

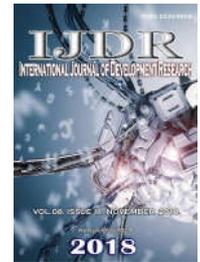


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## PREVALENCE OF ANEMIA AND ASSOCIATED FACTORS AMONG UNDER FIVE CHILDREN IN BEDELE HOSPITAL, ILUABABORA ZONE, OROMIA REGIONAL STATE SOUTH WEST ETHIOPIA, 2017

1,\*Abdisa Boka and 2Dessaiegn Nigatu

<sup>1</sup>Addis Ababa University, College of Health Science, School of Nursing and Midwifery, Addis Ababa, Ethiopia

<sup>2</sup>Mettu University, College of Health Science, Department of Pediatrics and Child Health Nursing, Illubabor, Ethiopia

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### ABSTRACT

**Back ground:** Anemia is major health problem throughout the world. The magnitude of the problem in developing countries high, since they are more exposed to various health and socioeconomic problems which are directly or indirectly related with anemia. Though all age groups can develop anemia due to various factors, under-five children and pregnant women are the most vulnerable age groups. The hemoglobin level below which anemia is considered according to WHO criteria is as follows. The children(6 months -6yrs) their level of hemoglobin were 11 gm/dl and the children aged 7yrs -14yrs their hemoglobin measurement were 12gm/dl, the adult male >15yrs their level of hemoglobin were 13gm/dl ,the pregnant female were 11gm/dl those non pregnant female and her level of hemoglobin were 12gm/dl. **Objective:** To assess the prevalence of anemia and associated factors in under five children at Bedele Hospital(BH), Ilubabor zone, Oromia regional state south west Ethiopia 2017. **Methods:** Institution based cross sectional survey was conducted at Bedele Hospital. All children admitted to Pediatrics ward were included in the study. Data was collected from April 1-30, 2017 by face to face interviews using pre-tested structured questionnaire. Data was processed and analyzed manually using scientific calculator. Descriptive statistics like frequency table, chi-square test of independence was used to characterize disease and associated factors. Tables were used to summarize the finding. **Results:** Prevalence of anemia in children admitted at BH was high (66.8%). severe anemia is constitute for 3%, moderate and mild anemia contributes 37.1% and 26.7% respectively. Characteristics most strongly associated with anemia were malaria, malnutrition and presence of helminthes. **Conclusions:** The prevalence of anemia was 66.8%. Mild, moderate and severe anemia was 26.7%, 37.1% and 3% respectively. **Recommendation:** Considering a high prevalence of anemia. Preventive strategies such as, fortification of food, iron supplementation, antimalarial prophylaxis, follow up clinics, regular screening of hemoglobin level must target all under five irrespective of their hemoglobin level or clinical status.

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### INTRODUCTION

Pediatric anemia refers to a hemoglobin or hematocrit level lower than the age-adjusted reference range for healthy children. Physiologically, anemia is a condition in which reduced hematocrit or hemoglobin levels lead to diminished oxygen-carrying capacity that does not optimally meet the metabolic demands of the body, as a result of deficiency of one or more essential nutrients, heavy blood loss, parasitic infections and congenital hemolytic diseases

\*Corresponding author: Abdisa Boka

Addis Ababa University, College of health science, School of nursing and midwifery, Addis Ababa, Ethiopia.

(Susumu Inoue *et al.*, 2013; Nelson Textbook of Pediatrics). Anemia is a public health problem affecting people in both developed and developing countries with bad consequences of human health as well as social and economic development (Harrison; Benoist *et al.*, 2008). It is a critical health concern because it affects growth and energy levels adversely (Nelson Textbook of Pediatrics). It damages immune mechanisms and is also associated with increased morbidity (Harrison). It occurs at all age groups, but is more prevalent in pregnant women and children (Nelson Textbook of Pediatrics). Especially, young children from low income families have a higher risk for developing anemia due to iron deficiency that occurs as a result of high demand for iron during the period of

rapid growth, due to this proper balance of nutrients in this formative period is critical for normal brain development and Shortages of nutrients such as iron and iodine can impair cognitive and motor development, and these effects are often irreversible (Marc Goodman-Bryan, 2011). Some of the factors that cause anemia are nutritional deficiency like iron deficiency, Vitamin B12 deficiency or folic acid deficiency and also infections like malaria, Hook worm, Shistosomiasis, HIV and other chronic infections. Among this iron deficiency is the most common which affect more than 70 million people in the world. It is also the most common problem in children with over all Magnitude of 38% (Neumann *et al.*, 2013; Hall *et al.*, 2010). Under-five children poorest areas of the world have frequent illness due to diarrhea and others every year (Tatala *et al.*, 2008). Diarrhea can result in loss of nutrients and less to malnutrition, which is highly related with anemia (Alaofè *et al.*, 2009). Because of its impact on cognitive development and physical growth; studies on the magnitude of anemia among children has paramount importance. Anemia creates long term effects among female children resulting in low birth weight babies and postpartum hemorrhage (Harrison; Benoist *et al.*, 2008). Anemia is a major cause of morbidity and mortality worldwide and it has a complex pathophysiology that can only be fully appreciated through an understanding of the normal structure and function of red cells, the regulation erythropoietin, and the complex adaptive process brought into play to compensate for a low hemoglobin concentration. The prevalence of Anemia is 20% globally and where as in developing countries is 39% (Neumann *et al.*, 2013). Though all age groups can develop anemia due to various factors, children and pregnant women are the most vulnerable groups, particularly serious problem for pregnant women, leading to premature delivery and low birth weight. Moderate anemia cause impaired growth and mental development which can reduce learning capability and facilitate increases susceptibility to infection. Severe anemia can result in death (Harrison; Benoist *et al.*, 2008; Ethiopia DHS 2011).

Anemia is one of the major public health problem of both developed and developing world (Marc Goodman-Bryan, 2011) The world health organization has estimated that Globally nearly two billion people are estimated to be anemic (i.e. close to one- fourth of the world's population). Africa is the most affected region. Anemia is most prevalent among pregnant women and children below five years of age and is particularly prevalent during the first two years of life. Around 60% of African children below five years of age have anemia (Pasricha *et al.*, 2013). In growing children there is a progressive increase of blood volume and consequently of Hgb so that there is an increased requirement of iron to synthesis (Rosere, 1988). When this increased requirement is not fulfilled due to inadequate or impaired absorption this child can develop iron deficiency anemia which has an overall magnitude of 38% (Neumann *et al.*, 2013). The magnitude of the problem is high in developing countries as they are more exposed to various health and socioeconomic problems which are direct or indirectly related with anemia. In sub-Saharan Africa the prevalence of anemia among preschool children ranges from 42% in Swaziland to 91% in Burkina Faso (Neumann *et al.*, 2013). In developing countries, the prevalence of anemia among school age children is 39%, and it is classified as severe public health problem (Nelson Textbook of Pediatrics; Benoist *et al.*, 2008). The problem is alarming in Sub-Saharan African Countries such as Kenya 48.9% (Neumann *et al.*, 2013), Mali 55.8% (Hall *et al.*, 2010) and

Tanzania 79.6% (Tatala *et al.*, 2008). Lack of awareness among the mothers about the problem coupled with their low educational status (Alaofè *et al.*, 2009), poor nutritional practices and unhealthy food habits (Kikafunda *et al.*, 2009), low iron bioavailability of the diet (Hashizume *et al.*, 2004), decreased physical activities (Djokic *et al.*, 2010), malaria and parasitic infestations are additional factors associated with lower hemoglobin (Hgb) level in children (Ramalingaswami *et al.*, 1997). In Ethiopia, the magnitude and distribution of anemia are not clearly known (12%) .EDHS 2011 more than four in ten Ethiopian children (44%) are- anemic. Anemia prevalence is highest among children age 9-11 months (73%) and decreases steadily with age from 12 to 59 months. Forty-five percent (45%) of children in rural areas have anemia, compared with 35 percent of children in urban areas. Regional variation of anemia in children ranges from 33% in Addis Ababa to 75% in Afar (Ethiopia DHS 2011). One child of every five (21%) has mild anemia, another 20% have moderate anemia, and 3 percent have severe anemia (Ethiopia DHS 2011). Study done in Gonder reported that the prevalence of anemia among children to be 36.7% (Pauloy, 1999). Another a retrospective medical record analysis of five years, done in Gondar Medical College Hospital 427 Malaria causes of children below 6years of age 369 (86.4%) children had severe anemia, coma, and hypoglycemia overlapping clinical features (AhemedZenin and Assefa, 1987). A study in one of the Jimma town found the prevalence of malnutrition in children to be 39.2% (Djokic *et al.*, 2010). Other pallor study done in Jimma town and reported anemia under 5 children was 5.7% compared with other study in Africa the Magnitude is very low, even though the Magnitude obtained is very low predisposing factors like family income, mother literacy level and malaria were highly associated with anemia in the study father's literacy level wasn't associated with anemia. The magnitude of anemia with respect to family income, mother level and malaria was found to be 9.1%, 6.2% 4.7% respectively (Selomon Assefa *et al.*, 2014). Study done in Agaro Health Center MCH clinic 60 (34%) of the investigated children were anemic and based on morphological classification, Normocytic 18(30%) and Macrocytic 9(15%) of the anemic children (Waldae, 1983). Another study in Asendabo Town show that prevalence of anemia was 39.1% as it was done on 271 school-age children (age range: 7–14 years) in Asendabo Town, Southwest of Ethiopia (Claudio Sandoval, 2014). Knowing the magnitude of the problem is helpful in early detection of both moderate & severe anemia to prevent complication. Anemia in children is associated with impaired mental and physical development and with increased morbidity and mortality.

## METHODS

### Study area

The study was conducted in Bedele Hospital. Bedele Hospital is located in Bedele town, Oromia region, Iluababor zone south west Ethiopia. Bedele Hospital is located 117 km far from the center of the zone (mettu town) to the east direction and 483 km far from the capital city of the country Addis Abebe to the south west of Ethiopia. It was established in 2007 by the government and starts to give service to the community in January 22, 2011. In the hospital now a days there are 163 workers including, 1 general surgeon, 2 emergency surgery, 10 medical Doctors, 1 dental Doctor, 4 Bsc Nurses, 4 diploma lab technicians, 4 Bsc pharmacist and 3 diploma pharmacist, 1 Bsc

x-ray technologist, 1 diploma radiography, 1 BSc psychiatric nurse and 78 supporters and give service for total population of 73,0646 that comes from 10 woredas and from 32 health centers. There are 52 beds for pediatric ward.

### Study design and period

An institution based cross sectional study was conducted at Bedele Hospital (BH). The study was conducted from April 1-30, 2017.

### Population

**Source population:** All under five children who visit Bedele Hospital during the study period was the source of population.

**Study population:** All 6-59 months children who admitted at Bedele Hospital pediatric ward during study period were the study population.

### Sample size determination and sampling technique

**Sample size determination:** All under-five children age 6-59 months who were admitted at pediatric ward of Bedele Hospital during data collection period taken as a sample.

**Sampling technique:** Non probability convenience sampling technique was used.

### Data collection instrument and technique

**Data collection instrument:** The parent/caretaker of each child was participated in the study through verbal communication. Structured questionnaires based Interview were used.

**Data collection technique:** Laboratory investigation, hemoglobin level was taken from the children identification card and those children who didn't perform laboratory investigation it was done with under five health professional at pediatric ward and child who has acute diarrhea stool examination was done during data collection and malaria screen for malaria sign indicated.

### Quality control measures

Before the actual data collection 5% pretest was done on children between age of 6-59 months and checked the wordings, logical flow and inclusiveness of the instrument and based on the finding of the test, possible amendment was made. The data was collected by graduating class of one BSc nursing student using questionnaires. The collected data checked daily for completeness and consistency, before the data was processing and analysis.

### Data processing, analysis and presentation

All the collected data was processed, i.e. cleaned, categorized, coded and analyzed using manually scientific calculator and chi square. The prevalence of anemia among children of different socio economic and demographic groups of mothers was determined. Finding was presented by using frequency table and association table.

### Ethical consideration

Ethical clearance was obtained from Mettu University, faculty of public health and medical sciences. Letter of permission to

conduct the study was gained from medical director of BH. The respondents (parents / caretaker of children) were informed about the objective of the study and their verbal consent was secured and also confidentiality of the information was maintained.

### Operational Definitional

**Anemia:** is defined as hemoglobin value less than 11 gm/dl.

**Mild anemia:** Hemoglobin value between 10gm/dl and 11 gm/dl

**Moderate anemia:** Hemoglobin value from 7gm/d to 10mg/dl

**Severe anemia:** Hemoglobin value less than 7gm/dl

## RESULTS

### Socio-demographic Characteristics of study participants

Data were collected from 202 respondents who were a caretaker of children age of 6-59 month admitted in BH pediatric ward. Majority of respondents were at age of 25-29yrs which accounts 63(31.2%), 178(88.1%) of them were female and 179 (88.6%) of them were married, 4 (2%) of them were single. 135(66.8%) of respondents were farmer and 14(6.9) gov't employee. Majority of the respondents were Muslim which account 118(66.8) and the least one wakeffata 5(2.5%). Regarding ethnicity the majority of respondents were Oromo which account 143(70.8%) and the least one was Tigre account 10(5%). 79(39%) respondents were illiterate and 13(6.4%) was grade 12+. Regarding to income the most of respondent income was less than 1500 which 159 (78.7%) per month.

### Distribution of anemic children among admitted children in BH

For the period of one month (from April 1 to 30, 2017) a total of 300 children were admitted at BH pediatric wards. Of these 98 were out of age limit and 202 children aged 6 to 59 months were eligible and those used to calculate prevalence of anemia. Therefore, anemia was found in 135 (66.8%) children. The prevalence of mild, moderate and severe anemia was 26.7%, 37% and 3% respectively.

### Distribution of anemic children with malnutrition and without malnutrition

Of 135 children who diagnosis with anemia, 51.9% was female and 53.3% were between 6-23 Month. The prevalence of anemia was higher in female by 2% when we compare with male. Moreover, anemia showed higher incidence in malnutrition patients which was 61%. The prevalence of anemia in mild, moderate, and severe malnutrition was 13.3%, 23% and 24% respectively.

### Distribution of laboratory investigation for malaria and intestinal parasite

Out of 202 children 69 (34.2%) of children were screened for malaria and 82(40.6%) were tested for intestinal parasite. Form which 16(23.3%) of them were positive for malaria and 46(59.1%) positive for intestinal parasite.

**Table 1. Distribution of Socio-demographic characteristic of the mother/ care taker, BH, pediatric ward, Iluababora Zone, southwest Ethiopia, April, 2017**

Variables	No	%	
Age	15-19	26	12.9
	20-24	53	26.2
	25-29	63	31.2
	>30	60	29.7
	Total	202	100
Sex	Male	24	11.9
	Female	178	88.1
Marital status	Total	202	100
	Married	179	88.6
	Single	4	2
	Widowed	7	3.5
	Divorced	12	5.9
Educational status of family	Total	202	100
	Illiterate	79	39
	Read & write	28	13.9
	Grade 1-8	65	32.2
	Grade 9-12	17	8.4
Occupation	12+	13	6.4
	Total	202	100
	Farmer	135	66.8
	Merchant	18	8.9
	Daily labor	20	9.9
	Gov't employee	14	6.9
Religion	Other1	15	7.4
	Total	202	100
	Orthodox	33	16.3
	Muslim	118	58.4
	Protestant	39	19.3
	Catholic	7	3.5
Ethnicity	Wakeffata	5	2.5
	Total	202	100
	Oromo	143	70.8
	Amhara	27	13.4
	Gurage	9	4.5
	Tigre	10	2
Family income/month	Other2	9	9.4
	Total	202	100
	<1500	159	78.7
	1500-6100	30	14.9
Family income/month	6100-18900	3	1.55
	Total	202	100

Other<sup>1</sup> (student, housewife, car driver and maid worker)Other<sup>2</sup> (kefa, Dawuro, Gambela and Silte)**Table 2. The distribution of anemia among 6-59 month children admitted in BH pediatric ward, Iluababora Zone, southwest Ethiopia, April, 2017**

Variable	No	%	
Anemic	Mild anemia	54	26.7
	Moderate anemia	75	37.1
	Severe anemia	6	3
Not anemic	67	33.2	
Total	202	100	

**Table 3. Distribution of anemia status among 6 to 59 months children by age and sex, admitted in BH pediatric ward, Iluababora Zone southwest Ethiopia, April, 2017**

Variable	Anemic		
	N	%	
Age of children in month	6-23	72	53.3
	24-59	63	46.6
	Total	135	100
Sex	Male	65	48.1
	Female	70	51.9
	Total	135	100
Nutritional status	Normal	53	39
	mild malnutrition	18	13.3
	Moderate malnutrition	31	23
	Severe malnutrition	33	24.4
	Total	135	100

**Table 4. Distribution of laboratory investigation for malaria and intestinal parasite among 6 - 59months children in BH, pediatric ward, Iluababora Zone southwest Ethiopia, April, 2017**

Variable	Blood film and stool/ex						Positive	Negative	Total			
	Yes		No		Total				Frequency	%	freq	%
Malaria	69	34.2	133	65.8	202	100	16	23.2				
Helminthes	82	40.6	120	59.4	202	100	46	59.1	36	40.9	82	100

**Table 5. Distribution of anemia among 6 - 59months children with malaria and intestinal parasite**

Variable	Positive for test	Anemia	
		Frequency	%
Malaria	16	14	87.5
Helminthes	46	33	71.7

**Table 6. Factor associated with anemia in BH pediatric ward, Iluababora zone southwest Ethiopia, April 2017**

Factor		Anemia						Total	X <sup>2</sup>	P value	
		Mild		Moderate		severe					
		No	%	No	%	No	%				
Child age(month)	6-23	21	15.6	49	36.3	2	1.4	72	53.1	9.83	0.007
	24-59	33	24.4	26	19.3	4	3	63	46.7		
	Total	54	40	75	55.6	6	4.4	135	100		
Child sex	Male	29	21.5	31	23	5	3.7	65	48	5.04	.081
	Female	25	18.5	44	32.6	1	0.7	70	52		
	Total	54	40	75	55.6	6	4.4	135	100		
Malaria	Yes	1	.7	10	7.4	3	2.2	14	10.4	15.1	0.001
	No	53	39.3	65	48.1	3	2.2	121	89.6		
Helminthes	Yes	15	11.1	17	13	1	.7	33	24.4	.65	.723
	No	39	28.9	58	43	5	3.7	102	75.6		
Nutrition- status	Total	54	40	75	55.6	6	4.4	135	100	15.7	0.015
	Normal	24	17.8	29	21.5	0	0	53	39.3		
	Mild	12	8.9	5	3.7	1	0.7	18	13.3		
	Moderate	6	4.4	23	17	2	1.5	31	23		
	Severe	12	8.9	18	13.3	3	2.2	33	24.4		
C- education	Total	54	40	75	55.6	6	4.4	135	100	12.2	0.144
	Illiterate	22	16.3	39	28.9	4	3	65	48.2		
	Read & w	18	13.3	27	20	0	0	67	49.6		
	Grade1-8	4	3	6	4.4	1	.7	11	8.1		
	Grad9-12	7	5.2	3	2.2	1	.7	11	8.1		
C- occupation	Total	54	40	75	55.6	6	4.4	135	100	6.72	0.567
	12 <sup>+</sup>	3	2	0	0	0	0	5	3.7		
	Farmer	37	27.4	50	37	4	3	91	67.4		
	Merchant	5	3.7	3	2.2	0	0	8	5.9		
	Daily labor	7	5.2	9	6.7	2	1.5	18	13.3		
Family in come	Gov't employ	3	2.2	5	3.7	0	0	8	5.9	7.17	0.127
	Other	2	1.5	8	6	0	0	10	7.4		
	Total	54	40	75	55.6	6	4.4	135	100		
	<1500	53	39.3	69	51	5	3.7	127	94.1		
	1500-6100	0	0	6	4.4	1	.7	7	5.2		
>6100	1	.7	0	0	0	0	1	.7			
Total	54	40	75	55.6	6	4.4	135	100			

Key: C-educ. Level of caretaker education, C-occupation-caretaker occupation, Nutrit. Status - nutritional status

### Distribution of anemic children with laboratory investigation of parasite

Out of 16 tested for malaria, 14 (87.5%) of them had anemia as well as 46 children positive test results for helminthes 33 (71.7%) children were presented with anemia problem

### Factors associated with anemia

To determine the association between anemia and associated factors, chi square was done. From a set of explanatory variables: age, nutritional status, malaria and helminthes; child's age, nutritional status and malaria were associated with anemia. Child age [ $X^2=9.83$ , p-value 0.013], nutritional status [ $X^2=15.7$ , p-value 0.015] and Malaria [ $X^2=15.1$  p-value 0.001], were associated with anemia.

### DISCUSSION

This study was conducted to determine prevalence of anemia and associated factor among 6 months to 59 months of children in BH. The findings of this study indicate that anemia is a major public health problem among children 6 month to 59 month admitted at BH in pediatric ward. The prevalence of anemia was found to be 66.8%. With mild, moderate and severe anemia being 26.7%, 37% and 3.1% respectively. The overall prevalence of anemia in this study was almost similar to those found by other researchers in Nigeria, Uganda and Kenya where the prevalence of anemia was between 60%-70% (Ughasoro *et al.*, 2011; Onyemaobi *et al.*, 2011; Kuvibdias *et al.*, 1993). EDHS 2011, reported prevalence of anemia to be 44% (Ethiopia DHS 2011) and another study done in Jimma town, Agaro and Asendabo reported the prevalence of anemia

to be 37.6%, 34% and 39.1% respectively (Kassahun, 2002; Waldae *et al.*, 1983; Claudio Sandoval, 2014). This study found much higher prevalence of anemia because much of the study unit manifest by multi-factor like malaria infection, parasite infection and malnutrition. The respective 54 (26.7%) and 75 (37%) mild and moderate anemia observed in this study were higher than severe anemia 6(4.4%) in this study. The other study was done in South western Brazil at Haiti prevalence of anemia among children was 38.8% (23.9% mild, 14.7% moderate and 0.2% severe) (Mohamed Ag Ayoya *et al.*, 2013). The prevalence of mild anemia was slightly higher than study done in South Western Brazil at Haiti (Mohamed Ag Ayoya *et al.*, 2013) but the prevalence of moderate anemia was much higher than study done in Haite because iron deficiency anemia is a major public health problem (Mohamed Ag Ayoya *et al.*, 2013). Another study done in West Africa, a study involves 3 countries including Burkina Faso, Ghana and Mail, the prevalence of mild anemia was 24.3%, moderate anemia was 64.3% and severe anemia was 10.6% (Magalhaes *et al.*, 2011) which slightly the same with this study.

In Ethiopia, the magnitude and distribution of anemia are not clearly known (Magalhaes *et al.*, 2011). But from EDHS 2011 more than four in ten Ethiopian children (44%) are- anemic. One child of every five (21%) has mild anemia, another 20% have moderate anemia, and 3% have severe anemia (Ethiopia DHS 2011). In this study anemia was two times (66.8%) higher than a study in Ethiopia (33%) (Luciana Pedrosa Leal, 2011) and 22.8% higher than EDHS 2011(44%) (Ethiopia DHS 2011). This difference might be due to geographic difference as most of them used more than one study area, age difference of participants in pediatric ward and anemia can be caused by different factors including nutrition in children, and sample size difference as sample size was smaller than the previous studies which may increase the prevalence. Among study reported malaria is an important cause of anemia (Nicholas *et al.*, 2013). It contributes to anemic through different mechanisms. In this study malaria was significant associated with anemia ( $p=0.001$ ). Malnutrition is among the causes of anemia as reported by other researchers (Kikafunda *et al.*, 2009). In this study children with normal nutritional status, mild malnutrition, moderate malnutrition, and severe malnutrition was develop anemia 39%,13.3,23 and 24.4 respectively and there was significant association between nutrition status and anemia ( $p=0.015$ ).

In this study 33(24.4%) children had intestinal helminthes. Their no association between intestinal helminthes and anemia [ $p=0.723$ ]. Unemployment has also been reported to be associated with anemia in other studies (Magalhaes and Clements, 2011). Same result was obtained in this study. Such findings reflect that better socio-demographic conditions could mean access to better feeding, health care and consequently lower prevalence of anemia. Unemployment and low level of education might lead to poor socio economic status. This is likely to reflect nutritional deficiencies and recurrence of infections which more likely increases the prevalence of anemia. Furthermore, education has a relationship with a capacity to grasp the knowledge needed for adequate healthcare and nutrition for children. Therefore low level of education can increase the risk of anemia. In this study the anemia was s not associated with educational level ( $p=0.144$ ) and occupation of caretaker ( $p=0.567$ ).

## Conclusion

This study has shown that there was high prevalence of anemia in children age 6 month to 59 month. Most of the time, little or no attention is given to children with mild and moderate anemia. This study has shown a significant contribution of those two groups. Therefore the prevalence of anemia (66.8%) in pediatric ward among children at age of 6 month to 59 month was significantly high in this study. The severe anemia was responsible for 3%, moderate and mild anemia contributes 37.1% and 26.7% respectively. Characteristics that strongly associated with anemia included malnutrition, malaria and unemployment among caretakers.

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## Acronyms and abbreviation

<b>BH</b>	: Bedele Hospital
<b>CBE</b>	: Community based education
<b>CDC</b>	: Center for disease control
<b>ETB</b>	: Ethiopian Birr
<b>Hct</b>	: Hematocrit
<b>Hgb</b>	: Hemoglobin
<b>HIV</b>	: Human immune deficiency virus
<b>ICSH</b>	: international council for standardization in hematology
<b>MCH</b>	: Mother and child health
<b>PCV</b>	: packed cell volume
<b>UNICEF</b>	: United Nations Children's Fund
<b>WHO</b>	: world health organization
<b>CI</b>	: Confidence Interval
<b>G/dl</b>	: Gram per deciliter

**Declaration of conflict of interests:** The authors declared that the manuscript is free of competing interest.

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