

WALLEGA UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
MEDICAL SCIENCE ACADEMIC AND SERVICE
DIRECTORATE

**MAGNITUDE AND ASSOCIATEDFACTORS OF ANEMIA AMONG
HIV-INFECTED CHILDREN RECEIVING ANTIRETROVIRAL
THERAPY IN PUBLIC HEALTH FACILITIES OF ILUABABORA
ZONE, ETHIOPIA:ACROSS-SECTIONAL STUDY**

**BY: TEKLE TAYE (YEAR III PEDIATRICS AND CHILD HEALTH
RESIDENT)**

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WOLLEGA UNIVERSITY
INSTITUTE OF HEALTH SCIENCE MEDICAL SCIENCE
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STATEMENT OF THE DECLARATION

By signing below, I declare that this thesis entitled “ magnitude and associated factors anemia among HIV-infected children receiving antiretroviral therapy in public health facilities of Iluababora zone, Oromia, Ethiopia; 2026” is entirely my original work. I confirm that all ethical standards were strictly observed throughout the planning, data collection, analysis, and completion of this study. All sources of information used have been appropriately acknowledged through proper citation and referencing, and every effort has been made to avoid any form of plagiarism. I further affirm that this thesis has not been submitted to any other institution or organization for the award of any academic degree, diploma, or certificate.

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LIST OF ABBREVIATIONS AND ACRONYM

Acronym	Full Form
AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-Retroviral Therapy
CD	Cluster of Differentiation
CDC	Center for Disease Control
CPLHIV	Children of People Living with HIV
EPO	Erythropoietin
HAART	Highly Active Anti-Retroviral Therapy
HAZ	Height for Age z score
HCT	Hematocrit
Hgb	Hemoglobin
HIV	Human Immune Deficiency Virus
IPI	Intestinal Parasitic Infection
WAZ	Weight for Age z score
WHO	World Health Organization
ZDV	Zidovudine

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ABSTRACT

Background: Anemia was defined based on age-specific, altitude-adjusted hemoglobin thresholds. It is a common hematological complication among children receiving highly active antiretroviral therapy (HAART) and has been identified as a predictor of early mortality in HIV-infected pediatric cohorts on HAART.

Objective: The aim of this study was to determine the magnitude of anemia and its associated factors among HAART experienced HIV positive children.

Methods: A facility-based prospective cross-sectional study was conducted in Illubabor Zone, Southwest Ethiopia from December, 2025, to February, 2026 among 198 HAART-experienced children. Data were collected through interviews and medical record review. Anemia was determined from venous blood using an automated hematology analyzer. Data were entered into EpiData version 4.6 and analyzed using SPSS 26. Binary and multivariable logistic regression were used, with $p < 0.05$ considered significant.

Result: The magnitude of anemia among participants were 30.2% (95% CI: 23.9–37.4, $n=60$). Normocytic normochromic anemia was the predominant morphological pattern in the current study, accounting for 63.7% of cases, followed by microcytic hypochromic anemia (26.7%) and macrocytic normochromic anemia (10%). Children aged ≤ 7 years had 4.2-fold higher adjusted odds of anemia compared with those aged 14–19 years (AOR 4.2, 95% CI: 1.9–9.1), while those aged 7–14 years had elevated but non-significant odds (AOR 1.8, 95% CI: 0.8–4.1). Taking additional medications or supplements increased anemia risk (AOR 7.8, 95% CI: 1.46–42.5). Low CD4 count was associated with increased odds of anemia (AOR 11.3, 95% CI: 1.22–103.2), although the estimate was imprecise.

Conclusion and Recommendation: This study shows anemia remains common among HAART-experienced children despite high viral suppression (90.4%), indicating that viral control alone is insufficient. Routine hematological monitoring and targeted anemia management should be part of their clinical care, and further studies are needed on its causes and complications.

Key Words: Anemia, Children, HIV, HAART, Ilubabor zone, Ethiopia.

1. INTRODUCTION

1.1. Background

Anemia, defined as a hemoglobin concentration below the normal range for age, sex, and physiological status, reduces the oxygen-carrying capacity of blood and has significant physiological consequences(1).It is a major global health problem, disproportionately affecting children in low- and middle-income countries, and is associated with fatigue, impaired growth, developmental delays, and increased morbidity. The condition is multifactorial in origin, with nutritional deficiencies, infections, and genetic disorders contributing to its prevalence(2)

Among these factors, HIV infection is considered a major contributor in pediatric populations, increasing the risk of anemia through chronic inflammation, opportunistic infections, bone marrow suppression, and adverse effects of antiretroviral therapy, particularly zidovudine anemia is one of the most frequent hematological complications of pediatric HIV and represents a clinically significant problem with direct implications for health outcomes.

The etiology of anemia in the context of HIV is complex and multifactorial. Nutritional deficiencies particularly of iron, folic acid, and vitamin B12—are common contributors, often exacerbated by poverty, poor dietary intake, and malabsorption. Coexisting infections such as malaria, helminth infections, and tuberculosis, further compound the problem in the regions with high HIV prevalence (3,4).In addition to these causes, HIV itself can directly or indirectly impair hematopoiesis. Although the hypothesis of direct HIV infection of erythroid progenitor cells has been investigated, definitive evidence remains lacking. Current evidence indicates that HIV-related inflammation up regulates hepcidin, trapping iron in macrophages and limiting its availability for erythropoiesis, thereby contributing to anemia of inflammation. More likely, the virus exerts its effects through indirect mechanisms, such as the production of pro-inflammatory cytokines that inhibit the proliferation and differentiation of hematopoietic cells within the bone marrow (5).

Furthermore, HIV may blunt the physiological response to erythropoietin, thereby reducing red blood cell production even in the presence of anemia. Autoimmune hemolysis and

neoplastic infiltration of the bone marrow are less common but notable contributors to HIV-associated anemia. Additionally, the use of certain antiretroviral drugs, particularly zidovudine, has been implicated in bone marrow suppression, thereby exacerbating or even inducing anemia in some pediatric patients receiving treatment (6).

The introduction of Highly Active Antiretroviral Therapy (HAART) has revolutionized HIV care and significantly improved survival and quality of life in infected children. However, its effects on anemia are dual: while HAART can improve anemia by suppressing viral replication and immune activation, certain components of HAART regimens—especially ZDV—can cause or worsen anemia due to bone marrow toxicity (7). Children initiating HAART with severe immune suppression often exhibit poorer hematological and clinical responses, emphasizing the need for early diagnosis and timely initiation of therapy to optimize outcomes (8).

1.2. Statement of the Problem

Anemia is one of the most commonly observed hematological abnormalities and an independent poor prognostic marker of HIV disease. The rate of progression and mortality in this subgroup of patients is high compared to non-anemic patients. WHO estimates that over two billion people are anemic worldwide and young children bear the world's highest prevalence rate of anemia (9,10). Globally, HIV remains a major public health challenge with millions affected, and despite advances in treatment, anemia continues to be a critical comorbidity in pediatric HIV (11).

It is especially common among HIV-infected children, both globally and in resource-limited settings such as sub-Saharan Africa (7). In children living with HIV, anemia is not only a prevalent complication but also a significant indicator of disease severity and a predictor of poor outcomes, including higher rates of morbidity, faster disease progression, and increased mortality (12).

In Ethiopia, opportunistic infections such as tuberculosis and pneumonia are the leading causes of morbidity and mortality among pediatric HIV patients, while anemia is the second leading cause and remains a significant public health concern. It is highly prevalent and associated with impaired immunity, disease progression, poor treatment outcomes, and increased mortality, despite being preventable and treatable. Although earlier studies reported a prevalence of 50–90%, more recent estimates (36–42%) still indicate a substantial burden.(13).

In children with HIV, anemia is not merely a laboratory abnormality but a clinically significant condition that directly affects health outcomes. Managing pediatric HIV is further complicated by anemia, especially in regions with limited diagnostic capacity. Its multifactorial nature makes differential diagnosis challenging and requires a comprehensive treatment approach that considers nutritional deficiencies, co-infections, medication side effects, and the effects of the virus itself(14).

Human Immunodeficiency Virus (HIV) remains a major global public health problem. In 2024, about 40.8 million people were living with HIV worldwide, including 1.4 million children aged 0–14 years(15). Numerous studies have shown a strong association between

lower hemoglobin levels and faster progression to Acquired Immune Deficiency Syndrome (AIDS), as well as increased mortality risk. The presence of anemia may reflect underlying opportunistic infections or advanced disease and thus warrants thorough investigation and management (8). In a large multinational study involving 1,571 participants from Africa, Asia, South America, the Caribbean, and the United States, anemia (defined as hemoglobin $\leq$ 10 g/dL) was observed in 12% of individuals at the time of antiretroviral therapy initiation, with significant variation across countries ($p < 0.0001$) (16). In East Africa, the pooled prevalence of anemia among HIV-infected children is about 36.17% according to a recent systematic review and meta-analysis (17).

Moreover, patients infected with intestinal parasites, and not on HAART also develop anemia (18). It is also associated with eating green leafy vegetables and being on cotrimoxazole treatment (19). Anemia has been reported as a very common complication of pediatric HIV infection, associated with a poor prognosis. It has been identified as one of the predictors of early mortality in a cohort of HIV-infected children receiving HAART (19,20).

Anemia is a significant negative predictor of survival among HIV infected children (20)

HIV related anemia decreases the quality of life and survival rate of HIV patients. Anemia may impair physical, socio-emotional and neurophysiological functioning of HIV infected children. It is a risk factor for delayed psychomotor development and cognitive function and also impairs cell-mediated immunity (10). Because of the long-term effects of iron deficiency anemia during infancy it is important to prevent and treat it appropriately as early in infancy as possible (21).

Increasing access to potent ART in resource-limited settings has transformed the prognosis of HIV infection, but adverse events may still occur after therapy initiation. Anemia is commonly seen after ART initiation, whether due to pre-existing HIV related bone marrow suppression or as a side effect of ART (22). The impact of anemia among HIV-infected children is significant, as anemia is a common comorbid condition that worsens disease progression, reduces survival time, and increases mortality risk. Children with HIV are particularly vulnerable due to their high iron requirements, frequent infections, and nutritional deficiencies. Anemia in this population is associated with impaired physical functioning, decreased quality of life, and accelerated HIV disease progression (9,23).

Anemia severity among HIV-infected children varies, with many studies reporting a substantial proportion experiencing moderate to severe anemia.

HAART was reported to increase Hb levels in adults, despite the hematotoxic effects of some individual agents, and this may also apply to children. Several drugs given during the course of HIV disease could cause anemia in children including antiretroviral (24).

The multifactorial pathogenesis of anemia in HIV infection is also related to bleeding (gastrointestinal malignancy/severe infection), insufficient dietary intake (vitamins such as cobalamin and folate, iron, and general malnutrition), hemolytic anemia (i.e., malignancies, infections (25). In HIV-infected patients, anemia may be caused by nutrient deficiencies (iron, folic acid, and vitamin B12), sickle cell disease, HIV/AIDS itself, malaria, hookworm, and other infections. Other mechanisms for HIV-associated anemia, although uncommon, include autoimmune destruction of erythrocytes. Direct infection of marrow precursor cells has been hypothesized but not proven (12,26).

Hematological abnormalities are associated with increased risk of disease progression and death in individuals infected with HIV. Anemia is also a common feature of HIV infection, occurring in approximately 35% of patients who initiate antiretroviral treatment (ART) in Europe and North America, which makes it to be recognized as an important clinical problem (27).

A study in Ethiopia found that among anemic HIV-infected children, 44.4% had mild anemia, 42.2% had moderate anemia, and 13.3% had severe anemia (14). Several studies in Ethiopia have documented the magnitude and associated factors of anemia among HIV-infected children.

A cross-sectional study in the Afar region reported a high anemia prevalence of 53.9% among HIV-infected children on ART. Key predictors included stunting (nutritional status), advanced WHO clinical stage, and lack of antenatal care follow-up (4).

A study in the Awi Zone found an anemia prevalence of 13.3% among HIV-infected children on ART. Factors significantly associated with anemia included low baseline CD4 count (<200 cells/mm³), advanced WHO clinical stages (III or IV), hookworm infection, and malaria infection. The study also highlighted that anemia prevalence in HIV-positive children

in Ethiopia ranges from 16.2% to 46%, with a meta-analysis estimating an overall prevalence of 22.3% (14).

Even though several studies have been conducted on the prevalence of anemia, providing information on its pattern across different geographical locations, age groups, social groups, and risk categories, evidence remains limited regarding its prevalence among children as well as associated risk factors and hematological abnormalities in the southern region of the country, particularly in the study area. Hence, this study was conducted to determine the magnitude and associated factors of anemia among HIV-infected children receiving highly active antiretroviral therapy in public health facilities of the Ilubabor zone, southwest Ethiopia.

This study uniquely contributes at the national level by addressing a geographic evidence gap in southern Ethiopia and providing updated local data on the magnitude and determinants of anemia among pediatric HIV patients. At the global level, it adds context-specific evidence from a resource-limited setting, improving understanding of anemia patterns in HIV-infected children and informing similar settings for targeted prevention and management strategies.

1.3. Significance of the Study

This study was conducted to determine the magnitude and associated factors, of anemia in HAART experienced children in public health facility of Ilubabor zone south west Ethiopia. HIV associated Anemia is always overseen and it could be a challenge for prognosis of patients who are taking HAART.

The study of anemia prevalence and associated factors among children on HAART is crucial because anemia remains a significant complication that impairs immune function, accelerates HIV progression, and increases morbidity in pediatric HIV patients. Despite HAART reducing anemia prevalence, Ethiopian studies report rates between 7% and 22%, influenced by factors such as low baseline CD4 count, advanced clinical stage, and parasitic infections like malaria and hookworm.

Findings of this study will help us to generate essential evidence to strengthen anemia screening, guide targeted interventions, and support comprehensive HIV care for children. Such information is crucial for shaping regional health policies and optimizing resource allocation for integrated pediatric HIV and anemia management, thereby contributing to better treatment outcomes and improved quality of life for HIV-infected children in the region.

2. LITERATURE REVIEW

2.1 :Magnitude of Anemia

Globally, anemia affects nearly 40% of children under the age of 15 living with HIV, with prevalence rates varying widely across different regions. A systematic review indicates that anemia prevalence among ART unexposed HIV-infected children can be as high as 42.8%, with significant reductions observed after the initiation of HAART (17). Studies from West Africa report very high anemia rates (70–88%), followed by Central Africa (63–67%) and East Africa (38–69%) (28,29). A retrospective study conducted among children attending the pediatric HIV comprehensive care clinic at Kenyatta National Hospital revealed that hematological abnormalities are common among HIV-infected children newly enrolled for ART treatment. Anemia was the most frequently observed hematological abnormality, with nearly half of the study population exhibiting a microcytic hypochromic pattern (24).

A follow-up study carried out among Indian children at Dr. Ram Manohar Lohia Hospital reported that, after one year of ART, anemia was present in 36.3% of the children. Among these, eleven had moderate anemia, and none had severe anemia. The study concluded that there was a significant reduction in both the prevalence and severity of anemia following HAART initiation (30). Similarly, a retrospective study involving 248 HIV-infected children aged 1–12 years attending three outpatient clinics in South India found an overall anemia prevalence of 66%, with 8% experiencing severe anemia (30).

In Nigeria, a cross-sectional study on 68 HIV-confirmed children showed that anemia ($Hb < 100$ g/L) was present in 77.9% of participants. Among them, 5.9% had severe anemia (< 60 g/L), 32.3% had moderate anemia (60–70 g/L), and 39.7% had mild anemia (80–99 g/L). The mean hemoglobin concentration declined significantly with disease progression ($p < 0.05$). Additionally, 6% of children had leucopenia, 17.5% had neutropenia, and 2.5% (one child) had thrombocytopenia. These hematologic abnormalities were more prevalent in children in clinical stages B and C, although the differences were not statistically significant (31). A systematic review examining HIV-associated anemia in children from a global perspective found that the prevalence of mild anemia ranged from 22–94%, while moderate anemia ranged from 3–82% (32).

In Ethiopia, a cross-sectional study conducted on 265 HIV-infected children at the Gondar University Hospital ART clinic reported an anemia prevalence of 16.2%. Of the anemic children, 60.5% had mild anemia, 37.2% had moderate anemia, and 2.3% had severe anemia(19). Another cross-sectional study conducted at theZewditu Memorial Hospital ART Clinic in Addis Ababa found an overall anemia prevalence of 22.2%, with 52.5% having mild anemia, 42.5% moderate, and 5.0% severe anemia (27) .

A four-year retrospective study at HiwotFana Specialized University Hospital in Harar, Ethiopia, involving 108 children on ART, reported an anemia prevalence of 54.4%. However, this declined to 39.2% following ART initiation(13) . Additionally, a cross-sectional study conducted at Jimma University Specialized Hospital on hematologic abnormalities among children on HAART showed an anemia prevalence of 21.9% (33).

2.2 :Types of Anemia

Hematological abnormalities are common amongHIV children not on ART, and anemia was the commonest hematological abnormality with almost half of the study population having microcytic hypochromic picture of anemia(37). An observational cohort study among HIV-infected children in a rural Ugandan clinicMbarara, Uganda, showed that microcytic-hypochromic anemia (44.9%) was the commonest type of anemia(12).

A cross-sectional study done on people on second line antiretroviral treatment in Lilongwe, Malawi showed that the prevalence of anemia was 33.2% mild, moderate and severe anemia was 17.5%, 13.8%, and 1.9% respectively. Female participants had a higher prevalence than male participants(40). Another cross sectional study conducted on 265 HIV infected children attending Gondar university Hospital ART clinic showed that About 46.5 % of anemic children had normocytic-normochromic anemia followed by macrocytic-normochromic anemia (39.5%)(19).

In general, anemia is high among ART users with different determinant factors with different types of anemia existing among ART users. However, the prevalence, the determinant factors and types of anemia among children on ART is not much known.

2.3:Associated Factor of Anemia

2.3.1: Socio-Demographic Factors

A retrospective study from 248 HIV-infected children aged 1–12 years attending three outpatient clinics in South India showed that the proportion of underweight and small children in the population was 55% and 46% respectively. Independent risk factors of anemia included the pre-school age group, (OR: 2.87), rural residence (OR: 12.04; p). The magnitude of anemia is high among children from Large family size and low monthly average income(43).

2.3.2:Nutritional Factors

A cohort study done on Prenatally infected children aged 2–12 years at three sites in southern India, which are followed for 1 year showed a high prevalence of anemia mediated by iron deficiency, vitamin A deficiency, Poor nutritional status, chronic inflammation and presence of stunting (Height for- age Z score < -2) (35). Use of iron/multivitamin supplementation was protective against risk of anemia (OR: 0.44; 95% CI, 0.1–1.2)(43).

2.3.3: Clinical Factors

Anemia was independently associated with young age, advanced HIV WHO disease stage (p = 0.034) and low CD4 percentage (34).

A study done on a total of 180 children patients attending Zewditu Memorial Hospital ART Clinic in Addis Ababa, Ethiopia showed that there was a significant increase in severity and prevalence of anemia in those with CD4+ T cell counts below 350 cells/ μ L. Having intestinal parasitic infections (AOR = 2.7, 95% CI, 1.1–7.2), having lower CD4+ T cell count (AOR = 3.8, 95% CI, 1.6–9.4), and being HAART-inexperienced children (AOR = 2.3, 95% CI, 1.6–9.4) were identified as significant predictors of anemia, concluding anemia was more prevalent and severe in patients with low CD4+ T cell counts(12,44).

2.3.4: ART Drugs and Other Medication

Several drugs given during the course of HIV disease could cause anemia in children including antiretroviral (36). HAART was reported to increase Hb levels in adults, despite the hematotoxic effects of some individual agents, and this may also apply to children. Cotrimoxazole is another drug associated with bone marrow suppression and causing anemia(37).

HIV positive children in Northwest Ethiopia have a mild type of anemia and the increase in prevalence of anemia is due to being on cotrimoxazole and eating green leafy vegetables (19).

2.3.5:Infections

Pulmonary tuberculosis was an independent risk factor in (OR: 3.36; 95% CI: 1.43, 7.89) when correlated variables such as HIV disease stage and severe immunodeficiency, and nutritional supplement use were not included (43).

Moreover patients infected with intestinal parasites, and Children newly initiating HAART also will develop anemia(27).

A longitudinal cohort study nested within the Zimbabwe Vitamin A for Mothers and Babies Project showed that at one year of age, HIV-positive infants were 5.26 (AOR, $P < 0.001$) times more likely to be anemic compared to HIV-negative infants (38).

A cross sectional research done in 130 HIV infected Children (0-15 Years) Residing in Nkambe, North West Region, Cameroon aimed to assess effect of ART on anemia showed that there was a significant increase ($P=0.00$) in the mean CD4+, Hb and weight after ART intervention (39).

2:4:Conceptual Framework

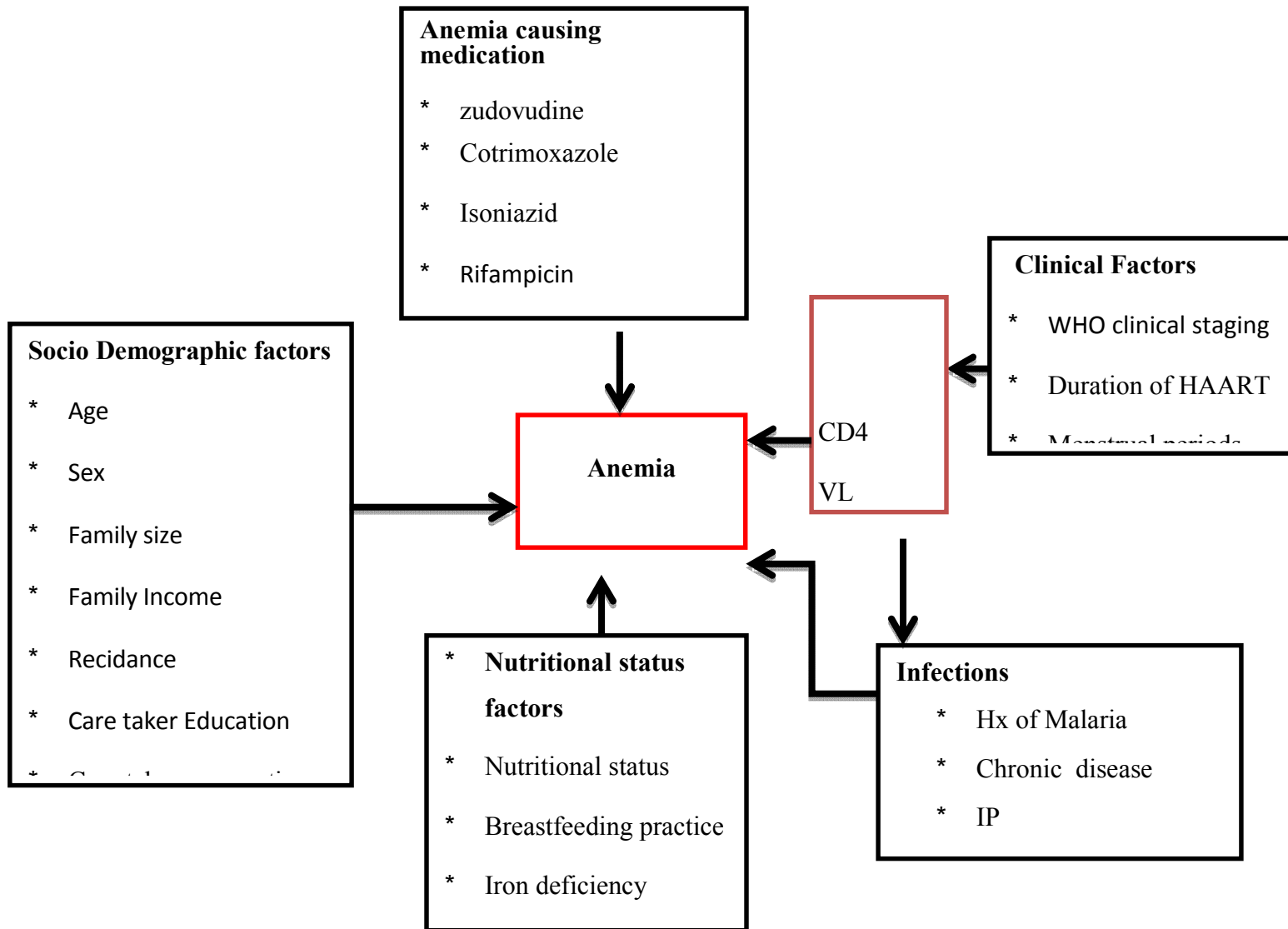


Figure 1. Conceptual Frame Work of Anemia and Associated Factors Among HIV-Infected Children Receiving Antiretroviral therapy, December, 2025 to February, 2026.

Source: -from different literatures

3. OBJECTIVES

3.1. General Objective

To assess the magnitude of anemia and its associated factor among HIV positive children on HAART in public health facilities of Iluababora zone, Oromia, Ethiopia, December 2025.

3.2. Specific Objectives

To determine the magnitude of anemia among HIV positive Children on HAART in public health facilities of Iluababora zone, Oromia, Ethiopia ,December, 2025 .

To identify factors associated with anemia among HIV positive children on HAART in public health facilities of Iluababora zone, Oromia, Ethiopia, December, 2025.

4. METHOD AND MATERIALS

4.1. Study Area and Period

The study was conducted in Ilubabor Zone, which is located approximately 600 km southwest of Addis Ababa, the capital city of Ethiopia. The zone lies along the main road connecting Jimma and Gambella. The total land area of the zone is about 67,000 km². In terms of agro-ecological distribution, Woyna-Dega accounts for the largest proportion (83%), followed by Qolla (17%).

According to the latest administrative estimates, the total population of Ilubabor Zone is approximately 2,271,609, of which around 900,000 are children. In the zone, ten public health facilities currently provide antiretroviral therapy (ART) services for children living with HIV.

4.2. Study Design

Facility based cross sectional study was conducted.

4.3. Population

4.3.1. Source population

All HIV infected children on HAART in public health facilities within the Ilubabor Zone.

4.3.2. Study population

All children on ART follow-up in Ilubabor Zone who met the inclusion criteria during time of this study.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

Children aged 6 months to 19 years who are attending ART clinics at public health facilities in Ilubabor zone during the data collection period and who voluntarily agree to participate were included in this study. The minimum age of 6 months is set because, during the first few months of life, infants experience physiological anemia, reaching the lowest hemoglobin levels at around 2–3 months; by 6 months, hemoglobin levels typically recover. The upper age limit of 19 years was selected because, in Ethiopia, individuals living with Human Immunodeficiency Virus are generally transitioned from pediatric to adult HIV care at 18–19 years of age in most health facilities.

4.4.2. Exclusion criteria

To ensure accurate estimation of current anemia prevalence, children who had a blood transfusion within the past three months or were receiving treatment for previously diagnosed anemia (including iron supplementation) were excluded to minimize treatment-related bias. Nevertheless, children who were found to be anemic at the time of data collection were included to reduce misclassification and capture active cases.

4.5. Sample Size and Sampling Technique

4.5.1. Sample size Determination

The sample size ($n = 198$) was calculated using a single population proportion formula, assuming 13.3% anemia prevalence from a local Awi zone study, with 95% confidence level, 5% margin of error, and 10% non-response.(14). Of 237 eligible children, 198 (83.5%) were included. Using a higher prevalence would require a sample size exceeding the available population; thus, the local estimate ensured feasibility while maintaining acceptable precision. Finite population correction was not applied, as the study aimed for broader generalizability, and the high sampling fraction minimizes its impact on precision. The paper was selected because it was conducted in a similar population of HIV-infected children on HAART in Ethiopia.

4.5.2. Sampling technique

There are 14 government health facilities (public hospitals and health centers) actively providing ART services for HIV-infected persons (both adults and children) in the Ilubabor zone. Out of these, HIV-infected children, who are on ART, found only in 10 health facilities. Therefore, from those 10 health facilities, six health facilities (one hospital and five health centers) were purposively selected based on their level of laboratory service.

The required sample size was then proportionally allocated to each selected facility. Within each facility, children were recruited consecutively as they attended ART follow-up visits during the study period until the allocated sample size was achieved.

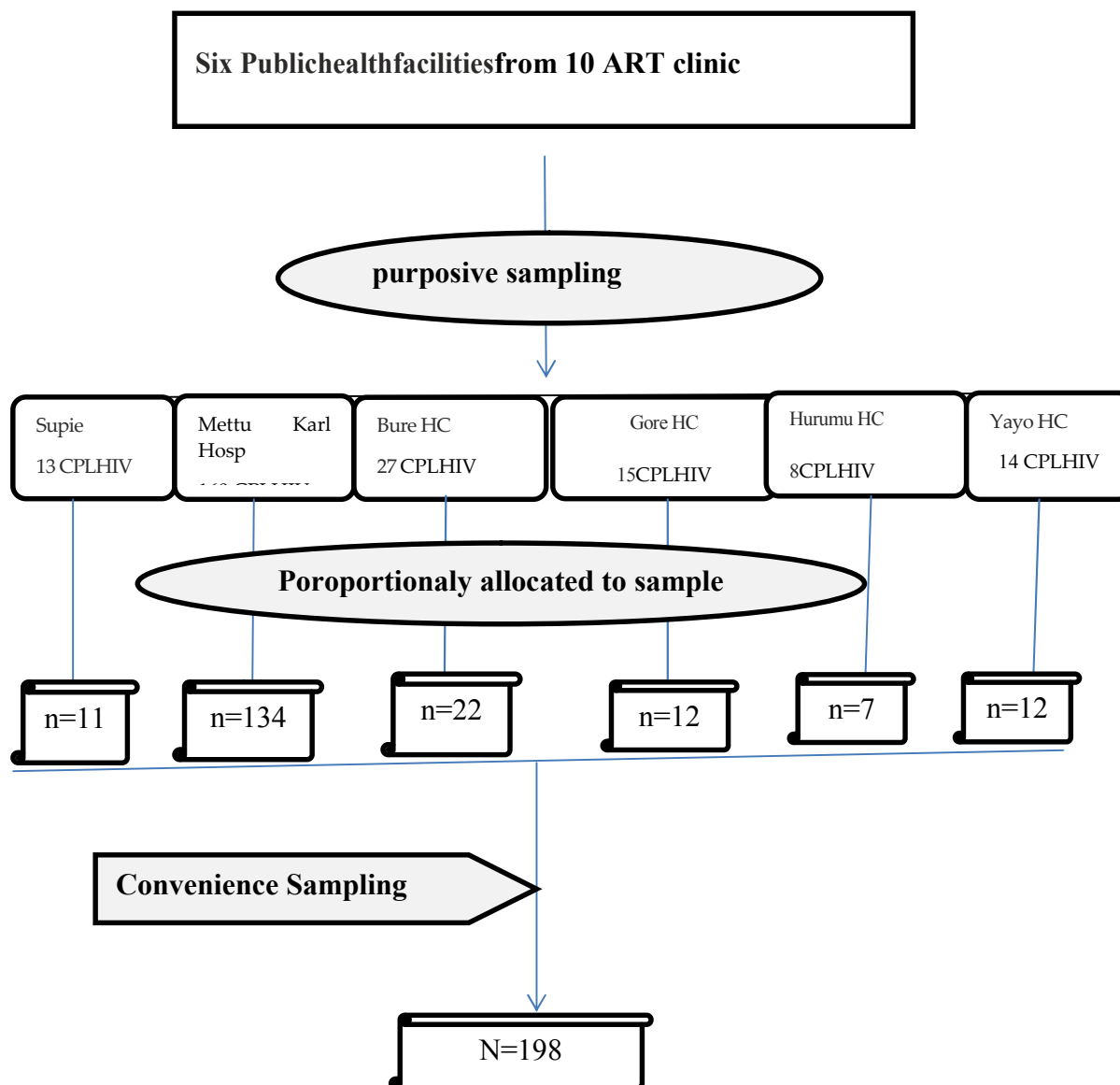


Figure 2. Diagrammatic presentation of sampling technique of Study participant , south west Ethiopia, December, 2025 to February, 2026.

4.6. Study Variables

4.6.1. Dependent variable

- Anemia

4.6.2. Independent variables

Sociodemographic Variables: Age of the child, sex of the child, residence, family income, family size, guardians' or parents' educational status, guardians' or parents' occupation, and children's educational status

Clinical and Health-Related Variables: History of malaria, presence of opportunistic infections, IP, CD4 count, Viral load, type and duration of antiretroviral therapy (HAART), and Nutritional status.

4.7. Data Collection Technique and Instruments

4.7.1. Socio-demographic and clinical data collection

Socio-demographic and clinical data was collected by using semi- structured and pretested questionnaire by trained data collector. The questionnaires were developed by reviewing the relevant literature and pretested in similar setups before the actual data collection to increase the quality of the data. It was prepared first in English version and then translated to Afanoromo and again to English to confirm the correctness of the translation. A detailed review of the medical records was done for each child to collect data for baseline Hbg concentration, WHO clinical staging and types of drug by using check list. Laboratory results for hematological parameters, CD4 count and parasitological examinations was collected by using laboratory format designed for this study.

4.7.2. Blood and stool collection

After interview and detailed review of the medical record, the study participants were sent to laboratory where blood and stool is collected for determination of complete blood count, CD4 count, viral load, blood film and intestinal parasites, and the result was collected within six hours and filled on the data collection format. About Three milliliter(pediatric-safe phlebotomy volume) of venous blood was collected from each study participant using ethylene diamine tetra acetic acid (EDTA) anticoagulated test tube by Vacutainer technique.

Stool sample was collected from each study participant and assessed for intestinal parasitic infection using wet mount preparation. A single stool specimen was collected from each patient using clean, dry, leak proof, and wide-mouthed caps; a drop of saline was mixed by an applicator stick on the slide.

4.7.3. Blood and stool sample analysis

Hematological parameters: Hbg concentration, mean cell volume (MCV), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), red blood cell (RBC) count and red cell distribution width (RDW) were determined using hematological auto-analyzer (ruby Cell-Dyne USA) within 30 minute after collection. CD4 count was assayed using the Becton Dickenson (BD) FACS count (BD, USA). Low, normal and high control reagent was used for both hematology and CD4 analyzer to check the accuracy and precision of the results. Analysis were only continued when three of the control reagent passed. Thin and tick blood film was done for morphological identification and for malaria parasite and analyzed. The result of the test was recorded on the laboratory format designed for this research (Annex I, Part V).

The collected stool specimen was examined for intestinal parasites within 10–15 minutes of collection.

4.7.4. Anthropometric data collection

The weight of the children was measured using automatic weighing scale which was calibrated twice daily. It was recorded to the nearest 0.1kg. Height of the child was also measured by height scale (batch number-M-37/123/5097, INDIA). For those less than two years of age, length measurement was conducted using a length measuring board in a recumbent position on a hard and flat surface. For those who were two years old and above, height was measured on a standing position by prestige weight scale (manufacturer-hospital equipment manufacturing company (HENC)). Height (length) of the child recorded to the nearest 0.1cm. BAZ for these age above five years, HAZ and WAZ score was analyzed using the WHO Anthroplus software and was expressed as standard deviation (mean $\pm$ SD) designed (28). All equipment and reagents were supplied by participating health facilities.

4.8. Data processing and statistical analysis

Data entry was made using EpiData version 4.6 and the data were exported to SPSS version 26 statistical software for analysis. Prior to analysis data processing activity such as coding, categorizing, cleaning, and computing were performed. Descriptive statistics was applied to determine the outcome variable and explore the characteristics of the patients. Prevalence of anemia among HIV positive children on HAART was estimated by proportion along with 95% CI and margin of error of 5%.

Bivariable analysis had been performed. All variables with p-value < 0.2 in bivariable logistic regression was entered to multivariable logistic regression model and forward stepwise regression method was used for analysis.

The adjusted odds ratio (AOR) with a 95% confidence interval was estimated to assess the strength of association and P value of < 0.05 used to declare the statistical significance in the multivariable analysis. Multicollinearity among independent variables was checked. In addition the fitness of the model was checked using the Hosmer and Lemeshow goodness of fit-test.

4.9. Data quality assurance

Training Was given to sample collectors and supervisor for one day on how to approach study subject. Supervisors was played a central role in managing data quality by overseeing field and laboratory activities, ensuring adherence to protocols, and providing immediate corrective feedback when deviations occur. To ensure quality of data, sample was handled and checked depending on the standard operating procedure in place (Annex II), and proper handling of quality control materials and reagents was checked daily. Calibration of analyzers was also checked and quality control testing for BD FACS count and CBC analyzer was performed before running tests. The quality of the Geimsa stains also maintained daily. A pretest was conducted at Bedele Hospital on 10% of participants to ensure tool clarity and validity, and revisions was made before data collection. The questioner was also checked daily for the completeness of necessary information and appropriate measure was taken on time to correct any incompleteness before data entry and running of the test. Data clean up and cross checking was done before analysis.

4.10. Ethical consideration

Ethical clearance was obtained from the Research Ethics Committee of Wallaga University, Institute of Health Sciences. The study was adhere to national research ethics guidelines and international ethical standards guidelines, particularly regarding research involving vulnerable populations such as children and individuals living with HIV.

Written informed consent was obtained from the parents or legal guardians of all participating children (Annex III). Additionally, age-appropriate assent was obtained from children aged seven years and above. Participation was entirely voluntary, and all participants were had the right to withdraw from the study at any time without any Consequences on their ongoing HIV care and treatment (Annex IV).

Given the Susceptibility of the study population, children living with HIV special attention was paid to protect their dignity, rights, and well-being. Confidentiality of all personal and medical information was rigorously maintained. Data was Anonymized using unique participant codes, and access to sensitive information was strictly limited to authorized research personnel.

The study was ensured that no procedures interfere with the routine HIV care and support the participants where receiving. Children found to had anemia or other medical concerns during the study was referred to appropriate healthcare services in coordination with their existing HIV care providers. All study procedures was conducted with respect and care for the best interests of the child participants (Annex III).

4.11. Plan for dissemination and utilization of results

The findings of this study will be disseminated through multiple channels. Initially, results will be presented at Wallaga University, Institute of Health Sciences. Subsequently, the findings will be shared at relevant national and international scientific conferences. In addition, results will be communicated to local health authorities and key stakeholders to support evidence-based policy and programmatic decision-making. Finally, the study will be submitted for publication in peer-reviewed scientific journals.

4.12. Operational definition

ART: A treatment regimen containing at least three different anti-retroviral drugs (29).

Anemia: Anemia was operationally defined based on the criteria of the World Health Organization as a hemoglobin (Hb) concentration below the age-specific reference value after altitude adjustment. Accordingly, anemia was considered present when the hemoglobin level was <11 g/dL for children younger than 5 years, <11.5 g/dL for children aged 5–11.9 years, and <12 g/dL for children aged 12–14.9 years. The severity of anemia was further categorized as mild anemia (Hb 10–10.9 g/dL for children under 5 years and 11–11.9 g/dL for children aged 5–14.9 years), moderate anemia (Hb 7.0–9.9 g/dL for children under 5 years and 8.0–10.9 g/dL for children aged 5–14.9 years), and severe anemia (Hb <7.0 g/dL for children under 5 years and <8.0 g/dL for children aged 5–14.9 years). In addition, anemia was morphologically classified using red blood cell indices obtained from the complete blood count as normocytic (mean corpuscular volume [MCV] 76–96 fL), microcytic (MCV <76 fL), or macrocytic (MCV >96 fL), and according to hemoglobin concentration within red blood cells as normochromic (mean corpuscular hemoglobin concentration [MCHC] 31–35 g/dL) or hypochromic (MCHC <31 g/dL) (30)

HAART Experienced: People who have already taken one or more forms of HIV medication.

HAART un exposed: HIV positive patients who have never taken any anti-retroviral therapy for their infection (31).

Preschool children: Are those children whose age is less than seven.

Schoolchildren: Are those children whose age is greater than seven (32).

5. RESULT

5.1. Socio-demographic characteristics of the participants

All 198 eligible children were enrolled in the study, resulting in a 100% response rate and complete data availability. The participants' mean age was 12.3 ± 3.2 years, with an age range of 1–19 years. Among participants (48.5%) were adolescents aged 14–19 years, while 26.8% were preschool children. A slight male predominance was observed ($n=110$, 55.6%), and the majority resided in urban areas ($n=142$, 71.7%). Most participants were attending primary school (59.1%). Caregivers were predominantly housewives (35.4%) or daily laborers (25.8%), with 37.4% having primary education and 29.3% having no formal education. Mothers served as the primary caregivers for 53.0% of children, followed by fathers (18.2%) and grandparents (16.2%). The average household income was below 5000 ETB for (54.0%) of participants (Table 1).

Table 1:Socio-demographic characteristics of the study participants at in Public Health Facilities of Iluababora Zone, Oromia, Ethiopia, from December,2025 to February, 2026(n=198)

Variable	Category	N(%)
Age	≤7 7-14 14-19	53(26.8) 49(24.7) 96(48.5)
Sex	Male Female	110(55.6) 88(44.4)
Residence	Urban Rural	142(71.7) 56(28.3)
Educationalstatus	kindergarten Primary Secondary College	47(23.7) 117(59.1) 28(14.1) 6 (3)
Care taker Occupation	Farmer House wife Daily laborer Merchant Gov't employer Student	27(13.6) 70(35.4) 51(25.8) 13(6.6) 32(16.2) 5(2.5)
Care taker educational status	No formal education Primary Secondary College and above	58(29.3) 74(37.4) 37(18.7) 29(14.6)
Primary Care taker	Father Mother Grand parent Orophan Older sibling Uncle Aunt	36(18.2) 105(53.0) 32(16.2) 6(3) 6(3) 3(1.5) 10(5.1)
Average monthly income HH	>5000 ETB <5000ETB	91(46.0) 107(54.0)

5.2. Clinical and immunologic characteristics of the study participants

Most of the participants (n=191) were in WHO clinical stage of either 1 or 2. From the total study participants 3.5% had temperature of >37 degree centigrade ($^{\circ}\text{C}$). None of the participants has diarrhea. The prevalence of intestinal parasitosis was 2.5%. Active malaria was detected in 3% of the study participants. From the total study participants 94.4% were on First line HAART regimen, other medications were sparse, with 96.0% on none and 2.5% on nutritional supplements and 3.5 % had CD4 cell count of less than or equal to 350 and 90.4% had viral load test target not detected. Nutritional status was favorable, with wasting (WAZ <-2) in only 2.5%, stunting (HAZ <-2) in 2.0%, and low (BMI-for-age <-2) in 1 of 163 children >5 years 0.6%. Among 59 girls ≥ 8 years, 42 (71.2%) had menstrual periods. (Table 2).

Table 2: Clinical and immunologic characteristics of the study participants at Public Health Facilities of Iluababora Zone, Oromia, Ethiopia, from December, 2025 to February, 2026

VARIABLES	CATEGORY	N=198(%)
WHO stage	1 and 2 3 and 4	191(96.5) 7(3.5)
Intestinal parasites	Yes No	5(2.5) 193(97.5)
Malaria	Yes No	6(3.0) 192(97.0)
Temperature	≤ 37 > 37	193(96.5) 5(3.5)
Other medication	No Cotrimoxazole Zidovudine	190(96.0) 3(1.5) 5(2.5)
ART Regimen	First line Second line	188(94.8) 10(5.1)
CD4 cell	≤ 350 > 350	7(3.5) 191(96.5)
viral load	≤ 150 > 150	179(90.4) 19(9.6)
Menstrual periods (for girls aged ≥ 8 years)	Yes No	42(71.2) 17(28.8)
WAZ	< -2 > -2	5(2.5) 193(97.5)
HAZ	< -2 > -2	4(2.0) 194(98.0)
BMI for age above 5 years	< -2 > -2	1(0.6) 162(99.4)

5.3. Magnitude of anemia

The magnitude of anemia among participant was 30.2% (n=60). Children younger than seven years old had a higher prevalence, 50.9% (n=27) of anemia.

Males had slightly higher anemia (33.6%) than females (26.1%). Urban residence predominated (71.7%) with comparable anemia rates to rural (29.6% vs 32.1%). Secondary school students showed high anemia (64.3%), contrasting primary school (22.2%).

Advanced WHO stage 3-4 showed 42.9% anemia versus 29.8% in early stages. Among participant on Second-line HAART regimen anemia prevalence was 90% versus 31.4% on first-line regimen treatment. Children with Low CD4 ≤ 350 cells/ μ L had 85.7% (n=6) anemia, and participants with higher viral loads >150 copies/mL had 52.6% anemia prevalence.

Most patients (96.0%) received no additional medications beyond HAART, with 28.4% anemia prevalence. Severe malnutrition (HAZ/WAZ ≤ -2) carried 75-80% anemia prevalence despite low occurrence (2.0-2.5%). (Table 3).

Table 3: Magnitude of anemia among HAART experienced children at Public Health Facilities of Ilu ababora Zone, Oromia, Ethiopia, from December,2025 to February ,2026.

Variable	Category	Anemia YES (n, row %)	Anemia NO (n, row %)	Total (n, %)
Sex	Male	37 (33.6)	73 (66.4)	110 (55.6)
	Female	23 (26.1)	65 (73.9)	88 (44.4)
Age (years)	≤7	27 (50.9)	26 (49.1)	53 (26.8)
	7-14	15 (30.6)	34 (69.4)	49 (24.7)
	14-19	18 (18.8)	78 (81.2)	96 (48.5)
Residence	Rural	18 (32.1)	38 (67.9)	56 (28.3)
	Urban	42 (29.6)	100 (70.4)	142 (71.7)
Educational status	Kindergarten	23 (48.9)	24 (51.1)	47 (23.7)
	Primary	26 (22.2)	91 (77.8)	117 (59.1)
	Secondary	18 (64.3)	10 (35.7)	28 (14.1)
	College	1 (16.7)	5 (83.3)	6 (3.0)
Monthly HH income	≤5000 ETB	31 (29.0)	76 (71.0)	107 (54.0)
	>5000 ETB	29 (31.9)	62 (68.1)	91 (46.0)
WHO stage	1 and 2	57 (29.8)	134 (70.2)	191 (96.5)
	3 and 4	3 (42.9)	4 (57.1)	7 (3.5)
ART Regimen	First line	59 (31.4)	129 (68.6)	188 (94.9)
	Second line	1 (10.0)	9 (90.0)	10 (5.1)
Other medication/supplement	No	54 (28.4)	136 (71.6)	190 (96.0)
	Cotrimoxazole	2 (16.1)*	1 (20.0)*	3 (1.5)
	Ziduvodine	3(75.0)*	2(25.0)*	5 (2.5)
CD4 Count	≤350	6 (85.7)	1 (14.3)	7 (3.5)
	>350	54 (28.3)	137 (71.7)	191 (96.5)
Viral load	≤150	50 (27.9)	129 (72.1)	179 (90.4)
	>150	10 (52.6)	9 (47.4)	19 (9.6)
HAZ	≤-2	3 (75.0)	1 (25.0)	4 (2.0)
	>-2	57 (29.4)	137 (70.6)	194 (98.0)
WAZ	≤-2	4 (80.0)	1 (20.0)	5 (2.5)
	>-2	56 (29.0)	137 (71.0)	193 (97.5)

*Note: Small subgroups (n=3,5) yield unstable row %,),HAZ:height for age z score,WAZ :weight for age Z score

5.4. Associated factors of Anemia

Multivariable logistic regression identified age group, use of other medications or supplements, and CD4 count as factors associated with anemia among pediatric HIV patients on HAART. Children aged ≤ 7 years had 4.2-fold higher adjusted odds of anemia compared with those aged 14–19 years (AOR 4.2, 95% CI: 1.9–9.1), while those aged 7–14 years had elevated but non-significant odds (AOR 1.8, 95% CI: 0.8–4.1). Taking other medications or supplements that cause anemia was associated with a 7.8-fold increase in anemia odds (AOR 7.8, 95% CI: 1.46–42.5). A CD4 count of ≤ 350 cells/ μ L was associated with higher odds of anemia (AOR 11.3, 95% CI: 1.22–103.2). (Table 3)

Table 4: Bivariable and Multivariable Logistic Regression Analysis of Factors Associated with Anemia Among 198 Pediatric HIV Patients on ART, Ilubabor Zone, Ethiopia from December ,2025 to February, 2026

Variable	Category	COR (95% CI)	COR p-value	AOR (95% CI)	AOR p-value
Age	≤7	4.5 (2.14-9.464)	<0.001	4.2 (1.9-9.1)	<0.001
	7-14	1.912 (0.86-4.23)	0.110	1.8 (0.8-4.1)	0.2
	14-19	1			
Sex	Male	1			
	Female	1.432 (0.772-2.659)	0.255		
Residence	Urban	1			
	Rural	0.887 (0.455-1.727)	0.724		
Education Status	Kindergarten	1			
	Primary	4.8 (0.519-44.202)	0.2		
	Secondary	1.43 (0.160-12.8)	0.750		
	College	2.8 (0.28-27.21)	0.38		
HH Income	<5000 ETB	1			
	>5000 ETB	0.9 (0.48-1.6)	0.66		
Caretaker EDU	No	1			
	Primary	1.92 (0.71-5.23)	0.22		
	Secondary	2.51 (0.566-4.02)	0.411		
	College	0.733 (0.23-2.4)	0.61		
HAART Regimen	First line	1			
	Second line	4.12 (0.510-33.24)	0.2	9.52(0.56–162.94)	0.12
Other Medication	No	1		1	
	Yes	7.556 (1.48-38.604)	0.015	7.8 (1.46-42.5)	0.021
WHO Stage	1&2	1			
	3&4	0.567 (0.123-2.62)	0.467		
CD4 Count	>350	1		1	
	≤350	15.2 (1.79-129.42)	0.013	11.3 (1.22-103.2)	0.033
Viral Load	≤150	1		1	
	>150	2.87 (1.10–7.46)	0.031	0.6 (0.2-2)	0.337
HAZ	<-2	7.21 (0.734-70.81)	0.090	5.2 (0.44-62.3)	0.092
	≥-2	1		1	

Note: HH income: House hold income

5.5. Type and severity of anemia among participants

Anemia subtyping was performed exclusively using age-adjusted red blood cell (RBC) indices, incorporating pediatric age-specific reference ranges as delineated in the operational definitions to precisely classify cases across all age range of participants. Due to resource limitations, peripheral blood film morphology was not conducted. This quantitative methodology identified three distinct morphological categories—microcytic hypochromic, normocytic normochromic, and macrocytic normochromic (Figure 1).

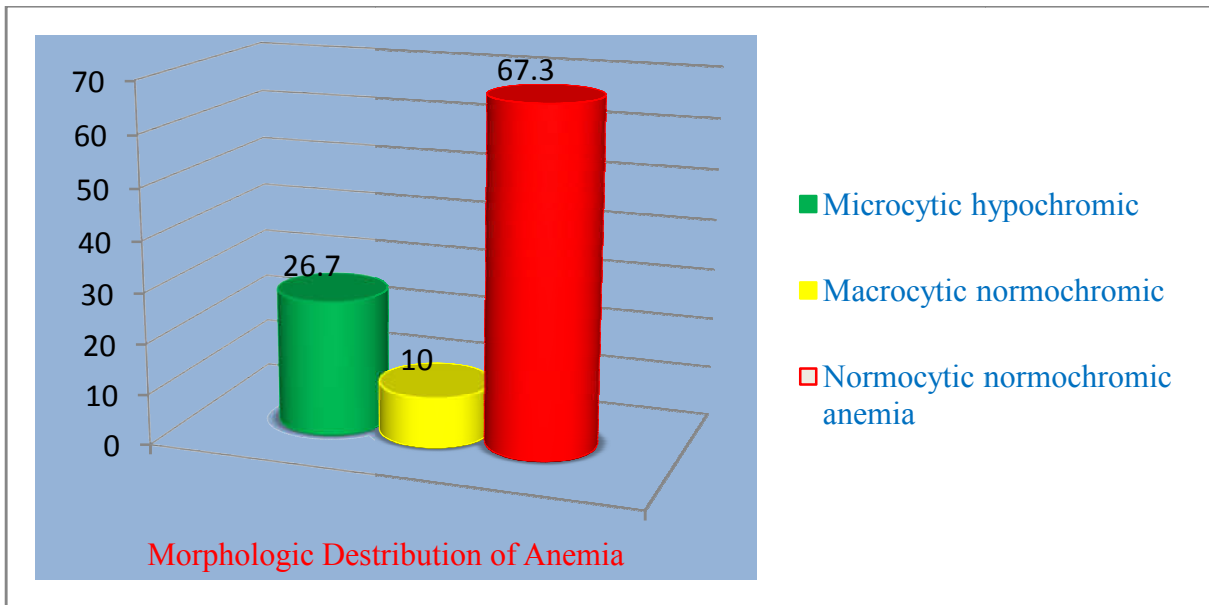
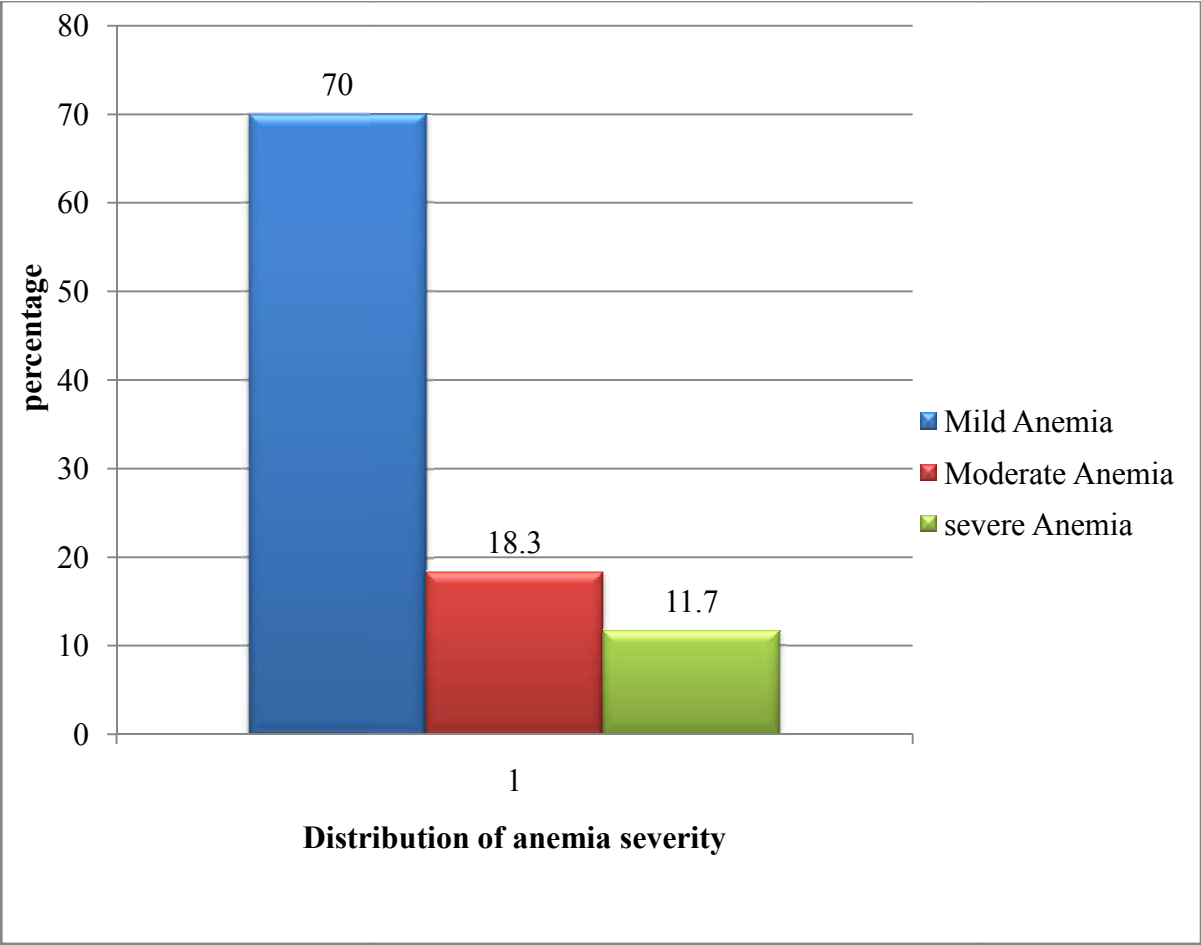


Figure 3: Morphological distribution of anemia among HAART experienced children at Ilubabor Zone, Ethiopia from December, 2025 to February, 2026

Theseverity distribution of anemia amongstudyparticipants werestudied based on age-specific reference ranges for hemoglobin and hematocrit levels, stratifying cases into mild, moderate, and severe categories as per established pediatric hematology criteria outlined in the operational definitions(Figure2).

Figure 4: Distribution of severity of anemia among HAART experienced children at Ilubabor Zone, Ethiopia from December,2025 to February,2026



6. DISCUSSION

The present study documented an intermediate anemia prevalence of 30.3% among pediatric HIV-infected patients receiving HAART. Globally, this prevalence is substantially lower than reports from high-burden settings, including Lagos, Nigeria (77.9%) (33), western Uganda (57.6%) (12), and India (47.1%) (34). Elevated estimates in these settings often emerge from delayed ART initiation, advanced immunosuppression (WHO stage 3–4), and compounded burdens of opportunistic infections, malaria, and severe acute malnutrition. The lower prevalence observed in our study likely reflects earlier ART access, better virologic suppression, and structured monitoring within pediatric HIV programs.

At the African regional level, studies consistently report moderate-to-high anemia prevalence among HIV-infected children, particularly in cohorts with suboptimal ART adherence or advanced disease at enrollment. For instance, Nigeria reports 39.7% mild, 32.3% moderate, and 5.9% severe anemia (35); Burkina Faso shows 25.2% mild, 50.3% moderate, and 6.0% severe (36); and studies from Malawi frequently identify moderate anemia as the dominant category, with severe anemia generally <10% (37). Compared to these regional benchmarks, our cohort demonstrated a milder severity distribution (70% mild, 18.3% moderate, 11.7% severe), suggesting improved clinical stability and effective inflammation control.

Within Ethiopia, the observed prevalence occupies an intermediate position relative to facility-based studies. It is higher than Hawassa University Comprehensive Specialized Hospital (11.4%) (10), Mekelle (7%) (38), and the national pooled prevalence (23.8%) (8), but lower than Gondar University Hospital (53.9%) (19) and Eastern Ethiopia (39.2%) (13). It partially overlaps Jimma University (21.9–40%) (39) and approximates Zewditu Memorial Hospital (22.2%) (14). The intermediate magnitude observed in this study may reflect a transitional stage of antiretroviral therapy program implementation, wherein improvements in virologic suppression coexist with persistent nutritional and hematologic vulnerabilities, in contrast to settings with more mature program coverage or those experiencing a higher underlying disease burden.

Normocytic normochromic anemia was the predominant morphological pattern in the current study, accounting for 63.7% of cases, followed by microcytic hypochromic anemia (26.7%) and macrocytic normochromic anemia (10%). This distribution closely mirrors findings from Hawassa (64.5%, 16.1%, and 19.4%, respectively)(10), and aligns with reports from Tigray, where normocytic anemia ranged from 46.5% to 64.5%(38). The consistency of anemia morphology across Ethiopian settings supports the persistence of HIV-associated chronic inflammation, mediated through cytokine and hepcidin pathways, even in the context of excellent ART response (90.4% viral suppression).

This contrasts with pre-ART cohorts from Jimma, where higher proportions of microcytic anemia (approximately 40% among ARV-naïve patients) were reported(31). The relatively higher microcytic fraction observed in the current study compared with Hawassa likely reflects greater iron malabsorption associated with household poverty (54%)(10), while the lower macrocytic proportion relative to Tigray (39%)(38) is consistent with predominant first-line ART use, minimizing zidovudine-related bone marrow suppression.

The present study demonstrated that mild anemia predominated (70%), with moderate (18.3%) and severe anemia (11.7%) being less frequent. This pattern indicates a generally milder anemia profile compared with several African and Ethiopian cohorts.

At the regional African level, studies from Nigeria and Burkina Faso report a predominance of moderate anemia, with severity distributions of 39.7% mild, 32.3% moderate, 5.9% severe and 25.2%(33), mild, 50.3% moderate, 6.0% severe(36), respectively. Similarly, Malawi consistently shows moderate anemia as the dominant category, with severe anemia generally <10%(37). These findings contrast with the present study, where mild anemia is the dominant severity class, suggesting better disease control and reduced infection-driven hematologic complications in the current cohort.

Within Ethiopia, severity profiles vary by region and treatment setting. In Tigray, severe anemia accounted for 25% of cases(38), reflecting a substantially higher burden of advanced anemia. Hawassa reported 41.9% mild, 51.6% moderate, and 6.5% severe anemia, again highlighting predominance of moderate anemia(10). Conversely, facility-based cohorts from Gondar University Hospital and Zewditu Memorial Hospital (Addis Ababa) showed milder severity patterns, with severe anemia limited to 2.3%(19) and 5.0%(27), respectively. Awi

Zone reported 44.4% mild, 42.2% moderate, and 13.3% severe anemia(14), indicating a relatively higher severe anemia burden compared with other Ethiopian cohorts. HiwotFana reported a notable proportion of moderate (44.7%) and severe anemia (7.8%) prior to ART initiation(40).

Compared with these Ethiopian findings, the present study demonstrates a higher proportion of severe anemia than Gondar, Zewditu, Hawassa, and West African cohorts, but lower than Tigray and similar to Awi Zone. Importantly, severe anemia in the current cohort was largely confined to a small subgroup of immunosuppressed children, indicating that residual immune compromise remains the main driver of severe anemia, even in a cohort with high immune reconstitution (96.5% CD4 >350 cells/ μ L). Overall, the severity distribution supports a transition from infection-driven anemia to nutritional etiologies, reflecting improved ART outcomes and clinical stability in this population.

In multivariable analysis, younger age was a strong independent predictor of anemia among HIV-infected children in Ethiopia, with those aged ≤ 7 years exhibiting 4.2-fold higher adjusted odds compared with adolescents aged 14–19 years (AOR = 4.2; 95% CI: 1.9–9.1). This pattern is consistent with reports from Ethiopian sites including Hawassa, Eastern Ethiopia, HiwotFana Specialized Hospital, Zewditu Memorial Hospital, Bahir Dar, Gondar University Hospital, and national pooled analyses. The increased risk in younger children reflects rapid growth and elevated micronutrient requirements, immature erythropoiesis and immune function, and heightened susceptibility to infections and chronic inflammation, all of which are exacerbated by HIV-related nutrient depletion(41). These biological vulnerabilities, compounded by poverty, food insecurity, and high infection burden—evident in the 54% of households earning <5000 ETB/month—explain why younger age consistently predicts anemia in Ethiopian and broader African pediatric HIV populations.

In the current study, descriptive analysis demonstrated clear differences in anemia prevalence according to other medication/supplement use. Among children not receiving any additional medication, anemia was observed in (28.4%). In contrast, anemia prevalence varied among those receiving specific medications. Children on cotrimoxazole prophylaxis had anemia in (16.1%), whereas a markedly higher proportion of anemia was observed among children receiving zidovudine, with (75.0%) affected. Although the number of children receiving

cotrimoxazole and zidovudine was small, the disproportionately high prevalence of anemia among zidovudine users suggests a potential medication-related hematologic effect, consistent with previous reports(42). This highlights that certain medications, particularly zidovudine, may contribute directly to anemia through bone marrow suppression or interference with red blood cell production.

In the multivariable logistic regression model, use of other medications was associated with nearly an eightfold increased likelihood of anemia (AOR = 7.8; 95% CI: 1.46–42.5; $p = 0.021$), confirming that other medication use was an independent predictor of anemia in this cohort. These results are consistent with reports from Ethiopian settings highlighting the role of prophylactic and adjunctive therapies in modifying anemia risk among children living with HIV(7,28,41). Clinically, this emphasizes the need for careful selection and monitoring of adjunctive medications, particularly zidovudine, to reduce anemia-related morbidity in pediatric HIV care.

In this study, low CD4 counts (≤ 350 cells/ μ L) were strongly associated with anemia. Among children with CD4 ≤ 350 , 85.7% were anemic, compared with a much lower prevalence in children with CD4 > 350 . After adjusting for age, sex, ART regimen, viral load, and other medications, low CD4 remained a significant independent predictor of anemia (AOR = 11.3; 95% CI: 1.22–103.2). The wide confidence interval likely reflects the small sample size in the low CD4 subgroup but confirms that immune suppression is a major independent determinant of anemia in this cohort. Globally, low CD4 count has been consistently associated with anemia in pediatric HIV cohorts, as immunosuppression increases susceptibility to opportunistic infections, chronic inflammation, and bone marrow suppression, and anemia is a strong predictor of disease progression and mortality(43,44). Studies from Uganda and South Africa show that hemoglobin recovery often lags behind CD4 restoration after ART initiation, indicating a delayed hematologic response even after immune reconstitution(12,22). In Ethiopia, studies from Gondar , Afar , Tigray , Awi Zone , and Zewditu Hospital (4,14,19,27,38), consistently reported that low CD4 counts and advanced WHO stage are significant predictors of anemia, indicating that immunosuppression remains the dominant driver. This finding is consistent with global and Ethiopian evidence showing that low CD4 count increases susceptibility to opportunistic infections, chronic inflammation, and bone marrow suppression, all of which contribute to

hematologic deficits.

Notably, our study also included a higher proportion of children achieving CD4 >350 cells/ μ L, reflecting improved ART adherence and viral suppression. This suggests a shift in anemia etiology from purely immunosuppressive causes toward nutritional deficiencies, inflammation, and hematotoxic medication effects. Nevertheless, the persistence of anemia despite CD4 recovery underscores that hematologic normalization lags behind immune restoration, emphasizing the need for ongoing anemia screening, nutritional assessment, and monitoring for high-risk children, even when immune function appears restored.

Viral load was not independently associated with anemia after multivariable adjustment in the current study (AOR 0.6, $p = 0.337$), despite a higher crude anemia prevalence among children with viral loads >150 copies/mL (52.6%, $n = 19$). This finding contrasts with reports from Hawassa, where detectable viral load remained an independent predictor of anemia, as well as Indian pediatric cohorts in which ongoing viremia was strongly associated with hematologic suppression through chronic inflammation and bone marrow dysfunction (10,45). Similar significant associations have been documented in pre-ART and early ART African cohorts from Uganda, and Nigeria, where poor viral suppression was common and anemia remained predominantly infection-driven (12,46). In contrast, the absence of an independent association in the present study is consistent with findings from Gondar and Jimma, where viral load lost statistical significance after adjustment, reflecting sustained ART exposure and improved virologic control (10,39). The very high viral suppression rate observed in this cohort (90.4% $\leq$ 150 copies/mL) likely attenuated the biological contribution of HIV replication to anemia by reducing inflammatory cytokine activation, opportunistic infections, and direct marrow suppression. Globally, studies from Europe and North America similarly demonstrate that in mature ART programs with high viral suppression coverage, viral load is no longer a dominant determinant of anemia, with nutritional deficiencies and age-related vulnerability emerging as stronger predictors. This epidemiologic transition from infection-mediated anemia in the pre-ART era to nutritionally driven anemia in established ART settings plausibly explains the divergence between the current findings and earlier Ethiopian and Asian studies conducted in settings with lower suppression rates.

Limitation of the study

This study has several important limitations that should be considered when interpreting the findings. The cross-sectional design limits the ability to establish temporality and causal relationships between exposures and anemia outcomes.

A potential selection bias may have arisen from facility-based recruitment, which may not be fully representative of all HIV-infected children, particularly those not engaged in care or lost to follow-up.

Recall bias may have affected caregiver-reported information on past medical history, medication exposure, and nutritional status. In addition, lack of altitude adjustment for hemoglobin values may have led to misclassification of anemia status. Small subgroup sample sizes reduced statistical power and precision, resulting in wide confidence intervals.

Resource constraints also limited peripheral blood smear examination and iron biomarker assessment, restricting etiological classification of anemia. Finally, the predominantly urban study population limits generalizability to rural settings, and the absence of detailed dietary data constrained assessment of nutritional determinants.

7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

Anemia remains highly prevalent among children living with HIV despite high rates of viral suppression, suggesting that virologic control alone may not be sufficient to address this comorbidity. In this study, viral load was not independently associated with anemia, indicating that other factors such as nutritional status and socioeconomic conditions may play a more important role. These findings underscore the importance of integrating routine anemia screening and nutrition-focused interventions into pediatric ART services, in line with the Ethiopian National HIV/AIDS and ART guidelines.

7.2. Recommendations

In line with the Ethiopian National ART Guideline, routine anemia screening should be integrated into pediatric HIV care with regular hemoglobin monitoring and strengthened nutritional assessment during ART follow-up. Given the persistent burden of anemia, targeted iron and micronutrient supplementation, along with structured caregiver counseling on dietary diversity, should be prioritized, and food support strengthened for socioeconomically vulnerable families to address predominantly nutrition-related (microcytic) anemia. Future studies should adopt longitudinal designs and include dietary assessment, iron biomarkers, and peripheral blood smear examination to improve etiological classification and guide more precise, evidence-based interventions.

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ANNEXES

Annex I: Questionnaires in English

A questionnaire prepared to assess prevalence of anemia and associated factors among HIV-infected children in antiretroviral therapy clinic at public healthy facility of Ilubabor zone, December, 2025

Date..... Study number.....

Part I. Socio-Demographic characteristics of the study participant.

S/n	Questions	Choice of answer	Remark
101	Sex	1.Male 2.Female	
102	How old are is He/She?	Age in year	
103	Residence	1. Urban 2. Rural	
104	Whoistheprimarycaretaker?	1.Father2.Mother 3.Grand parent 4.Older sibling 5.Aunt6.Uncle7.orophan	
105	caretaker Educationalstatus	1.Noformaleducation 2. Primary 3.Secondary4.College	
106	What isCare takeroccupational status ?	1.House wife 2.Farmer 3.Daily laborer 4.Merchant 5.Gov't employee 6.Student 99. Other, specify	

107	If school age ,Children's educational	1.kindergarten 2.primary 3.sechondary 4.Tertiary	
108	Average Monthly income of the HH	_____	

PART II: NUTRITIONAL HABIT AND PAST MEDICAL HISTORY

	Questions	Choice of answer	Remark
201	Breastfeeding history	1. yes 2. No	
202	Is the child still breast feeding	1. yes 2. No	
103	Mixed feeding started ?	1. Yes 2. No	
104	If yes to que 203 when did started mixed feeding	1. < 6 month 2. > 6 month	
105	How many times does the child feed in a day?	_____	
106	Any food shortage at home in last 4 weeks?	1. Yes 2. No	
107	Which food groups did the child eat recently?	Meat/fish Eggs Dark green leafy vegetables Other vegetables Fruits	
108	Did the child consume iron-rich foods like meat/fish?	1. Yes 2. No	
109	Did the child consume vitamin C-rich foods like fruits yesterday?	1. Yes 2. No	
110	Did the child consume folate-rich foods yesterday?	1. Yes 2. No	
111	Past medical/drug history	1. Yes 2. No	
112	Previous transfusion	1. Yes 2. No	
113	When was the last transfusion done? (Weeks)	_____	
114	Duration on HAART	_____ years	
115	HAART regimen	1. First line 2. Second line	
116	Zidovudine based HAART regimen?	1. Yes 2. No	
117	Did the child is getting Other medications that may cause anemia?	1. Yes 2. No specify: _____	If yes,

118	Have you started menstrual periods (for girls aged 8 years and above)?	1. Yes 2. No	
119	If yes, what is the duration of the period?	_____ (Days)	

PART III: CLINICAL AND ANTHROPOMETRY DATA

301	Length/Height	_____ (cm)	
302	Weight	_____ kg	
303	MUAC	_____ cm	
304	Weightfor heightZscore	_____	
305	Heightfor age Zscore	_____	
306	Temperature	_____ °C	
307	WHOclinicalstaging	_____	

	Questions	Choice of answer	Remark
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PARTV:LABORATORY INVESTIGATIONS

401	CurrentCD4 count	_____	
402	CurrentCD4 percentage	_____ %	
403	Resent VL result	_____	
403	Hb/ HCT _____	_____ %/ g/dl	
404	MCV _____	_____ g/dl	
405	MCH	_____	
406	MCHC	_____	
407	RDW	_____ %	
408	Malariaparasites	1. yes 2. No	
409	IfyesWhat species	_____	
410	What is the parasite density	_____	
411	Stool examination	_____	

Annex II: Information Sheet In English Version

Information sheet

Title of study :prevalence of anemia and associated factors among HIV- infected children in antiretroviral therapy clinic at healthy facility of Ilubabor zone south west.

Principal Investigator: Dr. Tekle Taye pediatric resident wallaga university .

Purpose of the study: To know the of prevalence anemia and its associated factors.

Introduction:The aim of this investigation is to assess the prevalence and associated risk factors for anemia in HIV infected children. This study will help us to understand the factors that are likely to contribute to anemia in HIV infected children so that they can be addressed in order to improve the quality of life of these children. We respectfully request your permission for your child to participate in this study. Please be assured that all necessary measures will be taken to ensure your child's safety, privacy, and well-being throughout the research process..

Procedure During the study, the following will be done

1: you will be asked questions about your child's current and past medical and nutritional history.

2: Your child will be examined.

3: We shall collect samples of blood, stool from your child which will include blood and stool.

During sample collection, strict aseptic measures will be used to make sure that your child does not get exposed to infection.

Benefit Your child will receive a complete medical exam, the investigations done during the study will be free of charge. Findings from this study will help us in setting prevention programmes and developing treatment protocols. For those who will be anemic will get proper treatment and counseling.

Risks and discomforts during the process of drawing blood, your child will feel some pain however this will be mild. We shall draw about a teaspoon of blood from your child to do the blood tests. This amount of blood will be too little to cause harm to your child's health. All

information obtained in this study will be considered confidential and used only for research purpose and patient care. Patient identity will be kept confidential.

Confidentiality Your child's records will be kept confidential and only the people working on the study will have access to them. A study number will be used instead of the child's name.

Who to contact : This research will be reviewed and approved by Wollaga University, Institute of Health Sciences' Research Ethics Committee. If you have any questions, you may ask those now or later. If you wish to ask questions later, you may contact principal Investigator : Dr. Tekle Taye Tel: +251965998816.

Statement of Consent : The purpose and nature of this study has been explained to me and I understand that the participation of my child in the study is voluntary and that no consequences will result if I refuse my child to participate. I have the right to know the results of the laboratory tests for my child. By signing this form, I agree to participate in this study:

Parent/guardian signature _____ Date _____ Patient ID _____

Patient _____ PI _____ signature _____ Date _____

ANNEX III: consent form English version

CodeNo_____

I confirm that I have received a clear explanation about the purpose of this study, which focuses on anemia and its associated factors among HIV-positive children receiving HAART in our country. I understand that the relationship between anemia and HAART in HIV-infected patients is not yet fully understood, and this study aims to fill that knowledge gap and contribute to improved care.

I have been informed that my child's participation will involve providing a small blood sample through a safe and harmless procedure, and a brief interview lasting about five minutes. I am aware that all information collected will be kept strictly confidential. Testing will be conducted anonymously, with samples identified only by codes, and no names will appear on reports.

I understand that if the child is capable, they may provide consent themselves; otherwise, consent will be given by the parent or legal guardian. Regardless, participation is entirely voluntary. The child or guardian can decline participation, refuse to answer questions, or withdraw at any time without any impact on current or future healthcare services.

I have also been informed that the child will benefit from free laboratory tests, and based on the results, will receive appropriate medical care from the assigned healthcare professional.

Having understood the purpose of this research and the nature of participation, I (legal guardian or the child, if capable) voluntarily agree to provide a blood sample for the study. I also consent to the sample being used for future related research.

I confirm my agreement by signing below.

Participant's Signature (if applicable)

Guardian/Parent Signature

Witness Signature

Person Obtaining Consent

Date: _____

Researcher's Contact: Dr. Tekle Taye Wallaga University Phone: +251 965 998 816

Annex: IV: Assent form in English

This research is being conducted to better understand anemia and the factors that contribute to it in children living with HIV. We are inviting children to take part in this study. If you agree to participate, we will ask you a few questions about your health. A doctor will also examine you and take a small sample of your blood using a needle. You may feel a brief pinch or discomfort when the needle goes in, but the pain will go away quickly after the sample is taken. You will also be asked to provide a small stool sample in a container we will give you. Taking part in this study is completely voluntary. You can choose not to participate or stop at any time, and this will not affect your care in any way. If you have any questions now or later, you or your parent/guardian can contact Tekle at +25196599881

Annex V: Afan Oromo version questionnaire

Qorannoo: Babal'ina hirinaa dhiigaa fi sababoota isaa ijoollee HIV qabaniirratti, kanneen kilinika ART, dhaabilee tajaajila fayyaa uummataa, godina Ilubabor keessaa jiraan, Muddee, 2025

Guyyaa: _____

Lakkoofsa qorannoo: _____

Kutaa I: Haala Hawaasummaa fi Beekumsa walii gala Maatii

Lakk	Gaaffii	Deebi	Yaadaa
101	Saala	1. Dhiira 2. Dhalaa	
102	Umurii	_____ waggaan	
103	Bakka jireenya	1. Magaalaa 2. Baadiyyaa	
104	Eenyutu kunuunsa ijoolleef godhaa?	1. Abbaa 2. Haadha 3. Akaakayuu 4. Obboleessa/Obboleettii 5. Nama kan biraa 7. Hin qabuu	
105	Sadarkaa barnoota nama kunuunsaa jiruu	1. Barnoota hin qabu 2. Barnoota sadarkaa jalqabaa 3. Barnoota sadarkaa giddugaleessaa 4. Koleejii fi isaa olii	
106	Gahee hojii namaa kunuunsaa kennuufi	1. hin qabuu/qabduu 2. Qonnaan bulaa 3. Hojii guyyaa guyyaa 4. Daldalaa 5. Hojetaa mootummaa 6. Barataa 7. Kan biraa -----	
107	Yoo ijoolleen barnoota irraa jiraatan, sadarkaa barnootaa	1. Keejii 2. Mana barumsaa sadarkaa 1ffaa 3. Mana barumsaa giddugaleessaa 4. Mana barumsaa sadarkaa 2ffaa 5. koollejjii/Yuunivarsitii	
108	Galii ji'a keessaa kan	_____ qarshiin	

	maatii		
--	--------	--	--

Kutaa II: haala sirna Soorata fi Seenaa Fayyaa

Lakk	Gaaffii	Deebbii	Yaadaa
201	Harmaa hodhaa turee/turtee ?	1. Eeyyee 2. Lakkii	
202	Amma harmaa hodhaa jiraa /jirtii?	1. Eeyyee 2. Lakkii	
203	Soorata dabalataajalqabameera?	1. Eeyyee 2. Lakkii	
204	Yoo eeyyee ta. ee, yeroo kam soorata dabalataa jalqabame?	1. < ji'a 6 2. > ji'a 6	
205	Guyyaati yeroo meeqa nyaata?		
206	Hanqinni nyaataa maatii keessatti torbaan afur darban keessa turee?	1. Eeyyee 2. Lakkii	
207	Gosaa nyaataa kamtu daa'ima kanaan yeroo dhiyoo kana nyaatame?	1. Foon 2. killee 3. kuduraa magariisa 4. Kuduraa biraa 5. fuduraa nyaataa	
208	Daa'imni foon nyaata kan akka qurxumii fakkaatan qabu nyaate?	1. Eeyyee 2. Lakkii	
209	Daa'imni guyyaa kaleessaa midhaan Vaayitaamin C qaban nyaatee?	1. Eeyyee 2. Lakkii	
210	Daa'imni guyyaa kaleessaa midhaan foolaatii (Folate) qaban nyaatee	1. Eeyyee 2. Lakkii	
211	Qorichoota fayadamuu jiraa	1. Eeyyee 2. Lakkii	
212	Kanaan duraa dhiigaa fudhatee beektaa?	1. Eeyyee 2. Lakkii	
213	Yeroon dhumaa dhiigaa sif kenamee? (torban)	_____	
214	Yeroo hangamiif qorichaa HAART fudhachaa jirtaa?	_____ waggaa	
215	Gartuun qorichaa HAART kamiin fudhataa jirtaa?	1. gartuu jalqabaa 2. gartuu lammaffaa	
216	Akaakuu qorichaa ARV	_____	
217	Dubartoonni umurii 8 ol, marsaa lagu arguu jalqabde?	1. Eeyyee 2. Lakkii	
218	Yoo eeyyee, hangaamiif turaa?	_____ guyyaa	

Kutaa III: Odeeffannoo Fayyaa fi Safartuu Qaamaa

lakk	Gaaffii	deebbii	Yaadaa
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301	Dheerina	_____	
		cm	
302	Ulfaatina	_____	
		kg	
303	MUAC	_____	
		cm	
304	Z-score ulfaatinaf	_____	
305	Z-score dheerinaf	_____	
306	Ho'a qaamaa	_____	
		°C	
307	Sadarkaa WHO	_____	

Kutaa IV: Qorannoo Labaratorii

S/N	Questions	Choice of Answer	Remark
401	Lakkoofsa CD4 amma	_____	
402	% CD4 amma	_____	
		%	
403	Bu'aa viiraal looda dhumaa	_____	
404	Hb / HCT	_____	
		% / g/dl	
405	MCV	_____	
		fL	
406	MCH	_____	
		pg	
407	MCHC	_____	
		g/dl	
408	RDW	_____	
		%	
409	Parasitii bookee busaa qabaa?	1. Eeyyee 2. Lakkii	
410	Yoo eeyyee ta'ee, gosaa maal?	_____	
411	Persentiin hangaam dhiigaa keesssaati?	_____	
412	Qorannoo boolii irraati kan argamee	_____	

Annex VI: Information Sheet afaan oromifa Version

Mata-duree qorannoo: Haammaa hirrinaa dhigaaf waantoota isaan wal qabataan daa'imman kanneen HIV qabamaani dhaabilee fayyaa Hawaasa Godinaa Iluu Abbaa Boor keessatti qoricha HIV fudhataa jiranii qorachuudha.

Qorataan: Dr. Tekle Taye, barataa speeshalistii ogeessa daa'immanii , Yuunivarsiitii Wallaggaa.

Kaayyoo Qorannoo:

Sababni qorannoon kun gaggeeffamu hirrinaa dhiiga daa'imman HIV qabaniin walqabatee mudatu beekuu fi sababoota isaa adda baafachuuf dha.

Seensa:

Qorannoon kun hammaa hirrinaa dhiiga daa'imman HIVn qabaman keessatti argamu fi sababoota isaa adda baasuuf kan gargaaruu dha. Qorannoon kun karaa itti qulqullina jireenya daa'imman HIV qabanii fooyyessinuu beeknuu fi tarsiiimoo ittiin qorannoo tajaajila fayyaa cimsuuf deeggarsa ni godha. Kanaafuu daa'ima keessan qorannoo kana keessatti hirmaachisuuf eeyyama keessan kabajaan gaafanna. Daa'ima keessan nageenyii fi, iccitiin fayyaa isaa akka eegamuf ofi eeggannoon barbaachisu hunduu ni taasifama.

Adeemsa Qorannoo:

1. Daa'ima keessan irratti waa'ee seenaa fayyaa fi nyaata yeroo ammaa fi darbe

gaafanna.

2. Daa'ima keessaniif qorannaan fayyaa guutuu ni taasifata.

3. dhiigaa fi boollii daa'ima keessan irraa qoranoof karaa qulqulinaa qabuun ni fudhatamaa.

Faayidaa:

- Daa'ima keessan qorannoo fayyaa guutuu ni argata.

- Qorannoowwan kana keessatti taasifaman kaffaltii malee ni raawwatamu.

- Bu'aan qorannoo kanaa karoorfama ittisaafi qorannoo fooyyeessuuf ni tajaajila.

- Yoo daa'imni keessan hirinaa dhiiga kan qabu ta'e tajaajila yaalaf fi gorsaa sirrii ni argata.

Hirmaachisummaa fi Riqicha:

- Yeroo dhiiga fudhatanii, daa'imni keessan dhukkubbii salphaa ni dhaga'a, garuu dhiiga xinnoo fudhatama.

- Dhiigi fudhatamu kun fayyaa daa'ima keessan miidhuu hin danda'u.

- Odeeffannoon qorannoo kana keessatti argamu hundi iccitiidhaan ni eeggama, qorannoo fi tajaajila fayyaaf qofa ni tajaajila.

- bakkaa maqaa daa'ima irrati lakkoofsa qorannoo ittiin walitti dhufeenya qabu qofaan tajaajilamna.

Iccitii Odeeffannoo:

Galmeen daa'ima keessan iccitiidhaan ni eeggama, nama qorannoo kana hojjechaa jiru qofatu argata. Bakkaa maqaa daa'ima lakkoofsa qorannoo fayyadamuun itti fayyadamna.

Namoota Quunnamuuf:

Qorannoon kun koree qu.annoof Qorannoo Seeraa Yuunivarsiitii Wallaggaa, Instiitiyuutii Saayinsii Fayyaan ilaalame ragaasifama,. Gaaffii yoo qabaattan amma ykn booddee gaafachuu ni dandeessu.

Qorataan: Dr. Tekle Taye

Bilbila: +251965998816

Ibsa Eeyyama Hirmaannaa:

Kaayyoo fi adeemsi qorannoo kanaa naaf ibsameera. Daa'ima koo qorannoo kana keessatti hirmaachisuun filannoo kooti malee dirqama miti. Yoo daa'ima koo hirmaachisuun hin fedhin rakkoon mudatu hin jiru. Bu'aa qorannoo fi qorannoo laaboraatoorii daa'ima koo irratti godhamuu nan beeka. Mallattoo koo mallatteessuun, daa'ima koo qorannoo kana keessatti hirmaachisuun nan eeyyama.

Mallattoo Maatii/Waaliin: _____ Guyyaa: _____

Daa'imaa: _____

Mallattoo Qorataa Ol'aanaa (PI): _____ Guyyaa: _____

ANNEX VII: consent form afaan oromifa version

Lakk. Koodii: _____

Ani ibsa ifa ta'e kan kaayyoo qorannoo kanaa ibsuargadhee jira, qorannoon kun hirinaa dhiigaaf fi sababoota isaa garaagaraa ilaalchisee daa'imman HIV qabanii fi dawaa HAART fudhachaa jiran irratti xiyyeeffata. Ani kanaan hubadhe, haala walqabataa jiru irratti odeeffannoon guutuun akka hin jirreef, qorannoon kunis odeeffannoo haaraa argamsiisuun tajaajila fayyaa fooyyessuuf akka tajaajiluudha.

kaan Naaf ibsame mallattoo xixiqoo hirrinaa dhiigaa da. imaa koo irrati agarsiisanuu fi gaaffii gabaabaa daqiiqaa shan ta'uuf qofa fudhatamu danda'u. Odeeffannoon guutamu hundi dhoksaa ta'a, maqaan hin fayyadamu; koodiin qofa itti fayyadama.

kanan Hubadhe daa'imni yoo dandeettii qabaate ofiin hayyama kennuu danda'a; yoo hin danda'in garuu maatii ykn abbaa seeraa irraa hayyamni ni fudhatama. Qooda fudhachuun guutumaan guutuutti fedhiidhaan ta'a; yoo barbaadame, gaaffii kamiyyuu deebisuuf dirqama hin jiru, yeroo kamiyyuu qorannoo keessaa bahanis tajaajila fayyaa amma fi itti aanutti hin miidhu.

Daa'imni qorannoo kana irraa bu'aa argatu, tajaajila qorannoo fi qoricha gargaaraa bilisaan argata.

Kaayyoo qorannoo kanaa fi haala qooda fudhatamuu isaa hubachuun koo booda, (abbaa seeraa ykn daa'ima dandeettii qabu) dhiiga xixiqqoo kennuuf fedhii koo guutuun nan mirkaneessa. Bu.aan qorannoo dhiigaa kunis qorannoowwan walqabatan gara fuula duraatti akka oolu nan hayyama.

Mirkaneessuuf mallattoo armaan gadii nan kaa'a.

Mallattoo Qooda-fudhattoota (yoo danda'ame): _____

Mallattoo Abbaa/Haadha ykn Abbaa Seeraa: _____

Mallattoo Ragaa Baa'aa: _____

Maqaa nama hayyama kennisiisu: _____

Guyyaa: _____

Teessoo Qorataa: Dr. Tekle Taye, Yunivarsiitii Wallaggaa

Bilbila: +251 965 998 816

ANNEX VIII: Assent Form Afaan Oromoo version

Qorannoon kun dhiibbaa dhiigaa fi sababoota isaan walqabaatan daa'imman HIV'n waliin jiraatan irratti hubachuuf geggeeffamaa jira. Daa'imman qorannoo kana keessatti hirmaachuuf waamnee jirra. Yoo hirmaachuuf walii galle, waa'ee fayyaa kee gaafii muraasa si gaafanna. Akkasumas ogeessi fayyaa si ilaaluun dhiiga xiqqoo limmoon si irraa fudhata. Yeroo limoon si keessa seenu, xinnaan dhukkubbii sitti dhaga'amu danda'a; garuu yeroo gabaabaa keessatti ni bada. Akkasumas, qorannoo kanaaf saanduqa siif kennamu keessatti saamuna xiqqoo kennuu qabda.

Qorannoo kana keessatti hirmaachuun dirqama miti; fedhii keetiin irratti hirmaachuu yookaan dhiisuu ni dandeessa. Yeroo kamiyyuu hirmaachuu dhiisuu ykn keessaa ba'uu ni dandeessa; kun tajaajila fayyaa siif kennamu irratti rakkoo hin uumu. Yoo gaafii amma yookaan boodarra kan qabdu ta.ee, ati ykn maatiin kee Dr. Tekle Tayyee quunnamuu ni dandeessu, lakkoofsa bilbilaa +251965998816.