Prevalence of Anemia and Associated Factors Among Under Five Children Attending Public Health Facilities in Hargeisa City, Somaliland 2020

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Abstract: *Background:* Anemia is a widespread public health problem associated with an increased risk of morbidity and mortality. It is considered to be an important contributing factor to the global burden of disease. Affecting both developed and developing countries, it has an impact not only on human health and productivity but in the process it affects the socio-economic development of a nation. *Objective: this* study is to assess the prevalence of Anemia and associated factors among under-five children attending public health facility in Hargeisa, Somaliland 2020. *Method:* facility based cross sectional study design was conducted in Hargeisa, Somaliland from April to July, 2020. Total of 417 of children were participating and selected consecutively in the study. Data were collected by face to face interview with the mothers/caregivers of the child, by using semi structural questionnaire. Blood sample were collected from each child by using portable Hemocue Hb201 analyzer. Data were entered on to Epi data and exported to SPSS software version 20 for analysis, Descriptive statistics, Bivariate and Multivariate analysis were conducted. Crude odds ratio and adjusted odds ratio with 95% confidence interval was calculated. Statistical significance was set at p-value less than 0.05. *Result:* the overall prevalence of Anemia was 49.4% (95% CI (44.8-54.2)), 139 (33.3%) had mild anemia, 56 (13.4%) had moderate anemia, and 11 (2.6%) had severe anemia. Age of the child 6–11, 12–23 and 24-35 months (AOR=10.478 (95% CI: 4.113-26.694), (AOR =4.909 (95% CI: 1.826-13.198), (AOR= 4.433 (95% CI: 1.754-11.208, illiterate mothers and able Read and write (AOR = 2.998 (95% CI: 1.439-6.249), (OR=3.803 (95% CI: 1.720-8.411)), early (<6months) and late introduction of complementary foods (AOR = 2.626; 95% CI: (1.422-4.851), (AOR = 2.680 (95% CI: 1.401-5.126), diarrhea (AOR= 2.422 (95% CI: 1.371-4.278), underweight (AOR= 2.533 (95% CI: 1.439-4.460), wealth (AOR = 1.79 (95% CI: 1.066-3.020), deworming (AOR 3.032 (95% CI: 1.839-5.000)) were factors significantly associated with Anemia. *Conclusion*: The prevalence of anemia in this study is higher and it was severe public health problems according to WHO classification. Age of the child, mother's education, complementary feeding, and diarrhea, underweight and deworming were factors significantly associated with anemia among under-five children This study well recommended interventions to improve the health status and infant and young child feeding practices need to be prioritized to prevent deficiency of anemia.

Keywords: Prevalence, Anemia, Risk Factors, Under Five Children, Hargeisa, Somaliland

1. Introduction

1.1. Background

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 and low hemoglobin (Hb) Concentration fall below the required level. Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development [1, 2].

Anemia during childhood adversely affects the physical, social and mental development of the children in short and long-term outcome: it causes abnormalities of immune function, poor motor and cognitive development, poor school performance and reduced work productivity in the life of the children, thereby decreasing earning potentials and negatively

affects economic growth. [3]. Despite serious health and social implications, prevalence of Anemia remains a major public health concern and is indicated as one of the leading causes of infant mortality and morbidity in developing countries, in particular countries across Africa [4].

Anemia causes interaction between multiple factors including nutritional deficiency, genetic red blood cells disorders and infectious disease, particularly malaria and hookworm infections, Human immune deficiency virus/acquired immune deficiency syndrome should also increasingly be considered as direct and indirect contributor to anemia in young age [5].

According to WHO report indicated that 818 million children under the age of five are affected by anemia, mostly in developing countries about one million of them die every year [6].. Anemia affects 1.62 billion (24.8%) people, It effects at all age group of the people but is more prevalent in under five aged children, around 60% of African children below five years of age have anemia [6].

In Somaliland a study conducted by UNICEF and the Ministry of Health (MoH) identified 59.5% of under-five children as anemic, 18.3% mild anemia, 33.2% moderate anemia and 8% severe where anemic from a sample of 784 children drawn from 30 clusters and tested using the HemoCue. [7]. In Somaliland has micro nutrient strategies used to prevent and control the micro nutrients deficiency, these includes food based approach such as dietary diversity, home based food fortification and preventive supplementation of vulnerable groups, supplementation intervention includes vitamin A supplementation, iron supplementation and Deworming for the children [8].

1.2. Statement of the Problem

Anemia is a widespread public health problem associated with an increased risk of morbidity and mortality [9]. It is considered to be an important contributing factor to the global burden of disease. Affecting both developed and developing countries, it has an impact not only on human health and productivity but in the process it affects the socio-economic development of a nation [10].

Globally, 293.1 million (47.4%) under five year's children are anemic and 67.6% of these children live in Africa (6, 11). Out of the almost thirty percent of the world's population estimated with anemia (6). According to the 2011 World Health Organization (WHO) report, anemia resulting from Anemia due to the iron deficiency was one of the most important factors contributing to the global burden of diseases, and it increases morbidity and mortality in under five aged children [12].

In Africa, about 67.6% of children under five years old are suffering from anemia while they are 65.5% in Southeast Asia [11]. Also in africa and south East Asia its repored that anemia is risk factor for death resulting in about 726000 deaths in a childhood [2, 13]. The highest overall prevalence of anemia in children aged under 5 years is recorded in the Western and Central African Region as 75% [14]. In Eastern Africa, it is estimated that three quarters of under five

children suffer from anemia [6].

In sub-Saharan Africa the prevalence of anemia among preschool children ranges from 42% Swaziland to 91% in Burkina Faso [15]. Ghana 78.4% [16], Mali 55.8% [17] and Tanzania 85% [18]. Ethiopia demographic health survey 2016 stated that 57% of children age 6-59 months suffered from some degree of anemia (hemoglobin levels below 11 g/dl). 25% of children are classified with mild anemia, 29% with moderate anemia, and 3% with severe anemia. Between 2005 and 2016, the prevalence of anemia among Ethiopian children declined from 54% to 44% from 2005 to 2011, but increased to 57% in 2016 [19].

Anemia is a multi-factorial health problem in which the risk factors vary in different settings; could be socioeconomic factors (educational status of mother and father, low income family) and demographic factors (age, gender, and family size, age of the mother), clinical (infectious diseases such as malaria, helminthes infections, tuberculosis, general inflammatory disorders, hematological malignancies and chronic diseases like sickle cell disease.) [20].

In Somalia, national study has shown that Somali children are suffering from shocking levels of anemia. Sixty percent of under five children are anemic. The results also show that half of Somali under five children were Anemic [21]. According health management system of Somaliland to the ministry of health data showed that 6964 of under five children were Anemic in Somaliland in last three months of 2019 [22]. Despite these, the investigation of anemia in under-five children is limited in Somaliland and there is no existing data that revealed the prevalence of anemia Therefore, this study is designed to assess the prevalence of Anemia and associated factors among under-five children attending in Hargeisa public health facilities in Hargeisa city, Somaliland.

1.3. Significance of the Study

The study is important for ministry of health, Hargeisa districts health offices and other governmental and nongovernmental organizations working on promotion of child health to implement programs aimed to reduce risk of Anemia among under children. The study is also used for researchers and planners for the secondary source of data. The study has contributed to gain knowledge about Anemia and associated factors among under-five aged children.

1.4. Objectives

1.4.1. General Objectives

To assess the prevalence of Anemia and associated factors among under five children attending public health facilities in Hargeisa city, Somaliland, 2020.

1.4.2. Specific Objectives

1) To determine the prevalence of anemia among under five children attending public health Facilities in Hargeisa city, Somaliland, 2020.

To identify the factors associated with anemia among under five children Attending public health facilities in Hargeisa city, Somaliland, 2020.

2. Literature Review

2.1. Prevalence of Anemia

Globally, the percentage of children with anemia due to inadequate nutrition ranges from 44% to 74%, with the highest rates being among under five children [23]. Children ages two to five years-old take in on average 11.5-13.7 mg/day of iron through food alone [24]. In Europe, the prevalence of anemia in Sweden and Germany were found to be 8.6% and 7.8% respectively. However, in almost all countries in the Sub Saharan African region, the prevalence of anemia in children under age of five was reported to be above the severe prevalence threshold of 40%. The highest overall prevalence of anemia in children under 5 years was recorded in the Western and Central African Region were 75% [11].

A community-based cross-sectional study carried out in Nepali that describe the level of hemoglobin and prevalence of anemia in children living in the Terai region was found to be 58% [25]. More over, study in Haiti among children 6-59 months was found that the prevalence of anemia was 38.8% with 23.9%, 14.7%, 0.2% mild, moderate, and severe respectively [26]. Another study in Bangladesh, Narayanganj district showed that the prevalence of anemia in children of 6 months to 59 months was found to be 40.9% [27].

A community-based study that was done in rural western China among children under 36 months old, indicated that the prevalence of mild, moderate and severe anemia were 27.4%, 21.9% and 3.2%, respectively [28]. Other community based studies were carried out in Beit hanon, Jabalia and Beit lahia towns located in north Gaza that estimates of Hb of the 150 preschool children showed that 65.3% were anemic (Hb <11g/dl), Classification of children based on their Hb status showed that out of 80 male children, 53 (35.3%) were classified as anemic. Among 70 female children, 45 (30%) were anemic [9].

A institutional based cross sectional study carried out in Kassala, Eastern Sudan showed that 86% of all children were anemic, among these 64% of them were severely anemic [29]. Also another cross-sectional hospital-based study among under-five years children hospitalized at Bugando Medical center in Tanzania indicated that an overall anemia prevalence of 77.2% Who were 16.5% severity, 33% mild, 27.7% moderate) [30]. Also other Hospital based study, aimed to determine the prevalence of anemia among under 5 years old children of northern Tanzania showed that 47.6% of children were anemic that 20.8% were mildly anemic, 21.6% moderately anemic and 5.2% severely anemic [31].

A cross-sectional study in Western Province, Kenya about prevalence of Anemia and Associated Factors among Preschool Children (6-59 Months) where found that Prevalence of anemia was 25% and it was further divided into moderate (Hb between 7-10g/l) was 14.2% and mild (Hbbetween 10-11g/l) was 10.8%. There were no cases of severe anemia (Hb<7.0g/l) [32].

A cross-sectional health facility based study was conducted on Prevalence of anemia and its associated factors among children under five years of age, in South Wollo, Northeast Ethiopia showed that Prevalence of anemia was 41.1% (95% CI; 36.6%). where 67.5% had mild anemia, 31.3% had moderate anemia, and 1.2% had severe anemic (33). Other study was caried out prevalence of anemia and associated factors among under five children in bedele hospital, iluababora zone, oromia regional state south west Ethiopia showed that the prevalence of anemia was found to be 66.8%. With mild, moderate and severe anemia being 26.7%, 37% and 3.1% respectively [34].

A cross sectional study was done on anemia and associated factors among hospitalized children attending the University of Gondar Hospital, Northwest Ethiopia showed that prevalence of anemia was 58.6% where 28%, 51.1% and 20.9% had mild, moderate, and severe anemia. [35]. Other study was done factors Associated with Anemia among Children Aged under five Attending Growth Monitoring at Tsitsika Health Center, Wag-Himra Zone, Northeast Ethiopia showed that over all prevalence of anemia was 66.6%, the highest prevalence was recorded in the age group of 9–11 months (79.6%), followed by 6–8 months (69.2% [36].

According Micronutrient health survey in Somalia showed that over all prevalence of anemia among under five children was 59. 3%, which were classified as mild anemia, moderate anemia and severe Anemia 23%, 32.7%, 3.6% respectively. This survey also showed that prevalence of anemia in children aged less than five years in Somaliland was 45.2% which where, 20.9%, 22.6%, 1.7%, mild anemia, moderate anemic and severe Anemic respectively [7].

2.2. Associated Factors of Anemia

2.2.1. Socio Demographic Factors

According to Study in Northeast Ethiopia, Wag-Himra Zone about Factors Associated with Anemia among Children Attending Growth Monitoring at Tsitsika Health showed that the Children in the age group of 6–8, 9–11, and 12–17 months were 3.5 times, 9.6 times, and 2.9 times more likely to be anemic than children in the age range of 18–23 months, respectively [36]. Similarly, other cross-sectional health facility based study was conducted at Guguftu health center, South Wollo, Northeast Ethiopia showed that children in the age group of 6–11 and 12–23 months were 4.5 times and 2.8 times more likely to be anemic than children in the age range of 48–59 months respectively (33), other Study conducted in Kenya on the Prevalence and Risk Factors of Anemia showed Age of the child was found to be significantly associated with anemia. A child whose age is less than one year was found to be 2 times more susceptible to anemia as compared to a 5-year old child [37].

In a cross-sectional household-based study conducted in Cape Verde West Africa, the prevalence of anemia and associated factors among children below five years showed a significant negative association between maternal age and the risk of anemia. Children whose mothers are below 20 years of age were significantly more likely to have anemia than their counterparts whose

mothers are above 20 years (38). A study carried out in India rural community was obtained a similar result that highly significant association was found with a mother's age and anemia in children [39].

Across sectional study on Factors Associated with Anemia among Children at Tsitsika Health Center, Wag-Himra Zone, Northeast Ethiopia determined that Children of mothers with no formal education were 2.6 times more likely to be anemic than children of a mother with secondary and above education level [36]. Another Study conducted in Wollo, Northeast Ethiopia about associated factors among children under five years of age attending at Guguftu health center determines that Children with illiterate (or no formal education) mothers, and with primary education were 7 times and 3.3 times more in children with educated mother [33].

A study conducted in Kenya on Prevalence and Risk Factors of Anemia among young Children showed that Mothers with post-secondary education and secondary education complete had a protective effect on the risk of anemia on their children. The risk of anemia was 1.5 times more in children whose mothers had no education as compared to children whose mothers had post-secondary education [37]. According to a study conducted in Uganda children with richest wealth index were 85% more preventive compared poorest wealth index family [40]. Also, other study conducted Wag-Himra Zone, Northeast Ethiopia Children from families of lowest wealth quintiles were three times more likely to be anemic than children from highest wealth quintile [36]. similarly, other conducted eastern Ethiopia children with a family of middle wealth index were 56% more like to be anemic than those children family with rich wealth index [41].

2.2.2. Complementary Feeding and Dietary Diversity

A community-based cross-sectional study done in Damot Sore, South Ethiopia from March to April 2017 showed that Children who introduced complementary feeding earlier than the recommended time, which is at 6 months, or those started late after recommended time were nearly 2 times more likely to be anemic than children which started complementary feeding at 6 months. Also this study was found that Children from mothers who have had a poor practice of breastfeeding were three times more anemic than children of mothers that have had good breastfeeding practice [42]. similar study in Wag-Himra Zone, ethiopia was found Children with early introduction of complementary foods (<6 months) and late introduction complementary feeding late (≥9 months) were 11.1 times and 4.3 times more likely to be anemic than children with timely initiation of complementary food, respectively [36].

According the cross sectional study carried in Ethiopia showed that children with poor dietary diversity were 3.2 times more likely to be anemic compared to those children with good dietary diversity score [36]. Also, other community study done in Ethiopia showed that children with low dietary diversity were 3.24 times more likely to be

Anemic compared to those with high dietary diversity [43] similarly, study conducted demot sore district in Ethiopia indicated that children with poor dietary diversity were 2.86 times more likely to be anemic compared to children with good dietary diversity.

2.2.3. Morbidity and Health Related Characteristics

According demographic health survey conducted under five children in Togo about associated factors of anemia indicated anemia was three times higher in children with malaria infection compared to those without anemia [44]. Other Study caries out on prevalence of anemia among under five in Uganda 2009 showed that malaria infection positive under children were 5 times higher in Anemia those malaria negative under five children (40). Similarly, other conducted in Uganda showed that children who had malaria were 1.5 times times more likely to have anemia compared to those to those without malaria [45].
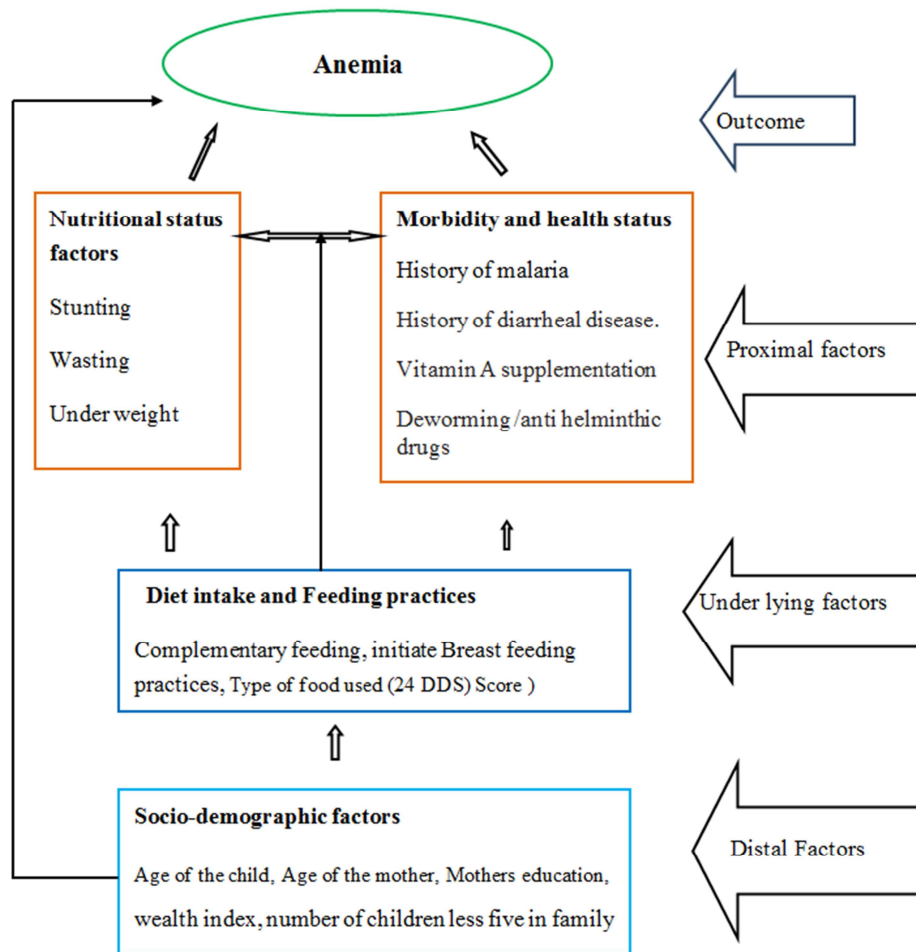
Study conducted in Northeast Ethiopia about children in 2015 showed that the Children with history of diarrhea before two weeks were 4.9 times more likely to be anemic than children without diarrhea [36]. Similar studies conducted in urban slum areas and rural of Indonesia were found that diarrhea were 1.19 times and 1.15 more likely to be Anemic than children with no history of diarrhea [46, 47]. Another study conducted Huaihua indicated that children with diarrhea were 1.35 times more likely to be Anemic children without diarrhea [48].

Meta analyses conducted in Ethiopia showed that children who were not receiving anti-helminthes were 2.34 times more likely to develop anemia than dewormed children (49), similarly, Across sectional study conducted eastern Ethiopia were found that the children were not given anti helminthic drugs were 1.8 times more likely to develop anemia than those receiving anti helminthic drugs [41]. Another study cried out southern Ethiopia also showed receiving anti-helminthic drugs was found to be inversely related with childhood anemia. Accordingly, children who received anti-helminthic drugs had 61% lower chance of getting anemia than their counterparts [50].

2.2.4. Nutritional Status

A Cross Sectional Study conducted children in north-western Uganda determines that children who were stunted had 2.5 times risk of anemia than non-stunted children. Also the risk of anemia was 2.6 times higher among underweight children [45]. Similarly, study conducted south wollo, ethioipia showed that Underweight children were 2.1 times more likely to be anemic than children with normal weight [33]. Community based cross sectional conducted wareda, Ethiopia were found that underweight child were 2.7 times more likely to develop anemia compared to normal weight children. Also Anemia were 2.76 times higher among wasting children [51]. other Study done by in juba indicated that there was a significant relationship between the presence of anemia and the nutritional status of the child [52].

2.3. Conceptual Frame Work

Source: conceptual frame work was prepared by reviewing and modification of different literature (33, 40, 44, 45).

Figure 1. Conceptual frame work on factors associated with Anemia among under five children.

4. Methods and Materials

4.1. Study Area and Period

This study was conducted in Hargeisa city. Hargiesa is the capital and largest city of of the self-declared but internationally unrecognized Republic of Somaliland in the Horn of Africa. It has five districts, with a population of around 1,500,000 residents.

Hargeisa is a city situated in the Marodi-Jeh region of an enclosed valley of the northwestern Galloon (Ogo) highlands. It sits at an elevation of 1,334 meters (4,377 feet) above sea level. It is the 700th largest city in the world by population size. The urban area occupies 75 square kilometers (29 sq mi). Hargeisa receives the bulk of its precipitation between April and September, averaging 400 millimeters (16 in) of rainfall annually. Average monthly temperatures in Hargeisa range from 18°C (64°F) in December and January to 24°C (75°F) in June. The common foods consumed in Hargeisa are food items like maize, rice, pasta, meat, sugar, dates, and wheat flour product foods. Hargeisa has one main public Hospital called Hargeisa group hospital and 12 health centers which are managed by the government. This study was started from May 2020 to July 2020 in Hargeisa public health facilities.

4.2. Study Design

Facility based Cross sectional study design was used to assess the prevalence of anemia and associated factors among under children attending public health facility in Hargeisa.

4.3. Population and Eligibility Criteria

4.3.1. Source Population

All the under-five children and their mothers/caretakers attending public Health Facilities in Hargeisa were considered as a source population.

4.3.2. Study Population

All the under-five children and their mothers /caretakers attending under-five OPD in selected public health facilities.

4.3.3. Eligibility Criteria

All under-five children who were attended in selected public health facilities during the study period and whose parents were accepted consent were included the study whereas, under- five children who were seriously ill and those who took iron supplementation were excluded from the study.

4.4. Sample Size Determination and Technique

4.4.1. Sample Size Determination for the First Objective

Sample size calculated by using single proportion population formula. It was calculated by considering 55.8% prevalence of anemia among under five children in Somalia (53). 5% margin of error and 95% confidence interval (CI), Sample size is calculated as follows:

$$n = [(Z\alpha/2)^2 p\ (1-p)]/d^2$$

n= desired sample size, Z = the normal standard deviate (level of statistically significant) which is set at 1.96 the corresponds to 95% confidence level, P = estimated prevalence of anemia among under five children is 55.8% in Somalia, q= 1-p =1-0.558=0.442, d = degree of accuracy essential, usually set at 0.05%

$$n = \frac{(1.96)^2\ (0.558)\ (0.442)}{(0.05)^2}$$

$$n = 379$$

The calculated sample size was added by 10% for non-response, to make a sample size of 417.

4.4.2. Sample Size Determination for Second Objective

Sample size was calculated for factors associated with anemia among under five children by reviewing deferent variables that were significantly associated with outcome variable with the following assumptions, two-sided confidence level of 95%, power of 80% using Epi Info 7 Stat Calc computer software program for double population proportions formula and respective odds ratio for each factor.

Table 1. Sample size determination for factors associated with Anemia.

Variables		Anemia in children< 5 years		AOR	Sample size	Reference
		%Exposed	%non exposed			
Introduction complementary feeding foods	<6moths at 6moths Yes	38.5%	61.5%	3.53	128	[33]
Under weight	No <24 moths	32.4%	67.6%	2.70	210	[51]
Age of the child	>24 moths	31.6%	69.0	3.47	156	[34]

Finally, the required sample size for this particular study was determined by taking the maximum sample size from the first objective which is *417*.

4.4.3. Sampling Procedure and Technique

This study was carried out in one Public Hospital and three Health center in Hargeisa city. Hargeisa has one public hospital and 12 health centers, one public hospital, and three health centers were selected randomly by the lottery method. Than 417 of sample size were distributed among health facilities according to proportional allocation to their size (PAS). Under-five children attended in selected public health facilities were selected consecutively and their mothers interviewed. The data were collected and recorded until the sample size was achieved.
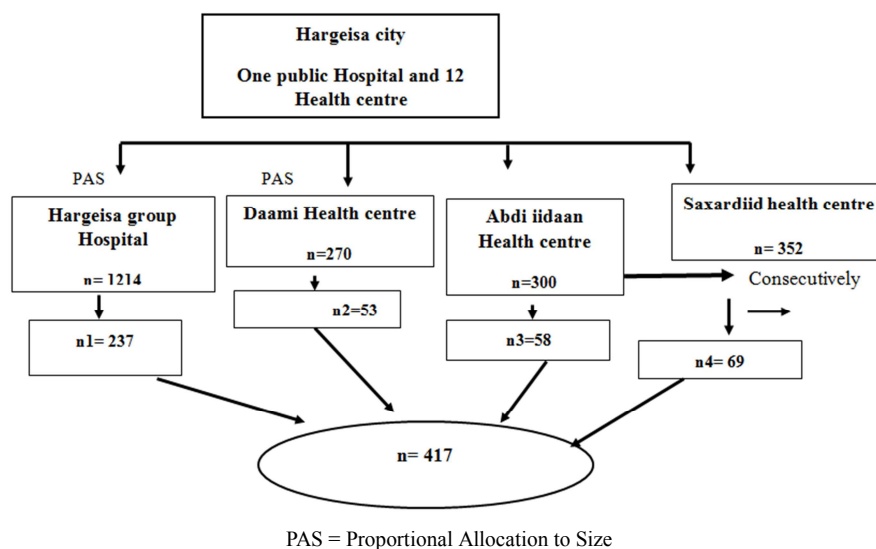

PAS = Proportional Allocation to Size

Figure 2. Schematic diagram of sampling procedure on prevalence of anemia and associated factors among under five children attending public health facility in Hargeisa city, 2020.

4.5. Data Collection Instrument and Procedure

Data were collected by face to face interviews with the mothers/caregivers of the child by using a pretested semi-structural questionnaire which was prepared by reviewing different literatures [33, 36]. The questionnaire was prepared in English language, and then it was translated into a local language. The Questionnaire is divided into socio-demographic characteristics, dietary diversity and feeding practice, morbidity and health care characteristics of children, anthropometric measurement, and laboratory analysis.

In anthropometric measurement weight and height of the child were measured Sliding board or stadiometer and digital electronic weight scale. Hemoglobin was measured using a portable Hem cue Hb201 analyzer, The Hem cue system consists of a portable battery-operated photometer and a supply of treated disposable cuvettes in which was Collected.

Five nurses and three Medical laboratory technicians were recruited as a data collector and three supervisors. Among the five nurses, four of them were administered the questionnaire in the local language. The remaining one nurse and the medical laboratory technicians have collected blood samples and anthropometric measurements. Finally, the filled questionnaires were submitted to the investigator.

Data on nutritional status was collected by measuring the weight and height of the child. The length was measured for children less than 24 months in a recumbent position and standing for children aged 24–59 months to the nearest of 0.1 cm by using a sliding board and stadiometer respectively. The weight of the child was measured without shoes and a minimum of light clothes to the nearest 0.1 kg by using a digital electronic weight scale utilized by UNICEF.

The dietary diversity score of the child was measured by using WHO "indicators for assessing infant and young child feeding practices" (54). Minimum dietary diversity for children by employing 24 hr. Mothers or care takers were asked to report all food items and beverages given to the child during the previous day of the survey which were categorized into seven food groups. Using dietary diversity score 4 (minimum dietary diversity score) as a cut-off point, a child was defined as having "poor dietary diversity" if consumed less than 4 food groups while having "good dietary diversity" if consumed 4 or more food groups.

Hemoglobin level was measured using a portable HemoCue Hb 201 analyzer aseptically following standard procedures and capillary blood samples were obtained by lancing the middle fingertip previously disinfected with 70% alcohol. The first two drops of blood were wiped away with cotton wool, and then the third drop of blood sample was taken and filled to micro cuvette. The filled micro cuvette was loaded in the cuvette holder of calibrated HemoCue Hb 201 analyser and after few seconds the hemoglobin measurement was displayed.

4.6. Study Variables

4.6.1. Dependent Variable
Anemia

4.6.2. Independent Variable

Socio-demography factors (age of the child, age of the mother, educational status of mother, Wealth index), feeding practices (Complementary feeding, dietary diversity), morbidity and health status (History of malaria infection, history of diarrheal disease) and nutritional status (stunting, underweight and wasting).

4.7. Data Quality Control

To assure the quality of data, training were given for data collectors about the objective of the study, confidentiality issues, study participant's right, consenting, and techniques of an interview.

Daily supervision was made during the data collection period. The Questionnaires were pre-tested before the actual data collection. The collected data were checked for their consistency and completeness daily. Standard operating procedures (SOPs) and manufacturers' instructions were strictly followed for laboratory activities.

4.8. Operational Definitions

Anemia: Hemoglobin (Hb) concentration below cut-off levels depending on age, sex and physiological status [1].

Mild anemia: Hemoglobin value between 10gm/d1 and 10.9 gm/d1 [1].

Moderate anemia: Hemoglobin value from 7gm/d to 9.9gm/d1 [1].

Severe anemia: Hemoglobin value less than 7gm/d1 [1].

Complementary feeding: is the period when infants are introduced to food different from milk in their diet, together with a gradual reduction of the intake of milk (either breast milk or formula), to finally and gradually acquire their family's diet model [55].

Dietary diversity score: its sum of the number of different foods or food groups consumed in 24 hour period. [56].

Underweight: weight-for-age Z-score between -2SD to -3 SD and <-3 SD, respectively from the median of WHO reference population [57].

Wealth index: is a composite measure of the cumulative living standard of the household also its considers characteristics that are related to wealth status (58). Wealth quintiles have five categories, one up to five (poor: first three groups of wealth quintiles, rich: last two groups of wealth quintiles).

4.9. Data Processing and Analysis

All data were checked for completeness than were entered, edited, coded, and cleaned into Epi data version 3.1 and exported to Statistical Package for Social Science (SPSS) version 20 for further analysis. Descriptive statistics such as frequency and percentage were used for Socio-demographic factors and study participants.

Anthropometric measurement converted into Z score height for age (HAZ), weight for height (WHZ), and weight

for age (WAZ) by using WHO Anthro software version 3.2.2.

Bivariate logistic regression analyses were used to identify the association of independent variables with dependent variable. Those independent variables having p-value < 0.25 in the bivariate logistic regression analysis were transferred into the multivariate logistic regression analysis. Odds ratio with 95% confidence was used to determine the strength of association. In the multivariate analysis associated factors with P-value < 0.05 were considered as statistical significance.

4.10. Ethical Consideration

Ethical approval was obtained from jigjiga University College of Health and Medical Science Research Institutional Ethical Review Committee. In addition, letters of permission was written to all respected offices. Then data collection was started after permission was get. To ensure confidentiality, it was study that the names of the study subjects were not written on the questionnaire. Written informed consent was obtained from each parent/caregiver of the study participants after explaining the purpose of the study and was asked for their willingness to participate in the study and was not forced. Their rights of denial to participate in the study were also assured Information.

5. Results

5.1. Socio- Demographic Characteristics of the Study Participants

A total of 417 under-five children participated in the study from May to July 2020 giving the response rate of 100%. The majority of the under-five children were females 265 (63.5%) while 152 (36.5%) were males. Nearly half of the children 223 (53.5%) were below two years of age. majority of the children 361 (86.6%) came from the urban part of the study area. More than three fourth 295 (70.7%) of mothers / caregivers of the children were aged between 28 and 37, 186 (44.6%) were illiterate / no formal education and more than half of the mothers/ caretakers 250 (60.0%) were housewife by occupation. The majority of the mothers 243 (58.3%) had two children aged below five years, and the majority of the mothers/ care givers 329 (78.9%) were married. Nearly half of fathers 204 (47.9%) were illiterate/no formal education. Nearly half of the family 237 (56.8%) were poor wealth index (Table 2).

Table 2. Socio-demographic characteristics of children under five years and their family attending public Health facility in Hargeisa, Somaliland, 2020, (n = 417).

Variables		Frequency (no)	Percent (%)
sex of the child	Female	265	63.5
	Male	152	36.5
Age of the child in (months)	0-5	26	6.2
	6-11	125	30.0
	12-23	72	17.3
	24-35	88	21.1
	36-47	50	12.0
	48-59	56	13.4
Age of the mother	18-27	85	20.4
	28-37	295	70.7
	38-43	37	8.9
Residence	Urban	361	86.6
	Rural	56	13.4
mothers education	Illiterate	186	44.6
	Read and write	102	24.5
	Primary	51	12.2
	≥ secondary	78	18.7
mothers occupation	Housewife	250	60.0
	Civil servant	62	14.9
	Merchant	76	18.2
	Farmer	18	4.3
	Others	11	2.6
Marital status of mother	Single	20	4.8
	Married	329	78.9
	Divorced	68	16.3
Number children < 5 years in family	1	18	4.3
	2	243	58.3
	>2	156	37.4
fathers education	Illiterate	204	47.9
	Primary	45	10.6
	≥ secondary	168	39.4
Wealth index	Poor	237	56.8
	Rich	180	43.2

Table 3. *Feeding practice and nutritional status of children under five years attending public health facility in Hargeisa, Somaliland, 2020 (n = 417).*

Variables		Frequency (no)	Percent (%)
Timely initiation of breastfeeding	Yes	413	99.0
	No	4	1.0
introduction of complementary food	early (<6months)	142	34.1
	late (>9 months)	136	32.6
	Timely (6-8months)	139	33.3
Underweight	Yes	202	48.4
	No	215	51.6
Wasted	Yes	95	22.8
	No	322	77.2
Stunted	Yes	163	39.1.
	No	254	60.9

5.2. Feeding Practice and Nutritional Status

Only four children (1%) were found without history of timely initiation of breast feeding practices. About more than quarter 142 (34.1%) of children had early introduction of complementary foods which is less than 6 months. Regarding the nutritional status of the children nearly half 202 (48.4) of the children were under weight, 163 (39.1%) were stunted or too short of their normal height, and less than quarter 95 (22.8%) of the children were wasted (Table 3).

5.3. Dietary Diversity

The study found that more than three fourth 294 (75.2%) of the children had poor dietary diversity from ≤3 food groups in the previous 24 hrs and nearly a quarter 97 (24.8%) of the children had good dietary diversity who received foods from ≥4 food groups in the previous 24 hrs, The most common foods eaten by the children were grains, roots or tubers 264 (67.5%) followed by milk and milk product 229 (58.6%) in the last 24 hours. The Least food group consumed by the children was Flesh foods, meat, poultry, fish, and seafood 152 (38.9%) (Table 4).

Table 4. *Dietary diversity of children under five years attending public health facility in Hargeisa, Somaliland, 2020 (n = 417).*

Variables		Frequency (no)	Percent (%)
Grains, roots or tubers	Yes	264	67.5
Vitamin A- rich plants foods	Yes	153	39.1
Flesh foods, meat, poultry, fish and sea food	Yes	152	38.9
Eggs	Yes	164	41.9
Pulses, legumes or nuts	Yes	216	55.2
Milk and milk products	Yes	229	58.6
Other fruits and vegetables	Yes	175	44.9
Dietary diversity score	Good*	97	24.8
	Poor**	294	75.2

Note: *Child who received foods from ≥4 food groups in the previous 24 hrs
**child received foods from ≤ 3 food groups in the previous 24 hrs.

5.4. Morbidity and Health Care Related Characteristics

About 356 (85.4%) of children were born at Health institution. Regarding the morbidity status, more than half of the children 263 (63.1%) reported to have diarrhea in the last two weeks, 177 (42.4%) of the children were having Fever, 220 (52.8%) had vomiting and only 26 (6.2%) were having a history of malaria infection. According to immunization of the children, 234 (56.1%) were fully immunized. More than half 236 (56.6%) of the children did not take anti helm antic drugs and 194 (46.5%) were taken vitamin A supplementation (Table 5).

Table 5. *Morbidity and health care related characteristics of children under five years attending public health facilities in Hargeisa, Somaliland, 2020 (n = 417).*

Variables		Frequency (no)	Percent (%)
Birth place of the child	Home	61	14.6
	Health institution	356	85.4
Diarrhea in last two weeks	Yes	263	63.1
	No	154	36.9
Fever in last two weeks	Yes	177	42.4
	No	240	57.6
Vomiting in last two weeks	Yes	220	52.8
	No	197	47.2
Immunization	partial immunized	131	31.4
	full immunized	234	56.1
	not immunized	52	12.5

Variables		Frequency (no)	Percent (%)
Anti-helm antic drugs	Yes	181	43.4
	No	236	56.6
Vitamin A supplementation	Yes	199	47.7
	No	218	52.3
History of Malaria	Yes	26	6.2
	No	391	93.8

5.5. Prevalence of Anemia Among Under Five Children

In this study, overall prevalence of Anemia was 49.4% (95% CL (44.8-54.2)), 139 (33.3%) had mild anemia, 56 (13.4%) had moderate anemia, and 11 (2.6%) had severe anemia respectively (figure 3), which 134 (65%) anemic children were females and 72 (35%) were males. According the age groups, the highest prevalence was recorded in the age group of 6–11 months 86 (68.8%). Also high prevalence of anemia was found in children, whose mothers had no formal education 109 (58.6%), early introduction of complementary foods (<6 months) 81 (57.0%), with diarrhea 137 (58.7%), poor wealth index 139 (58.6%), not taking anti Helminthic drugs or not deworming 139 (64.1%) and underweight 122 (60.4%) (Table 6).
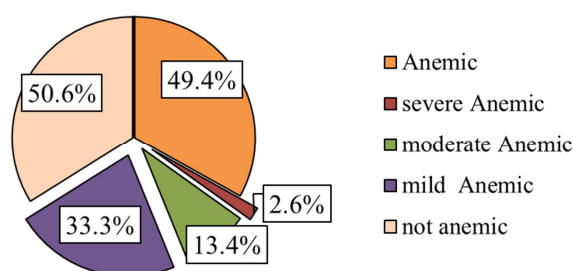

Figure 3. *Prevalence of anemia among children under five years attending public health facilities in Hargeisa, Somaliland, 2020 (n =417).*

5.6. Factors Associated with Anemia

In bivariate analyses association variables were (child age, Mother's educational status, the introduction of complementary food, 24DDS, diarrhea, fever, vomiting, deworming, vitamin A supplementation, wealth index, stunting, underweight). In multivariate Analyses was found that children in the age group of 6–11, 12–23, and 24-35 months were 10.5 times (AOR=10.478 (95% CI: 4.113-26.694), 4.9 times (AOR =4.909 (95% CI: 1.826-13.198), and 4.4 times (AOR= 4.433 (95% CI: 1.754-11.208)) more likely to be Anemic than children in the age between 48-59 months respectively. Children with illiterate /informal education mothers and able Read and write were 2.9 times (AOR = 2.998 (95% CI: 1.439-6.249)) and 3.8 times (OR=3.803 (95% CI: 1.720-8.411)) more likely to be Anemic than the children with mother of secondary education and above. Children with early (<6 months) and late (>9 months) introduction of complementary foods were 2.62 times (AOR = 2.626; 95% CI: (1.422-4.851) and 2.68 (AOR = 2.680 (95%. CI: 1.401-5.126) more likely to be anemic than children with timely (6-8 months) initiation of complementary foods respectively. children with diarrhea were 2.42 times (AOR= 2.422 (95%CI: 1.371-4.278) more likely to be Anemic than children without diarrhea. similarly those underweight children were 2.53 times (AOR= 2.533 (95% CL: 1.439-4.460) more likely to be Anemic than with normal weight. Children with family poor wealth index were 1.79 times (AOR = 1.79 (95% CI: 1.066-3.020) more likely to Anemic than children with family rich wealth index. Children who were not receiving anti-helminthes drugs were 3.032 times (AOR 3.032 (95% CI: 1.839-5.000)) more likely to develop anemia than dewormed ones (Table 6).

Table 6. *Result of bivariate and multivariate Analyses of factors associated with anemia among children under five years attending public Health facilities in Hargeisa, Somaliland, (n = 417).*

Variables	Anemia		Crude OR (95% CI)	Adjusted OR (95%CI)
	Anemic n (%)	Not anemic n (%)		
Age of the child in months				
0-5	5 (19.2%)	21 (80.8%	0.974 (0.300-3.161)	1.499 (0.379-5.924)
6-11	86 (68.8%)	39 (31.2%	9.021 (4.218-19.291)*	10.478 (4.113-26.694)**
12-23	40 (55.6%)	32 (44.4%)	5.114 (2.282-11.456)*	4.909 (1.826-13.198)**
24-35	49 (55.7%)	39 (44.3%)	5.140 (2.351-11.235)*	4.433 (1.754-11.208)**
36-47	15 (30.0%)	35 (70.0%)	1.753 (0.717-4.289	1.499 (0.379-5.924)
48-59	11 (19.6%)	45 (80.4%)	1.00	1.00
Mothers education				
Illiterate	109 (58.6%)	77 (41.4%)	2.831 (1.627-4.926)*	2.998 (1.439-6.249)**
Read and write	58 (56.9%)	44 (43.1%)	2.636 (1.429-4.864)*	3.803 (1.720-8.411)**
Primary	13 (25.5%%)	38 (74.5%)	0.684 (0.312-1.502)	1.051 (0.378-2.921)
≥ secondary	26 (33.3%)	52 (66.7%)	1.00	1.00
introduction of complementary food				
early (<6months)	81 (57.0%)	61 (43.0%)	3.06 (1.876- 5.013) *	2.626 (1.422-4.851)**
late (>9 months)	83 (61.0%)	53 (39.0%)	3.617 (2.194-5.962) *	2.680 (1.401-5.126)**
Timely (6-8months)	42 (30.2%)	97 (69.8%)	1.00	1.00
Diarrhea				
Yes	157 (59.7%)	106 (40.3%)	3.174 (2.087-4.826)*	2.422 (1.371-4.278)**

Variables	Anemia		Crude OR (95% CI)	Adjusted OR (95%CI)
	Anemic n (%)	Not anemic n (%)		
No	49 (31.8%)	105 (68.2%)	1.00	1.00
Fever				
Yes	94 (53.1%)	83 (46.9%)	1.294 (0.877-1.910)*	1.009 (0.602-1.692)
No	112 (46.7%	128 (53.3%)	1.00	1.00
Underweight				
Yes	122 (60.4%)	80 (39.6%)	2.3728 (1.607-3.524)*	2.533 (1.439-4.460)**
No	84 (39.1%)	131 (60.9%)	1.00	1.00
Vomiting				
Yes	118 (53.6%)	102 (46.4%)	1.433 (0.974-2.108)	1.375 (0.808-2.338)
No	88 (44.7%)	109 (55.3%)	1.00	1.00
Wealth index				
Poor	139 (58.6%)	98 (41.4%)	2.392 (1.607-3.561)*	1.795 (1.066-3.020)**
Rich	67 (37.2%)	113 (62.8%)	1.00	1.00
Dew arming/ Anti helm antic drugs				
Yes	67 (33.5%)	133 (66.5%)	1.00	1.00
No	139 (64.1%)	78 (35.9%)	3.538 (2.362-5.298)*	3.032 (1.839-5.000)**
Dietary diversity score				
Good	35 (36.1%)	62 (63.9%)	1.00	1.00
Poor	166 (43.5%	128 (56.5%)	2.297 (1.430- 3.691)*	1.530 (0.820-2.854)
VA supplementation				
Yes	90 (45.2%)	109 (54.8%)	1.00	1.00
No	116 (53.2%)	102 (46.7%)	1.377 (0.937-2.025)*	1.516 (0.892-2.576)
Stunting				
Yes	100 (61.3%)	63 (38.7%)	2.216 (1.483-3.313)*	1.306 (0.747-2.283)
No	106 (41.7%)	148 (58.3%)	1.00	1.00

1= reference *significance at p≤0.25 & ** significance at p ≤0.05
OR = odds ratio, CI = confidence interval.

6. Discussion

This study assessed the prevalence of anemia and associated factors among under children attending public health facilities in Hargeisa, Somaliland. The overall prevalence of Anemia was 49.4% (95 CI (44.8-54.2)). This level of prevalence is considered a severe public health problem according to WHO classification [11]. This finding was higher in studies conducted in Haiti (38.8%) (27), Bangladesh (40.9%) [27], northern Tanzania (47.6%) [31], South Wollo, Northeast Ethiopia (41.1%) (33) and Western Kenya (25%) [32] However, the result of this study is lower than studies conducted Tanzania (77.2%) (30] and Eastern Sudan (86%) [29]. western China (52.5%) [28], southwest Ethiopia (66.8%) [34], Beitlahia towns north Gaza (65.3%) [9] and Wag-Himra Zone, Northeast Ethiopia (66.6%) [36]. The difference in prevalence may be due to variation on the socio-demographic characteristics of the study participant. The difference might also due to variation in cultural, dietary patterns, study design, sampling techniques, sample size, and geographical location of the study participant.

According to this study, the majority of the anemic under-five aged children had mild anemia, (33.3%) followed by moderate anemia (13.4%) and severe anemia (2.6%) respectively. This finding similar to studies conducted in Haiti [27], western China [28], and Northeast Ethiopia [33]. Father more, this result different from studies conducted southwest Ethiopia [34], Northwest Ethiopia [35], which showed high moderate anemia.

In this study, the age of the child had a statistically significant association with anemia. children in the age group of 6–11, 12–23, and 24-35 months were ten times, five times and four times, more likely to be Anemic than children in the age between 48-59 months respectively. These findings are similar studies conducted in Kenya [37], South Wollo, Northeast Ethiopia (33], Wag-Himra Zone, Northeast Ethiopia [36]. This is because of high iron requirement due to the rapid growth and development rate. Furthermore, it may be caused to poor maternal iron reserves during pregnancy and diets poor in iron.

This study found associations between the level of mother's education and Anemia, children with mothers with illiterate/ no formal education and able to read and write were three times and nearly four times more likely to be Anemic than the children with mother of secondary education and above. This finding was similar in studies conducted, in Kenya [37], Wag-Himra Zone, Northeast Ethiopia [36], and Wollo, Northeast Ethiopia [33]. This may be explained by the fact that education enhances the mother's knowledge needed for their children's health and an appropriate feeding practice, which helps to improve their children's nutritional status. It is also confirmed that maternal education is a strong predictor for the nutritional outcomes of children.

The present study also has affirmed a higher prevalence of Anemia among children with early (<6months) of complementary foods. Children with early introduction of complementary foods and late introduction of complementary foods were 2.6 times and 2.68 times more likely to be anemic than children with timely initiation of complementary foods respectively. This study finding was supported by studies conducted on Damot Sore, South

Ethiopia [42], Wollo, Northeast Ethiopia [33], and Wag-Himra Zone, Northeast Ethiopia [36]. Giving liquid or solid food before 6 months causes interference with the absorption of iron in breast milk. Early exposure of infants before 6 months increases the risks of infection, diarrhea, and malabsorption. this may be due to a lack of knowledge about the adequacy of exclusive breastfeeding alone to the infants.

This study found that children with a history of diarrhea in the last two weeks were 2.4 times more likely to be Anemic than children without diarrhea. This finding is similar to studies conducted in urban slum areas of Indonesia [46], Huaihua [48], Northeast Ethiopia [36], and rural Indonesia [47]. This could mainly operate through a loss of appetite and malabsorption from diarrhea which in turn increases the likelihood of developing anemia.

Nutritional status is also associated with Anemia among under-five children. in this study, underweight children were two times more likely to be Anemic than children with normal weight, this study finding was supported by studies conducted in northwestern Uganda [45] wareda, Ethiopia [51], and Northeast Ethiop [33], Usually anemia and underweight often share common causes, it is expected that multiple nutrition problems would co-occur in the same individuals. Poverty and food insecurity are factors aggravated in anemia and underweight. Food insecurity affects the nutritional status of children by compromising the quantity and quality of dietary intake, which provides for the development of anemia [59]. Also, Low consumption of iron-rich foods and reduction of nutrient absorption caused by changes intestinal walls in malnourished individuals contribute towards the development of anemia [60].

This study found that children who were not receiving anti-helminthic drugs were nearly three times more likely to develop anemia compared to those dew arming ones. this study finding was similar studies conducted mate analyses in Ethiopia [49], eastern Ethiopia [41], and South Ethiopia [50]. Helminthes destroy red blood cells and decrease their lifespan, which is reaching in hemoglobin and finally results in anemia. Therefore, deworming infants every 6 months is the best option for the prevention mechanism of under-five anemia.

The present study found that children with families of poor wealth index were 1.7 times more likely to be anemic than a child with the highest wealth index The finding of this study was supported with studies conducted in Uganda [40], Wag-Himra Zone, Northeast Ethiopia [36], eastern Ethiopia [41]. Poor household economic status might result in loss of power to purchase diversified and nutrient-rich food and secure the household per capital food availability.

7. Strength and Limitation of the Study

7.1. Strength of the Study

This study including both measures hemoglobin level by using (HemoCue HB201) in a finger, this instrument gives result immediately and measurement height and weight of the child.

7.2. Limitation of Study

1) Because of the Cross-sectional natures of the study design; it was not revealed causal links between independent variables and anemia.
2) Due to the constraint of resources, I was unable to measure serum ferritin concentration, soluble transferrin receptor concentration, folate levels, vitamin B12 levels, thalassemia, and G6PD deficiency; which could have helped in finding the causes of anemia.
3) This study is conducted at a facility-based; hence, further community-based studies should be conducted to have findings more extrapolated the whole population.
4) A limitation number study participant was attending in Area of the study. This is due to the afraid of COVID-19.

8. Conclusion and Recommendation

8.1. Conclusions

The prevalence of anemia among under-five children is higher and it was severe public health problem with 49.4% according to WHO classification, Age of the child, mother's education, complementary feeding, wealth index, diarrhea in last two weeks, underweight and deworming were factors significantly associate with anemia among under-five children.

This study well recommended interventions to improve the health status and infant and young child feeding practices need to be prioritized to prevent deficiency of anemia targeting children aged under five years.

8.2. Recommendations

1) Improve overall diets, promote and support the consumption of micronutrient-rich diets through dietary diversification in children.
2) Infant and young child feeding recommendations should also emphasize local innovations to enhance iron intake.
3) Deworming of the children should also increase to prevent hookworm infection.
4) Continuous health education programs should be developed after assessing mothers /caretakers' knowledge, practices and beliefs on anemia in children.
5) Health workers and other related personnel to provide clear, and specific messages to prevent and treat anemia.
6) Strengthening community based nutrition activities which were previously integrated in to health extension packages.
7) Strengthening integration services with in health facilities.

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