had history of malaria infection in the last 3 months, and the odd was 3.2 times higher in the group (AOR=3.2, 95%CI: 1.4, 7.2).

In the bivariate analysis, adolescent girls who had heavy menstrual bleeding compared to light menses had increased odds of anemia. However, in multivariate logistic model the association failed to be significant. On the other hand, the relationship between menstrual duration and anemia risk was assessed. Less than 5 days considering as reference, the odds of being anemic were 6.4 times (AOR=6.4, 95%CI: 1.55, 27.0) higher among adolescent girls whose menstrual duration stay 5-7 days than in those whose menstrual duration was less than 5 days.

Discussion

This study aimed to determine the prevalence of anemia included associated factors that influence anemia, the prevalence of anemia was (15.2%), after adjustment made using multivariate logistic regression model, malaria attack history, low dietary diversity, long menstrual duration, overloaded physical work load, family size and low altitude established significant association .

The current study reported 15.2% prevalence of anemia. However, the figure might have been underestimated as the study was conducted in January – a relatively food surplus season. Furthermore, the effect of seasonal fluctuations of other risk factors e.g. malaria might not been captured due to the cross-sectional nature of the study.

In the present study the overall prevalence of anemia among adolescent girls was 15.2%. According to the WHO classification it is a mild public health problem [17]. This is comparable with the previous estimated prevalence of anemia for Ethiopia among adolescent and young female 15% [6] and National prevalence in Ethiopia, 15% [7]but slightly higher than report from Tigray, Ethiopia 7.1% [10] and lower than study report of Afar, North East Ethiopia 22.8% [11]and Jimma, South West Ethiopia 37.6% [26].

In other studies, the prevalence of anemia among adolescent girls in West Kenya 21% [27] ,Bangladesh 27% [28], Tanzania 55.3% [29] and West Uganda 46% [30] India Hassan district 45% [31]. The reason for variation might be attributed to socio-economical differences.

In this study, the majority of anemia cases 13.7% were mild (Hgb level <12 g/dl) followed by 1.5% of moderate anemia (7-9.9 g/dl) and a similar condition was observed in Jimma, Ethiopia, in which majority of the cases had moderate anemia (19.6%), mild anemia (18.1%) and no sever case [26] study in India Aurangabad district, Maharashtra showed similar, there was no sever case detected [32].

On other hand, by taking the WHO reference standard, -2 SD (Z score) as a cutoff point [21] in this present study adolescent girls showed evidence of stunting on the basis of height-for-age < -2SD ZScore. The prevalence of stunted and thinness were account to 21.3% and 16.5%, respectively. The study report of nutritional status of adolescent girls in Tigray, north Ethiopia revealed that the prevalence of stunting and thinness were 26.5% and 58.3%, respectively [33]. In contrast the survey report from Chiro,west Hararge. Ethiopia stunting and underweight was 7.2% and 24.4%, respectively [34] and study finding in Jimma Zone, South West Ethiopia were showed that 83.8% and 16.0% of underweight and stunting, respectively [35].

Nutritionally adolescence is critical life period; hence, adolescent girls are advised to eat diversified diet than usual. However, this was not the case in the study area, the level of diet diversity among this study participant was lower and it was significantly associated with anemia in this study. This report is agrees with the study finding of Nigeria [36] and West Uganda [30].

Malaria attack history in the last 3 month duration was the factor that revealed a significantly association with occurrence of anemia in adolescent girls (AOR=3.2), this finding is similar to the study conducted in Gonder, north west Ethiopia, malaria attack history was13.28 times odds of increased to develop anemia [37]. India, history of malaria attack in the past 3 month had positively correlated with anemia [38]. West Kenya, malaria was the main risk factors for anemia in younger girls [27] and Western Uganda; anemia was positively correlated with malaria [30]. The reason might be failure to seek early diagnosis and treatment of malaria and malaria infection itself that might lead to increased RBC destruction and consequently, end up in anemia.

In our study, long duration of menstruation (more than five days) among adolescent girls significantly associated with anemia (AOR=6.40) .This is consistent with the study conducted elsewhere, west Kenya, heavy menstruation was the main risk factor for anemia in young girls [27] ,in Bangladesh, Tangail region,

menstrual duration 5 days or more was risk factor for anemia [39], India ,menstrual cycle lasting 7 or more days was important contributing factors for anemia [40], and India raigad, significant association of anemia was found with excessive menstrual bleeding [38].This is likely due to the blood loss secondary to long menstrual duration.

In the present study, there was no significant association found between the age of adolescent, educational status of adolescent, educational status of father and mother, marital status of adolescent girls, occupation of father and mother and anemia in this study. This result was similar with the study finding [38, 41].

Conclusion

The overall prevalence of anemia is 15.2% .Out of the total study subject 13.7% and 1.5% had mild and moderate anemia, respectively. But there was no severe anemia case in this study. Shows the problem is mild public health significance in the area. Furthermore, prevalence of stunting and thinness were 21.3% and 16.5 %. Anemia was associated with malaria attack history, low dietary diversity, long menstrual duration and large family size, overloaded physical work loaded and lowers altitude. Therefore, there is need of strategy to reduce the burden of anemia like, continue promoting and enhancing dietary diversity and promote utilization of insecticide treated bed net (ITNs) at community level. Regular nutritional anemia education session is important strategy at community level. There is need of multisectorial collaboration between sectors to maximize nutritional status of adolescent. Further, research is needed at national level in large sample size.

Generally, the strengths of the study, most of the existed studies were institutional based, but the current one is community based and adequate and representative samples size was taken. On the other hand, the prevalence of anemia, stunting and thinness can be affected by seasonality bias and due to resource shortage key independent variables (blood film and stool examination) were not considered in the study.

Abbreviations And Acronyms

BCC	Behavioral Change Communication
BMI	Body Mass Index
DDS	Dietary Diversity Score
DALYs	Disability Adjusted Lost Year
EDHS	Ethiopia Demographic Health Survey
FANTA	Food and Nutrition Technical Assistance
GTP	Growth and Transformation Plan
HFA	Height for age
HTZ	Hadero Tunto Zuria
Hgb	Hemoglobin
HSDP	Health Sector Development Goal
IGA	Income Generating Activity
ID	Iron Deficiency
IDA	Iron Deficiency Anemia
ITNs	Insecticide Treated Bed Net
IQ	Intelligent Quotient
KTZ	Kembata Tembaro Zone
MGD	Millennium Developmental Goal
NNP	National Nutrition Program
SNNPR	Southern Nationality People Region
UNICEF	United Nation Children's Fund
WHO	World Health Organization

Declarations

Consent for Publication

"Not applicable" in this section.

Availability of data and Materials

We have data already collected from community and entered SPSS and analyzed. So we declare an Availability of data and materials.

Competing interest

The authors declare that they have no competing interest.

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Authors' contributions

The authors participated in the preparation of the study design, data collection, analysis and interpretation of data. Authors read and approved the final manuscript.

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Tables

Table 1

Variables	Ratio	% of anemia in non-exposed	OR	No of exposed	No non-exposed
Animal source [32] (<1times vs >1times/week)	1:1	66.3	2.37	128	128
Heavy Menstrual bleeding [31] (Heavy Vs Normal)	1:1	14.5	2.50	128	128
Socioeconmic status(SES) [56] (Low Vs Medium)	1:1	40.5	2.10	127	127

Table 2

Variables	Frequency	Percentage
Age(year)		
10-14	167	41.8
15-19	233	58.3
Family size		
<5	97	24.3
6-7	162	40.5
>8	141	35.3
Adolescent educational		
Illiterate	28	7.0
Primary(1-8 grade)	327	81.8
Secondary above	45	11.3
Marital status		
Single	384	96.0
Others	16	4.0
Religion		
Protestant	386	96.5
Others	14	3.5
Father education		
Illiterate	213	53.3
Primary(1-8grade)	129	32.3
Secondary or above	58	14.5
Mother education		
Illiterate	264	66.0
Primary(1-8grade)	112	28.0
Secondary or above	24	6.0
Father occupation		
Farmer	333	83.3
Civil servant	11	2.8
Merchant	48	12.0
Others	8	2.0
Mother IGA		
Yes	90	22.5
No	310	77.5
Household wealth index		
Poor	159	40.1
Medium	160	40.3
Richer	78	19.6
Residence		
Rural	393	98.3
Urban	7	1.8

Table 3

Food item	Frequency of meal intake per week		
	0 n (%)	1-2 times n(%)	≥ 3times n (%)
Meat	266(66.5)	123(30.8)	12(3.0)
Green vegetables	45(11.3)	141(35.3)	214(53.5)
Legumes	40(10.0)	134(33.6)	225(56.3)

Table 4

Variable	Frequency	Percentage
Staple diet		
Maize based	180	45.0
Root based	134	33.5
Enset based	65	16.3
Teff based	21	53
Dietary diversity		
High	43	10.8
Medium	242	60.5
Low	115	28.5
Meal frequency/day in a typical day		
1-2 times	10	2.5
3-4 times	390	97.5
Meal frequency/day in the preceding day		
1-2 times	26	6.5
3-4 times	374	93.5
Average coffee consumption per day (cups)		
< 2	52	18.6
2-4	196	70.0
>4	32	11.4

Table 5

Variables	Anemia Yes	No	COR 95 % CI	AOR 95 % CI
Family size				
<5people	19	78	1.1(0.6,2.3)	0.9(0.38,2.12)
6-7people	18	144	0.6(0.3,1.1)	**0.37(0.16,0.92)***
>8people	24	117	1	**1**
HH wealth				
Rich	17	61	1.9(0.9,4.2)	1.6(0.64,4.02)
Poor	22	137	0.9(0.4,1.8)	0.95(0.41.2.22)
Medium	21	139	1	1
Frequency of legumes consumption/week				
0	9	31	2.1(0.9,5.2)	2.28(0.65,8.06)
1-2times	23	111	1.4(0.7,2.7)	**3.0(1.23,7.33)***
≥3times	28	197	1	1
Frequency of green Vegetable				
0 Feed	7	38	0.9(0.3,2.3)	1.06(0.3,3.7)
1-2 times Feed	19	122	0.8(0.4,1.5)	0.45(0.2,1.2)
3times Feed	35	179	1	1
Menstrual duration				
No menses	17	113	1.2(0.6,2.3)	4.2(0.03,49)
5-7day	18	12	12.1(5.1,28.3)	**6.4(1.55,27.0)***
<5day	26	214	1	1
Menstrual bleeding				
Heavy	22	23	9.3(4.4,19.7)	2.5(0.76,8.0)
No menses	16	113	1.3(0.7,2.6)	0.3(0.9,39)
Light	23	203	1	1
Dietary diversity score				
High	2	41	2.1(0.9,5.2)	0.13(0.02,0.97)
Low	34	81	3.7(2.0,6.6)	**3.6(1.7,7.7)***
Medium	24	217	1	1
Physical workload				
Less	5	37	1.4(0.5,4.1)	1.2(0.35,4.5)
Over Load	35	77	5.3(2.9,10.0)	**4.0(1.7,9.5)***
Equally loaded	21	225	1	1
Malaria infection history				
Yes	30	49	7.6(3.8,15.0)	**3.2(1.4,7.2)***
No	31	290	1	1
Age(Adolescent)				
Late(15-19year)	34	141	1.0(0.6,1.9)	0.1(0.02,0.8)
Early(10-14year)	27	198	1	1
Altitude				
Low	30	106	2.3(1.1,4.7)	**3.2(1.23,8.31)***
Medium	17	117	1.2(0.5,2.5)	0.8(0.26,2.38)
High	14	116	1	1

***statistically significant variables at p< 0.05, 95% CI –confidence interval**

Note: All variables with the p< 0.25 in the bivirate was included in the multivariate to be analyzed

Figures

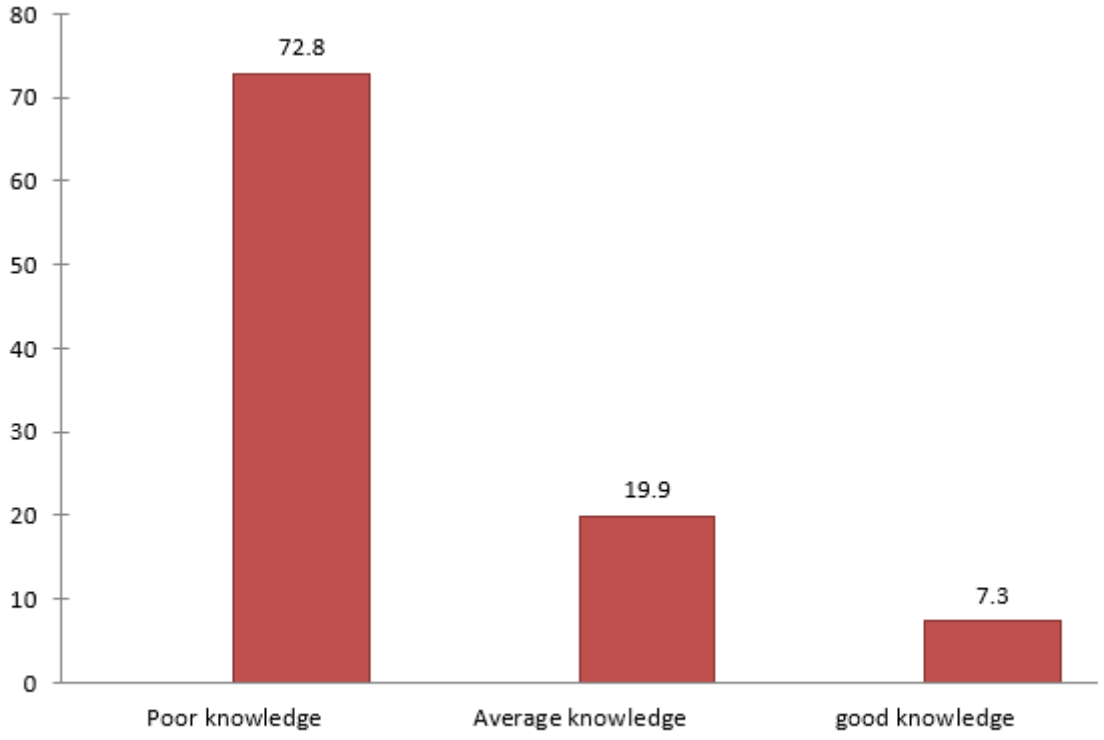

Figure 1

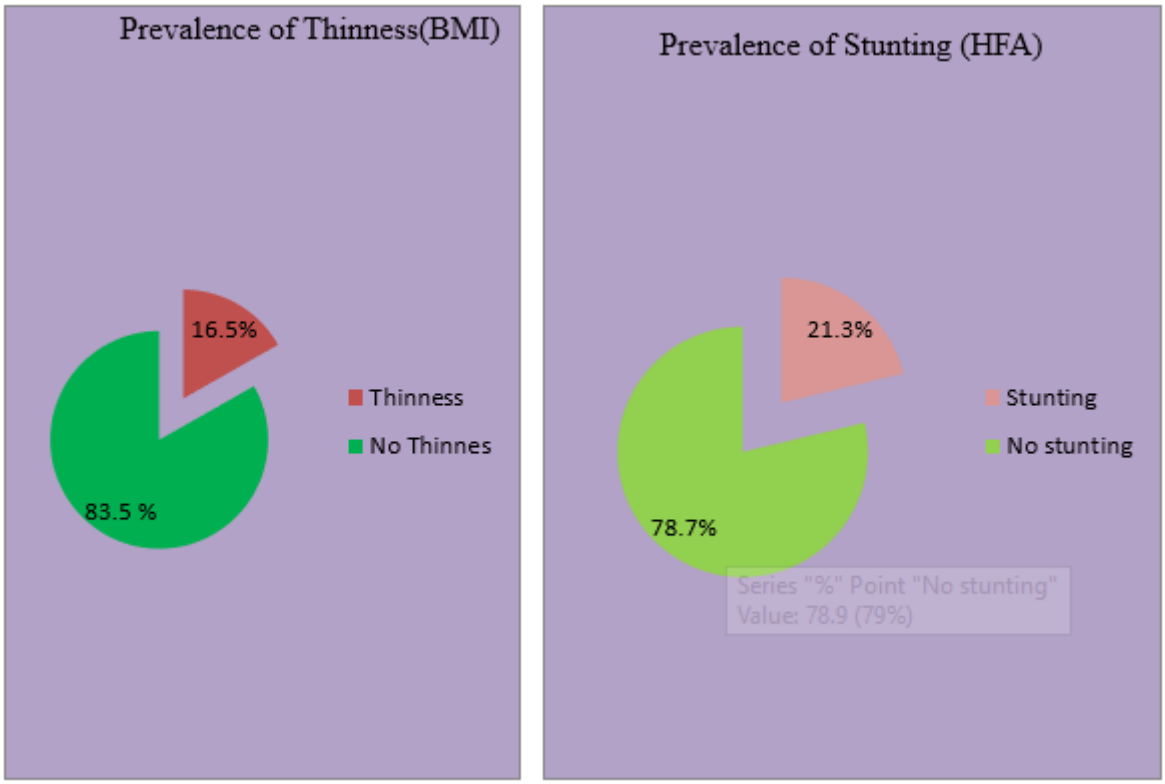

Figure 2

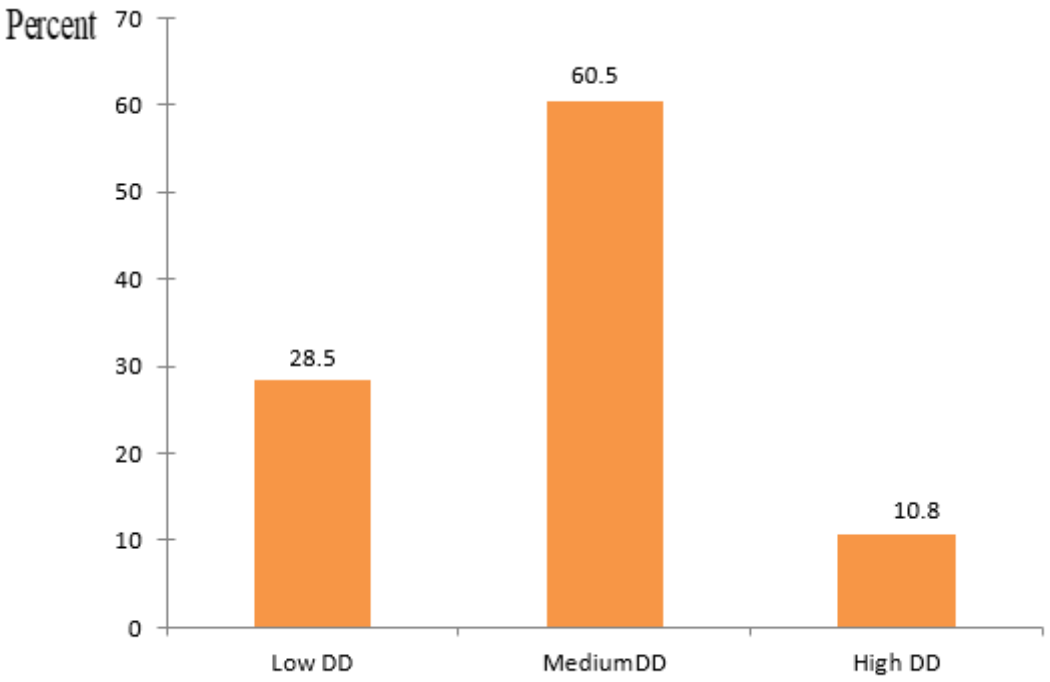

Figure 3

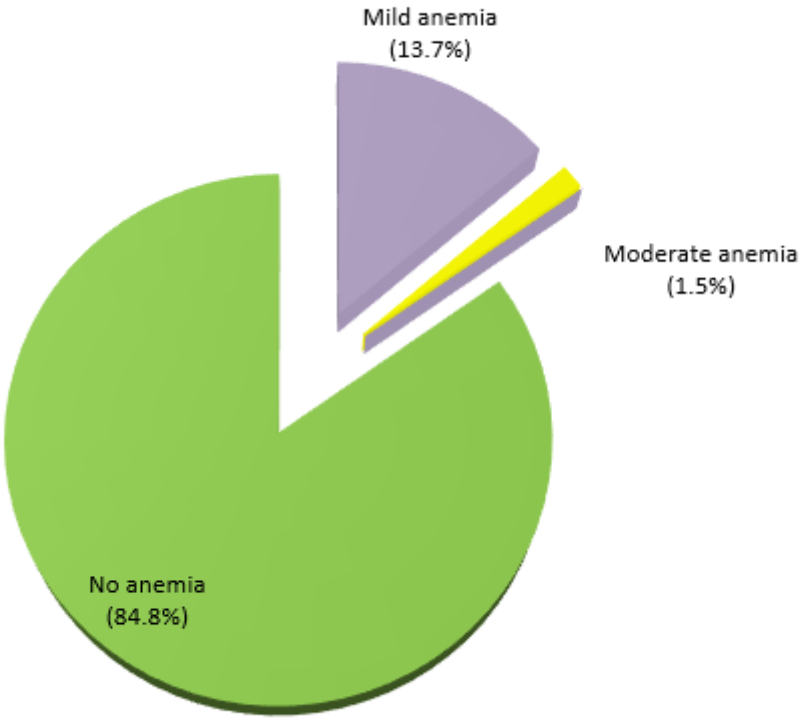

Figure 4