ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

MAGNITUDE OF ANEMIA AND ASSOCIATED FACTORSIN CHILDREN AGED 6-59 MONTHS AT KERANYO HEALTH CENTER, ADDIS ABABA, ETHIOPIA.

By: ZewduJiru(BSc)

Advisors: **Aster Tsegaye (MSc, PhD)**

JemalAlemu (MSc)

A thesis submitted tothe Department of Medical Laboratory Sciences, College of Health Sciences, Addis Ababa University in Partial Fulfilment of the Requirements for the Degree of Master of Clinical Laboratory Sciences (Hematology and Immunohematology)

February, 2021

Addis Ababa, Ethiopia

Addis Ababa University

School of Graduate Studies

This is to certify that the thesis prepared by ZewduJiru entitled:

Magnitude of Anemia and Associated Factors in children aged 6-59 months at Keranyo health center, Addis Ababa, Ethiopia and submitted in partial fulfilment of the requirements for Master of Science degree in Clinical Laboratory Sciences (Hematology and Immunohematology) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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External Examiner_____Signature _____ Date _____

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Advisor_____ Signature _____ Date _____

Advisor_____ Signature _____ Date _____

_____

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Acknowledgment

Praise is to almighty GOD who kept me alive, healthy, and energetic, gave me ability to develop and successfully undertake this thesis work.

First I would like to express my deepest gratitude to my advisorsDr. Aster Tsegaye and Mr.JemalAlemu for their unreserved support throughout the whole thesis work starting from the concept note to the final thesis.

My sincere thanks go to the study participants for making this study possible.

My deepest gratitude also goes to all who assisted me in searching and providing me relevant literature references in particular Department of Medical Laboratory librarians. The Department of Medical Laboratory Sciences of AAU is gratefully acknowledged for facilitating this study.

Finally, my sincere appreciation goes to my friends Mr. Elias Mchael,Mr.FentawTaddeseand, Mr.DelelegnYilma for their time and continuous encouragement during the whole period of this work.

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Abbreviations

EDHS……Ethiopian Demographic and Health Survey

Hgb……Hemoglobin

HiCN…….Hemoglobincynide

HIV……Human immuno deficiency virus

IDA……Iron deficiency Anemia

PSC……..Preschool children

RBC…….Red blood cell

SCD……...Sickle cell disease

WHO……World health organization

Abstract

Background: Anemia impairs physical capacity and work performance in all age groups. In children, anemia affects cognitive and motor development because of the need for adequate oxygen carrying capacity during the critical first few years of life when mental and physical growth are occurring at their fastest. In Ethiopia, Anemia among children aged 6-59 months children categorized as severe public health problem. Regular monitoring of the magnitude anemia and its predicting factors is helpful for appropriate intervention.

Objective: To assess the magnitude of anemia and associated factors in children aged 6-59 months at Keranyo health center, Addis Ababa, Ethiopiafrom January 01 to February 30, 2020.

Method: A cross sectional health facility based study wasconducted among 427 children aged 6 to 59 months. Convenient sampling technique was used to include the participants. Pretested and structured questionnaire was used to collect socioeconomic and demographic characteristics of the family and child. Data on nutritional status and capillary blood sample was collected from each child. Multivariate logistic regression was used to calculate adjusted odds ratios with the corresponding 95% confidence intervals.P-values less than 0.05 was also used to declare statistical significance.

Result: Of the total 427 children, 210 (49.2%) were males. The overall prevalence of anemia among children aged 6-59 months was 177(41.5%) (95% CI: 36.8% - 45.9%). Of the anemic under-five children, 14(3.3%) had mild, 149(34.9%) moderate and 14(3.3%) had severe anemia. Children whose maternal education is below elementary((AOR=3.82, 95% CI = (1.66, 8.77)), children who had fever in the last 2 weeks (AOR=2.13; 95% CI: (1.33, 3.42)), who consumed tea (AOR=2.17; 95% CI: (1.20, 3.93)) and with mothers who was not supplemented with iron during their last pregnancy (AOR=3.02; 95% CI: (1.40-6.55)) were more likely to become anemic.

Conclusion: This study confirmed thatthemagnitude of anemia in children aged 6-59 months in Keranyo health centeris in the severe public health category. Educational and occupational status of the mother, child history of fever in the last two weeks, child tea consumption and maternal iron supplementation during pregnancy were factors associated with anemia in those children (6-59 months).Therefore, strengthening awareness and bringingbehavioural change in order to increase the knowledge of reproductive women about anemia is warranted.

1. Introduction

1.1 Background

Anemia is a condition characterized by a decrease in the concentration of haemoglobin in the blood. It may be defined as qualitative or quantitative deficiency of haemoglobin, a molecule found inside RBC(1).

It is a global public health problem that affects people in both developing and developed countries associated with an increased risk of morbidity and mortality, especially among pregnant women and children under five years of age(2).

Anemia has been independently associated with overall increased mortality in young children, with lower cognitive performance, lower aerobic exercise capacity and heart failure. The higher oxygen demands of the paediatric brain make it particularly susceptible to the effects of severe anemia(3).

The epidemiology of anemia varies substantially between different ecological and socio cultural settings and has been one of the commonest public health problems in most parts of world(4)

Anemia impairs physical capacity and work performance in all age groups. In children, anemia affects cognitive and motor development because of the need for adequate oxygen carrying capacity during the critical first few years of life when mental and physical growth are occurring at their fastest. Developmental delay or learning delay caused by anemia is compounded by decreased overall energy capacity, leading to difficulties with paying attention in school or attending school(5).

In developing countries, it affects 46–66% of children aged less than five years. It has major consequences on socioeconomic development of a population and it could be due to a complex interaction of many factors, including poor nutrition and health. Dietary diversity, defined as the number of different food groups consumed over a given reference period, has been identified as a useful measure for overall quality and nutrient adequacy of the diet that may influence blood formation(6).

Breast-feeding and feeding practices, presence of infectious diseases, presence of inherited conditions such as thalassemia, presence of environmental pollutants such as leadandtobacco smoke, nutritional status, mother's age at childbirth, maternal haemoglobin and level of education, economic status, sanitation, and also the geographic region of residence can contribute directly or indirectly to lowering of the Hgb concentration among children(7).

In East Africa, approximately 75 % of under-five children have anemia with the prevalence's ranging between 44 and 76 percent. The risk factors for anemia vary in different settings; they include having intestinal parasites, malaria, HIV infection, nutritional deficiencies and habit of taking tea with meals, haematological malignancies and chronic diseases like sickle cell disease (SCD)(8).

In Ethiopia, Anemia among children aged 6-59 months children categorized as severe public health problem because of low household income and inadequate drinking water(9).Thus, regular monitoring of the magnitude and its associated factors will aid in the design of appropriate intervention.

1.2. Statement of the problem

Anaemia constitutes a major public health problem in young children in the developing world with wide social and economic implications. It is considered a major public health problem in Africa, because it is the cause of death for most children admitted to hospitals in Africa. Even where blood transfusion is available, there is a significant case fatality rate of 6% - 18%(10).
Low family income and low maternal level of education, more children in the family, lack of access to healthcare services, inadequate sanitary conditions, a diet with insufficient quantities of iron and diarrhoea were predictors of anemia in developing countries(11,12).

The fact that resource-rich post-industrial societies have a very low prevalence of iron-deficiency anemia offers hope that common types of anemia can be eliminated. However, Anemia shows the highest prevalence in tropical countries. In children under the age of 5, there is a target set for a 40% reduction in stunting, which is related to anemia WHO recommends daily iron supplementationforall children 6 months and older living in areas where anemia is highly prevalent. It also recommends:- identification of risk factors, aggressive promotion of anemia testing and prevention programs to high-risk groups(13).

Even though the prevalence of severe to moderate anemia in the last fifteen years has significantly declined in Ethiopia, children and pregnant women are still suffering from the consequences of anemia due to high iron requirements, low intake of iron from foods, and frequent episodes of infection (13,14).

The Ministry of Health has been trying to deal with this problem by providing resources in its under five years old children strategic plan by training its staff'son the prevention of childhood morbidity and mortality factors as well as dissemination of complementary feeding enhancing knowledge and practice to community so as to help reduce the incidence of childhood anemia.
Despite this fact, different studies have shown that childhood anemia is still the most prevalent among under five year’s old children in the country.

Children, who are 6-59 months of age , stunted and in the lowest socioeconomic group, and those with mothers who are illiterate, and underweight are at highest risk of anemia(3). Little is known about the prevalence of anemia and associated factors among under 5 years old children in Keranyo health center patients of Kolfe sub city Addis Ababa.

1.3. Significance of the study

The finding of this study will provide information regarding the prevalence and factors causing anemia among young children and helps to develop targeted awareness campaign to provide appropriate information, which in turn will lead to behavioural modifications and decrement of the burden of anemia. The health center can use the data for its planning of both diagnostics and medicines. The result will serve as reference for further studies.

2. Literature review

2.1 Prevalence of Anemia

The prevalence of anemia is highest in pregnant women, infants, and children. Iron deficiency anemia prevalence decreased almost to insignificance in North America and Western Europe, indicating IDA can be successfully addressed under favourable socioeconomic conditions(15)
Globally Anemia is a prevalent public health problem which affects about a quarter of the world population notably children whose age is 6-59 months with global prevalence rising to 47.4 %(2)

In Ghana, the prevalence of anemia (percentage of children with Hgb concentration <110 g/L) among children aged 6 to 59 months was 76% in the year 2011 and was reported to be of severe public health significance(16).

The prevalence for anemia among children aged 6 to 59 months in the year 2014, according to Ghana Demographic and Health Survey [GDHS] (2014) report, was 66%, with the Volta Region's rate superseding the national prevalence rate (69.9%)(17).

A meta analytical study done in Ethiopia in 2018 showed that the prevalence of anemia among childrenaged 6-59 monthswas(31.8 percent)(14)

A study done in Gondar town showed that Prevalence of anemiawas (28.6%) as determined byhemoglobin levels below 11.0 g/dl.Out of them 17.5% children were mildly anemic, and 10.3% were moderately anemic and 0.7% were severely anemic(18).

According to 2016 demographic and health statistics of Ethiopia more than half of children 6-59 months (56 percent) suffered from some degree of anemia which is haemoglobin levels below 11.0 g/dl.Based on haemoglobin concentration level, 25 percent were mildly anemic, 28 percent were moderately anemic, and 3 percent were severely anemic. Among them Addis Ababa city accounts 49.8% anemia out of which 20.6% wasmild anemia, 27.4% moderate anemia and 1.8% severe anemia(19).

2.2 Risk factors for Anemia

2.2.1 Nutritional deficiencies

Causes of anemia can be multi factorial but iron deficiency is thought to be the most common cause of anemiaglobally. Other nutritional deficiencies (including folate, vitamin B12 and

vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival, can all cause anemia(20).A systematic analysis of nationally representative surveys of PSC (preschool children) shows that that the current habit of assuming 50% of anemia attributable to ID should no longer be used for countries with a low to high HDI(21).

A hospital based cross sectional study done in India reported that 38% of children had mild anemia, 54% had moderate anemia and 8% had severe anemia, the diet deficient in iron was one of the chief associated factors causing childhood anemia(22). A cross sectional study done in Southern African countries indicated that micronutrient deficiencies were one of the main contributors of anemiain young children anemia(23).In contrast to this finding of low micronutrient deficiencies, a cross sectional study done during low prevalence of malaria in Republic of Congo reported high prevalence of anemia, although, the level of iron deficiency was low(24).

A study done in Bangladesh reported that childhood anemia was significantly associated with chronic malnutrition of child(25).A cross sectional studywas done in Gondar town among707 children, two hundred two (28.6%) of children were anemic: 124(17.5%) were mildly anemic, 73(10.3%) were moderately anemic, and 5 (0.7%) were severely anemic. The low frequency of child complementary feeding per day was one of the main factors associated with severity of childhood anemia(26).

2.2.2 Diarrhea and fever

A Meta-analysis survey conducted between 1990 and 2015 reported that a lack of access to a sanitation facility, i.e. a toilet and/or latrine, leads to numerous health challenges such as parasitic worms and environmental enteropathy. Parasitic worms are transmitted through human faeces and cause multiple health complications in children including anemia and child growth stunting. Environmental enteropathy occurs with repeated and long-term inflammation of the small intestine, which then reduces nutrient uptake and can cause child growth stunting, anemia and diarrhoea. One-sixth of the world population has no access to any type of sanitation facility, and are therefore at higher risk of these challenges(27).

Across sectional study done in Brazil revealed that drinking untreated water was one of the factors associated with childhood anemia(28).A repeated cross sectional and Cohort study done in drought-affected community in south-central Ethiopia report the prevalence of anemia was 28.2% in 2014 and increased to 36.8% in 2015. The incidence of anemia was 30 cases per 100 children years of observation. The risk of anemia was high among children with malaria(29).A cross sectional study done among children Aged 6–59 months in the district of Wolaita Zone, Southern Ethiopia report that fever within 2 weeks prior to the survey were significantly associated with anemia(30).

2.2.3 Maternal health status

In across sectional study done in Haiti reported that among factors causing anemia among in the age group between 6-59 months,hemoglobin status of the mother was one of the main contributors of anemia(31).A cross sectional study done in Benin among preschool children showed that greater risk of anemia was associated with low maternal health status(32).Findings from the Ethiopian Demographic and Health Survey (EDHS) indicated that maternal anemia was found to be associated with anemia in children(19).

2.2.4 Socio-economic status

A cross sectional study done in USA among low income population indicate that housing insecurity is associated with poor health, lower weight, and developmental risk among young children(33).A cross sectional study done in India to evaluate socio-economic and demographic determinants of anemia among Indian children aged 6-59 months. The study showed that economically under-privileged groups were more vulnerable to childhood anemia(34). Like other developing countries, the burden and its associated factors are greatly varied as to the social, economic, and geographical differences of the target population., A hospital based cross sectional study done in Tanzania showed that one of the factors associated with severe anemia were unemployment among caregivers(8).

A study done in Ethiopia shows that the odds of stunting among children with severe anemia were higher than children with no anemia and the pooled prevalence of anemia was higher among preschool-aged children than school-aged children. Furthermore, the odds of anemia was higher among children who were male, stunted, and wasted(14,35).

2.2.5 Knowledge on proper feeding practice

A cross sectional study done in Hohoe Municipality, Ghana reported that nutrition knowledge of the mother was one of the main factors that was significantly associated with anemia among the children (17).

2.2.6 Children's Age

A study done from Ghana Demographic and Health Surveys indicated that there was a significant notable relationship between children age and mother's age with anemia. Children aged 6-24 months were positively related with anemia and contribute significantly more than any of the variables(36).A similar study done in Uganda also indicate child's age12 to 23 months and being male, stunted growth and low educational status of caregivers result in anemic status of young children(37). A cross sectional study done among children aged 6–59 months living in KilteAwulaeloWoreda, Northern Ethiopia revealed that being age between 6 and 23 months is one of the factors associated with anemia(38).

In sum, as reviewed above, anemia in under-fives is a global challenge especially in developing countries. Proper monitoring of the magnitude and its determinants is crucial for intervention. However, no published study is available in the studied health facility.

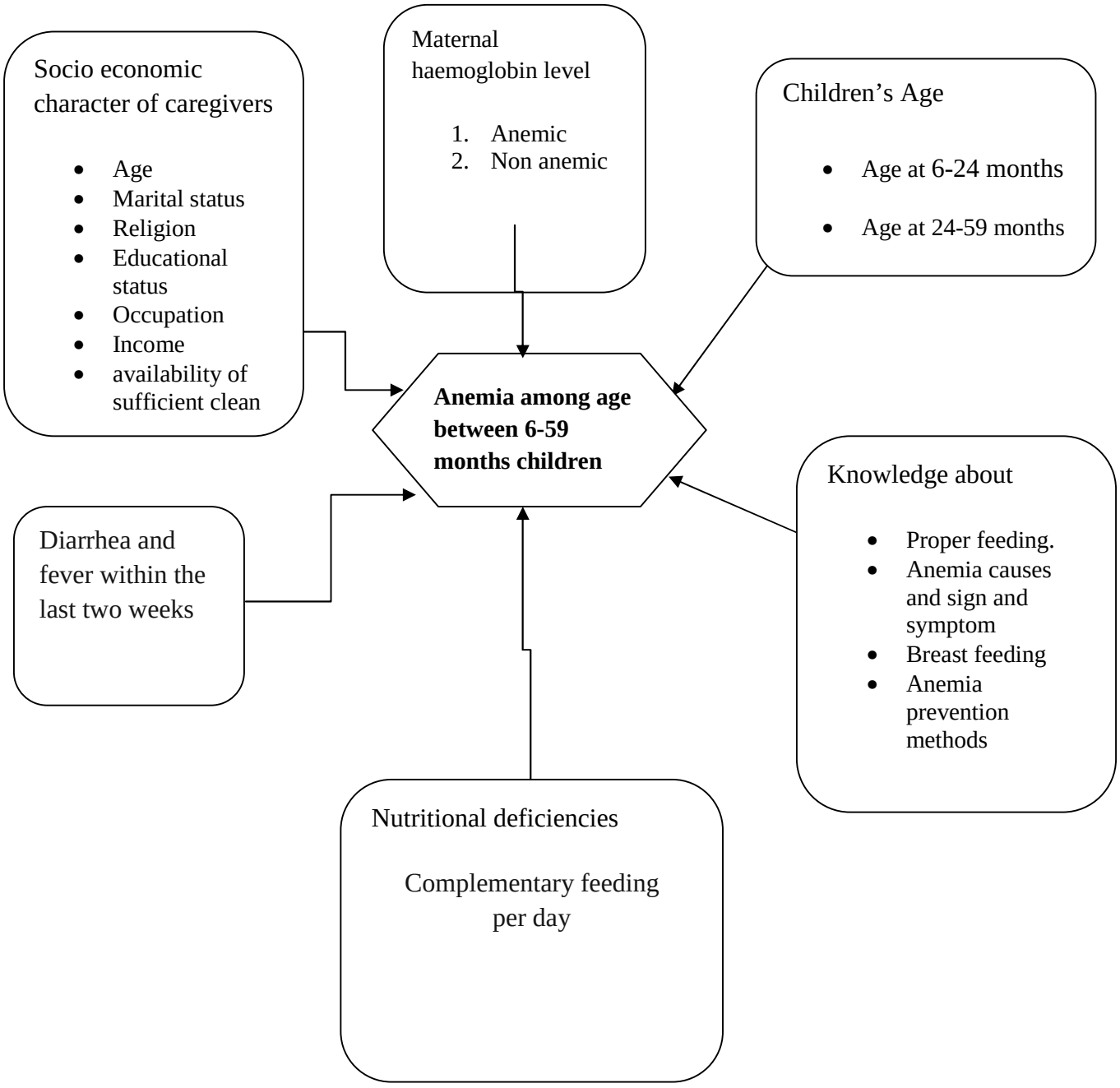

Figure 1: Conceptual framework for factors associated with Anemia among age between 6-59 months children.

3. Objective

3.1 General Objective

To determine the magnitude of anemia in children aged 6-59 months and associated factors at Keranyo health center, Addis Ababa, Ethiopia, from January 01 to February 30, 2020.

3.2. Specific Objectives

To determine magnitude of anemia among children age between 6-59 months in Keranyo health center, Addis Ababa.

To identify factors associated with anemia among age between 6-59 months children in in Keranyo health center, Addis Ababa.

4. Materials and methods

4.1. Study area:

Keranyo health centerwhich is established in 2005 is situated at western part of Addis Ababa and according to the 2020 G.C Woreda base plan given from the Sub city to the facility the total catchment population is 124,000 and the facility provides health services to people of around Kolfe Keranyo sub city Woreda 08 and adjoining areas of Burayutown. Outpatient, inpatient, maternal and children health delivery services TB treatment and ART are some of services provided by the facility. It is demarked by Burayu town in north, Woreda 06 in south, Woreda11 ineast and Woreda 07 in west.

4.2. Study design and period:

Institutional based cross sectional study on magnitude of anemia in children aged 6-59 months oldwas carried out at Keranyo health center, Addis Ababa, Ethiopia from January 2020 to February2020.

4.3. Source population and Study population

4.3.1 Source population:

All children who attended Keranyo health center at Paediatrics clinic, Growth monitoring and immunization clinics from January 2020 to February2020.

4.3.2Study population:

All children aged 6-59 months old who attended Keranyo health center at Paediatrics clinic, Growth monitoring and immunization clinics from January 2020 to February2020. .

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria:

Children aged 6–59 months who attended Keranyo health center and whose mothers or guardianswere voluntaryto participate in this study.

4.4.2 Exclusion criteria:

Severely sick children (including those with psychomotor retardation) and more than one child per guardians were excluded.

4.5. Study variables

4.5.1. Dependent variables:

Anemia in children aged 6-59 months.

4.5.2. Independent variables:

Socio economic character of caregivers, children's age, diarrhoea and fever within the last two weeks, complementary feeding per day, occupational status of caregivers, income, educational status of caregivers, Source ofdrinkingwater, knowledge about proper feeding practice.

4.6. Sample size calculation and Sampling method

4.6.1. Sample size calculation:

The sample size for the study was determined using single proportion formula by consideringanemia among children aged 6-59 months(P) 50%, z=standard score corresponding 95% confidence interval 1.96 and d marginal error corresponding(d) 5%. n= sample size required is calculated as:

$$n = \frac{(z)^2\, p(1-p)}{d^2}$$

$$n = \frac{(1.96)^2\, 0.5(0.5)}{(0.05)^2}$$

$$n = 384$$

Adding 10% non-response rate the final sample size become 422.

4.6.2. Sampling Method:

Convenient sampling methodwas followed.

4.7. Measurement and Data collection

4.7.1. Data collection procedure:

Data collection was conducted from January to February 2020.Trained research assistants conducted face-to-face interviews with caregivers of the children using structured questionnaires.

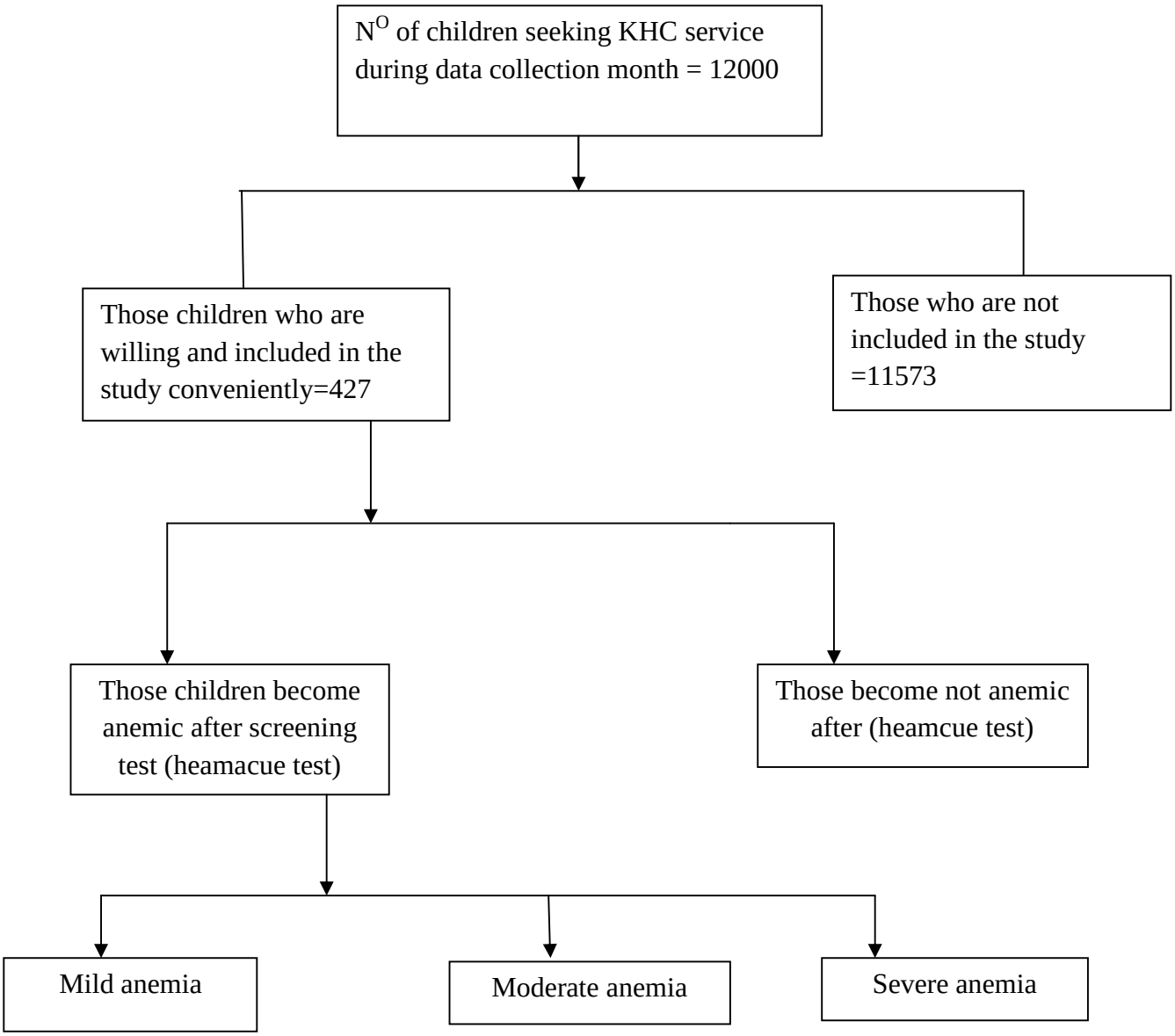

Figure 2: Schematic presentation of the sampling procedure

4.7.2. Laboratory analysis

4.7.2.1 Specimen collection and processing

Haemoglobin (Hgb) levels were measured using the HaemoCue method (HaemoCueHb 301, Sweden). Hgb determination was done within the health center by two experienced laboratory technologists. Blood was obtained from children by a heel or finger prick. The first drop of blood was wiped off and the next drop was collected into a disposable micro cuvette. Blood was drawn carefully to avoid introducing bubbles. The Hgb levels was displayed on a digital register on the HaemoCueHb 301 and recorded to the nearest 0.1 g/dl. To ensure hygiene and safety of the procedure, each set of accessory (lancet, micro cuvette, gloves, and alcohol swabs) were used once. To ensure accuracy of the HaemoCue, a controlled cuvette was used on a daily basis(39). Anemia was classified into severe, moderate and mild according to the WHO cut –off value(20).

4.7.2.2 Principles of HaemoCueHb 301

The system consists of an analyzer together with micro cuvettes. The micro cuvettes serve both as a pipette and as a measuring cuvette. A blood sample of approximately 10 micro litters was drawn into the cavity by capillary action. The measurement took place in the analyzer, which measures the absorbance of whole blood at aHgb/$HgbO_2$ isobestic point. The analyzer measured at two wave length (506 and 880nm) in order to compensate for turbidity. The HemocueHb 301 was calibrated against the hemoglobincynide (HiCN) method, the international reference method for the determination of the hemoglobin concentration in blood. The system is factory calibrated and needs no further calibration.

4.8. Data Quality Assurance:

4.8.1 Data collection tool

Data was collected using prepared interviewer administered questionnaire. The structured questionnaire was initially developed in English after reviewing existing literatures and translated into local language and then backward translation to English to check its consistency. The questionnaire included socio-demographic characteristics, complementary feeding per day, and knowledge about proper feeding practice and Anemia prevention methods, Diarrhea and fever within the last two weeks. Two trained diploma nurses collected the data supervised by one health officer.

4.8.2 Data quality control

The overall activity was controlled by the investigator of the study. Data quality was controlled through continuous supervision. All completed data collection form was examined for completeness and consistency during data management, storage and analysis. Training was given to two diploma data collectors and one health officer supervisor on the purpose of study and procedures of data collection for two days. Hemoglobin was measured by strictly adhering to standard operating procedure for capillary blood collection and analysis using HaemoCue.

4.9. Data analysis and interpretation

Data was entered in to and analysed using SPSS version 22 statistical software. Frequencies, proportions, tables and graphs were used to describe the study population in relation to relevant variables. In addition summary statistics such as mean and standard deviation was computed. Binary Logistic regression was used to assess the association between independent variables and dependent variables. Variables with a p-value less than 0.2 in the bivariate analysis were included in the multivariable analysis. Multivariable analysis was done to control (adjust) for possible confounding variable. Statistically Significance was determined using crude and adjusted odds ratios with 95% confidence intervals and p-value of less than 0.05.

4.10. Operational definitions:

Anemia: a child is said to have anemia when Hgb<11gm/dL.

Mild anemia: Hemoglobin level of 10g/dl to 11 g/dl,

Moderate anemia: Hemoglobin level of 7g/dl to 10 g/dl

Severe anemia: Hemoglobin concentrations less than 7 g/dl.

Malnutrition: Deficiency of nourishment in the body due to lack of healthful food or improper digestion and distribution of nutrients.

Caregiver: was defined as the person who looks after or was in charge of the children's well-being in the household.

4.11. Ethical considerations

The proposal was approved by Departmental Research and Ethics Review Committee of Department of Medical Laboratory Sciences, College of Health Science, Addis Ababa University. Official support letter was obtained and given to Addis Ababa health bureau to seek essential cooperation. Written informed consent was secured from the study participants mother or care givers and they were assured that the information was used only for the purpose of the study and confidentiality was kept. Name was not mentioned and only codes were used. In addition to this children with low haemoglobin level were further investigated and treated by KHC physicians. There was no potential risk occurring to participants except minimal discomfort while blood drawing from the children. In addition, participants were also allowed to interrupt the interview on desire and at the time of data collection.

4.12. Dissemination of results

The results of the study will be presented at Addis Ababa University Department of Medical Laboratory Sciences. The final document will be communicated to Addis Ababa Health Office, and other responsible bodies working in the area. Beside to this, the findings of the study will be sent to peer reviewed journals for publication.

5. Results

5.1. Socio demographic characteristics

A total of 427 subjects participated in the study. Of them, 302(70.7%) of the mothers/caregivers were in the age group of 26-35years. Children's mean age was 23.6(SD=±13.1) months. Nearly half, 210 (49.2%) of children were males. Majority 269(63.0%) of the interviewees were Muslim by religion. Nearly one-third, 135(31.6%) of the respondents can read and write. Regarding occupational status, more than half, 233(52.2%) of the mothers/caregivers were housewives. Nearly two third, 306(71.7%) of the respondents live in a rental house. (Table 1).

Table1: Socio-demographic characteristics of children and their parents/caregivers attending Keranyo Health Center, Addis Ababa, Ethiopia, 2020(n=427).

Variables	Frequency	Percent
Age of child (month)		
6-11	98	23.0
12-23	137	32.1
24-35	108	25.3
36-47	41	9.6
48-59	43	10.1
Mean (±SD)	23.6(±13.1)	
Sex (child)		
Male	210	49.2
Female	217	50.8
Age (Mother/Caregiver)		
≤25	102	23.9
26-35	302	70.7
36-45	14	3.3
≥46	9	2.1
Religion (Mother/Caregiver)		
Orthodox	122	28.6
Muslim	269	63.0
Protestant	36	8.4
Educational status (Mother/Caregiver)		
Illiterate	255	59.7
Read & write only	69	16.2
Primary	45	10.5
Secondary	44	10.3
College and above	14	3.3
Occupational status (Mother/Caregiver)		
Private	44	10.3
Housewife	329	77.0
Government employee	23	5.4
Merchant	31	7.3
Average monthly income(ETB)		
≤3,000	145	34.4
3,001-4,999	96	22.7
≥5,000	181	42.9
Number of children alive		
1-2	279	65.3
3-4	123	28.8
5-6	25	5.9
Type of housing		
Condominium	32	7.5
Rental	306	71.7
Private villa	77	18.0
Rent from government	12	2.8

5.2. Clinical information

Nearly all 401(93.9%) of the mothers had antenatal care visit for the index child. Moreover, half 204(50.9%) of the mothers had four visits of antenatal care. In addition, 146(34.2%), 186(43.6%) and 16(3.7%) had history of diarrhoea, fever and malaria, respectively, in the two weeks prior to this study (Table 2).

Table 2: Clinical information of children and their parents attending Keranyo Health Center, Addis Ababa, Ethiopia, 2020(n=427).

Variables	Frequency	Percent
ANC follow up during pregnancy		
Yes	401	93.9
No	26	6.1
Number of ANC Visits		
1 time	25	6.2
2 times	66	16.5
3 times	106	26.4
4 times	204	50.9
Child had diarrhoea (last 2 weeks)		
Yes	146	34.2
No	281	65.8
Fever (last 2 weeks)		
Yes	186	43.6
No	241	56.4
History of malaria		
Yes	16	3.7
No	411	96.3

5.3. Nutrition related characteristics

Out of the total 427 participants 411 (93.6%) of the children were breast feed ever and 392(92.3%) of them were exclusively breast fed. Nearly two third 300(63%) of them were breast fed 2 years and above. More than half 248 (58.1%) of children were feed infant formula milk and 407(95.6%) of them were eat solid food. Only 12 (2.8%) children were ever received iron

supplement while 395(92.5%) of mother of the index children were received iron supplement during their current pregnancy (Table 3).

Table 3: Nutrition related characteristics of children and their parents attending Keranyo health center, Addis Ababa, Ethiopia, 2020(n=427).

Variables	Frequency	Percent
Child ever breast feed		
Yes	411	96.3
No	16	3.7
Duration of breast feeding(n=411)		
<2 years	239	58.2
2 years	61	14.8
> 2 years	111	27.0
Exclusively breast feeding		
Yes	394	92.3
No	33	7.7
Child feed infant formula milk		
Yes	248	58.1
No	179	41.9
Child drink tea		
Yes	321	75.2
No	106	24.8
Child feeds solid foods		
Yes	407	95.3
No	20	4.7
Mother iron supplementation during pregnancy		
Yes	395	92.5
No	32	7.5

5.4. Prevalence of anemia

The overall prevalence of anemia among children aged 6-59 months was 177(41.5%) (95% CI: 36.8% - 45.9%). Of the anemic under-five children, 14(3.3%) had mild anemia, 149(34.9%) had moderate anemia and 14(3.3%) had severe anemia (Fig3).

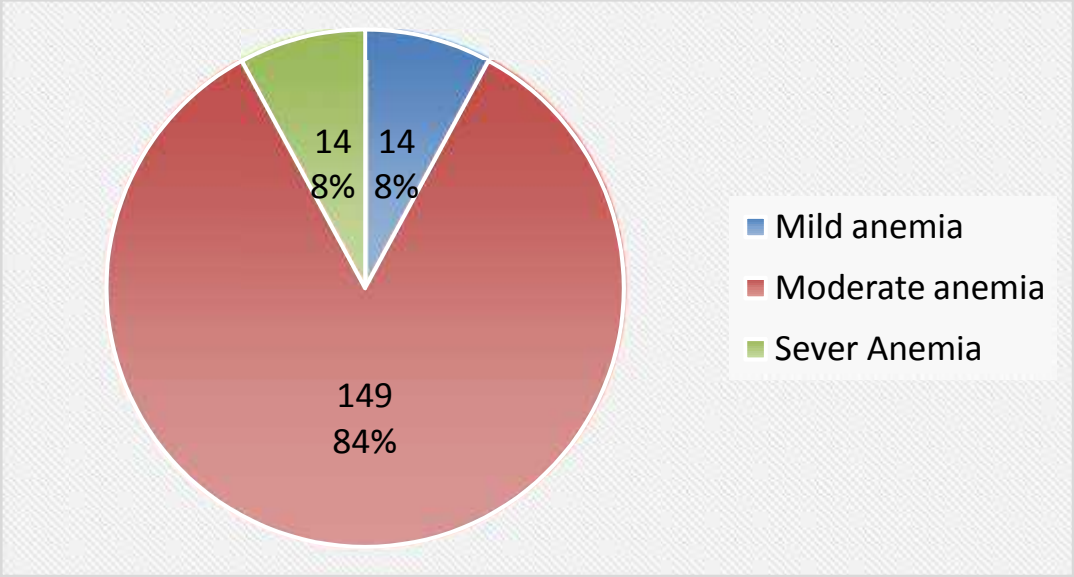

Fig 3: Distribution of anemia by severity among anemic children aged 6-59 months attending Keranyo health center, Addis Ababa, Ethiopia (n=177).

5.5. Factors associated with anemia

Variables with *P*-value ≤ 0.2 in the bivariate analysis (sex of child, age of child, age of mothers, mothers educational status, occupational status, child fever in the last two weeks, child drink tea and iron supplementation to the mother during pregnancy) were entered into the final multivariable logistic regression analysis to control potential confounding factors and to get estimates of the association between factors and dependent variables.

In the multivariable logistic regression, child sex, age of child, age of mother, educational status of mother, occupational status of mother, child fever, drinking tea and iron supplementation to the mother during pregnancy were independent variables having significant association with anemia among children aged 6-59 months at Keranyo health center. Male children were 2.32 times (AOR=2.32; 95% CI, (1.42-3.79)) more likely to be anemic than female children. Children in the age group of 6-11 and 12-23 months were 2.8 times (AOR=2.78; 95% CI, (1.08-7.13)) and (AOR=3.82; 95% CI, (1.66-8.77)) more likely to be anemic than children with mothers of secondary and above educational status respectively. Children who had fever in the last 2 weeks and who drink tea were 2.1 times (AOR=2.13; 95% CI, (1.33-3.42)) and 2.2 times (AOR=2.17; 95% CI, (1.20-3.95)) more likely to be anemic than children who had not fever and did not drink tea respectively. Similarly, children born from mothers who didn't take iron supplementation

during pregnancy were nearly 3.0 times (AOR=3.02; 95% CI, (1.40-6.55)) more likely to be anemic compared to those who took iron supplementation (Table 4).

Table 4: Factors associated with anemia among children aged 6-59months attending Keranyo health center, Addis Ababa, Ethiopia (n=427) 2020.

Variable	Anemia		COR (95% CI)	AOR (95% CI)
	Yes	No		
Sex (child)				
Male	102	108	1.79(1.21,2.64) *	2.32(1.42,3.79)*
Female	75	142	1	
Age (child)				
6-11	38	60	1.64(0.75,3.57)	2.78(1.08,7.13)*
12-23	75	62	3.13(1.48,6.59)*	3.81(1.52,9.55)*
24-35	29	79	0.95(0.43,2.09)	0.71(0.28,1.85)
36-47	23	18	3.3(1.33,8.18)*	2.92(0.98,8.65)
48-59	12	31	1	
Age (mother)				
≤29 years	109	183	0.59(0.39,0.89)*	1.50(1.0,1.66)*
≥30 years	68	67	1	
Educational Status (mother)				
Illiterate	124	131	4.04(2.01,8.15)*	3.82(1.66,8.77)*
Primary	42	72	2.49(1.17,5.32)*	1.44(0.58,3.58)
Secondary and above	11	47	1	
Occupational Status (Mother)				
Yes	72	224	1	1.0(0,81,1.11)*
No	105	26	5.9(3.57,9.79)*	
Child had fever (last 2 weeks)				
Yes	96	90	2.11(1.42,3.12)*	2.13(1.33,3.42)*
No	81	160	1	
Exclusive breast feeding				
Yes	165	229	1	
No	12	21	0.79(0.38,1.66)	
Tea consumption				
Yes	147	174	2.14(1.33,3.45)*	2.17(1.20,3.93)*
No	30	76	1	
Mother iron supplementation during pregnancy				
Yes	152	230	1	
No	25	20	1.89(1.02,3.53)*	3.02(1.40,6.55)*

*Statistical significance in COR **Statistical significance in AOR, **CI** confidence interval, **COR** crude odds ratio, **AOR** adjusted odds ratio.

6. Discussion

This study aimed to determine magnitude of anemia and associated factors in children aged 6-59 months in Kolfe Keranyo sub city Keranyo health center. Only 177(41.5%) of the children who participated in the study were anemic. Factors associated with anemia in those children (6-59 months) were sex, age of the child, maternal age, educational and occupational status of the mother, child history of fever in the last two weeks, child tea consumption and maternal iron supplementation during pregnancy.

Magnitude of anemia observed in this study was similar with 2016 Ethiopian DHS prevalence reported for the Amhara Region (42%)(19). It was consistent with a study done in south west central Ethiopia 36.8 %(30),kilteawulalloworeda northern Ethiopia 37.5%(39) and 41.1% in Guguftu health center, South Wollo, Northeast Ethiopia(40).The study was also consistent with a study in some African countries Uganda 43.2%(37) ,Namibia 44.1%(23) and Swaziland 40.9%(3)but larger in some African countries Northern Tanzania 83.17%(2),Mali 81.9%(3),Southern Africa 63.8%(23), Burkina Faso 87.9%(3) and India 77.8%(22) which could be due to the study area, and period.

In our study the odd of anemia among male children is 2 times more likely than female (AOR=2.32, 95% CI = (1.42, 3.79)) which is similar with a study done in India(23). Some studies revealed that both male and female children had an equal chance of developing anemia.(31, 40).The odd of anemia among Children with mothers (caregivers) age ≤29 years is 2 times more likely than mothers (care givers) age ≥30 years(AOR=1.50, 95% CI=(1.0-1.66)). This could be possibly explained as younger age mothers are active in health seeking activities.

This study showed that, the odds of anemia among children whose maternal educational status was illiterate was 4 times more likely than those children whose maternal educational status was secondary school and above(AOR=3.82, 95% CI = (1.66, 8.77)).This may be explained by the fact that low level of maternal education may have a negative impact on the socioeconomic status of the family, which would affect the child nutritional status and optimal child care.Moreover,education enhances the mother’s knowledge needed for their children’s health and an appropriate feeding practice, which help to improve their children nutritional status. This

finding is consistent with similar studies (15,41–43).(41–44) However this study is inconsistent with a study done in north west Ethiopia(45).

The odd of anemia among children whose mothers were unemployed occupational status was 1 times more likely than those children whose mother were employed (AOR=1.0, 95% CI = (0,81,1.11)).This finding is consistent with the study done in Wolaita Zone and Hohoe municipality, Ghana(46,47)which demonstrated that children of employed mothers were less likely to develop anaemia.Their finding supports the argument that, mothers who were with employed occupational status tend to have better income and help their children to have better nutritional status. The reasons for this might be low nutrition uptake among children from households with poor Socio economical status due to unemployment. Children from low socioeconomic families are more likely to be malnourished, which may aggravate anaemia.

This study revealed that the odd of anemia among children who had fever in the past 2 weeks is 2 times more likely than those children who had no fever. This findingis similar in a cross-sectional study among Palestinian refugee children showed that a current episode of fever was associated with an increased risk of anemia(48,49).This possibly explained as some physiological disorders directly causing anemiapriorly expressed clinically by symptoms of fever.

This study showed that the odd of anemia among children who consumed tea is 2 times more likely than those children who do not consumed tea. This might be due to drinking of tea interferes with iron absorption and can lead to iron deficiency anemia when consumed in large quantities(50). The odd of anemia among children whose mother is not supplemented with iron during their pregnancy is 3 times more likely than those children whose mother with iron supplementation. This finding is supported by similar study conducted in Hohoe Municipality, Ghana(47). This might be explained by the fact that from recent follow up studies children born to iron-folic acid supplemented women suggest that mortality is decreased and the infant’s iron endowment reflects the mother’s iron status during pregnancy. It is still not clear weather iron deficiency in pregnant woman might lead to a deficient iron status of their children(51).

7. Strength and limitation of the study

7.1. Strength

Satisfactory response rates among participants was obtained

7.2. Limitation

One of the limitations of this study is the cross-sectional nature of the study design; it does not reveal causal links between independent variables and anemia. Variables like serum ferritin concentration, folate levels, and vitamin B12 levels which could have helped in finding the causes of anemia and also child growth indicators directly linked with anaemia status and stool examination to check intestinal parasitosis were not determined due to resource limitation. Finally, information in all possible confounders was not collected for the association between out- come and exposures. This gave us little chance to control for other possible confounders that could explain magnitude of anemia.

8. Conclusion and Recommendation

8.1. Conclusion

The magnitude of anemia in children aged 6-59 months in Kolfe Keranyo sub city Keranyo health center was high. Sex of the child, age of the child, maternal age, educational and occupational status of the mother, child history of fever in the last two weeks, child tea consumption and maternal iron supplementation during pregnancy were factors associated with anemia in those children (6-59 months).

8.2. Recommendation

The ministry of health up to the local government health service authority should strengthen awareness creation, behavioural change programs in order to increase the knowledge of reproductive women about anemia.

Health professionals should incorporate anemia and its consequences in their day to day health education program for mothers who are pregnant and coming to the health center for care. Specifically health professionals in Maternity service delivery encouraged to strengthen one to one health information with mother regarding children feeding practice and early health facility visiting while the child became ill.

Health extension workers must work in coordination with health professionals to deliver awareness about early screening and referral of child who develop fever during their home to home visit and encourage the mother to have ANC during their pregnancy to be provided with iron for prevention of maternal anemia

Further study should be conducted at the community in Sub city level and at the city level to assess the magnitude of anemia and associated factors

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10. Annexes

Annex I. Subject information sheet (English version)

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

Subject information sheet for caregivers/guardians whose babies will be tested for hemoglobin to determine the prevalence of anemia in children aged 6-59 months and associated factors.

You are invited to participate in a study to be conducted by MSc student at Addis Ababa University, College of Health sciences, Department of Medical laboratory sciences, Please read the following statements and ask any unclear points before you agree to participate.

Title: Magnitude of Anemia in children aged 6-59 months and Associated Factors at Keranyo health center, Addis Ababa, Ethiopia.

Background: Anemia is a major public health problem around the world, it is affecting more than half of under five years old children in Sub-Saharan African countries. It is also a major public health problem among preschool-aged children in Ethiopia.

Aim of the study: Is to determine the magnitude of anemia in children aged 6-59 months and associated factors among Keranyo health center under five years' old children OPD patients. The study will provide baseline data for health planners and care providers to design preventive strategy in our country.

What are the risks of participating in this study?

Specimen collection will have no effect on the child except uncomfortable condition for a few seconds while finger prick for sample collection.

Benefit from the study: There is no financial incentive for the study but the result of the study will be communicated with children's physician.

Confidentiality: All information that you give and the results from child's specimen will be used for this study only. The sample will be coded, confidential. Only limited numbers of professionals will have access to the information.

What are my rights as a participant of this study?

Participation in this study is exclusively voluntarily. If you are not interested to participate or if you once decide to participate withdraw yourself at any time, there will be no consequences and you will get all the services provided in the health center with no problems. If you decide to participate, you have to sign on the consent form and you may obtain a copy of this information sheet.

Assurance of principal investigator: I, the under signed to confirm you that I take over the responsibility for the scientific ethical and technical conduct of the research project and for provision of progress reports for all concerned of the research project.

ZewduJiru (PI)…….. Signature……. Date….....,……

PI address: ZewduJiru, Keranyo health center, Addis Ababa, Ethiopia.

Email: Zewdu.jiru111@gmail.com Telephone: +251915993583/911350871

For additional information, please contact Addis Ababa University, College of Health sciences, Department of Medical laboratory sciences at:

Telephone: +251-1-12-75-51-70

Agree to participate? □Yes □No

Annex II. Consent form for parents/guardians

I have read the information above, or it has been read to me. I have been given the opportunity to ask questions and my questions have been answered to my satisfaction. I voluntarily consent that my child participates in this study provided he/she gives assent.

To collect her/his blood and be a participant in this study and understand that I have the right to withdraw my child from the study at any time.

Participant's Signature/finger print……

Name of deponent…… Signature…….

(For guardians unable to read)

Name of counselor nurse……. Signature…….. Date……..

Annex III Questionnaire

Questionnaire code _____ ID-code of informant_____

S.NO	Question	Choice or space to be filled	If
1. Socio-demographic characteristics of the child			
1.1	Date of birth	…….months or ……years	
1.2	Age of child's mother	…… in completed years	
1.3	Sex of the child	1.Male 2.Female	
1.4	Religion of the mother	• Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other specify	
1.5	Mother's educational status	• Unable to read & write 2. Read & write 3. Primary (1 to 8) 4. Secondary (9-12) 5. College & above	
1.6	Occupational status of the mother	• Private employed 2. Housewife 3. Government employee 4. Merchant 5. Other specified	
1.7	Marital status of the mother	1. Married 2. Single 3. Divorced 4. Widowed 5. Separated	
1.8	Average monthly income	_____	
1.9	No of alive children do you have?	_____	
1.10	Type of house do you lived	88. Condominium 2. Rental from private 3. Private Villa 4. Rent from the government	
1.11	What is your source of water	1. Piped 2. Non-piped 3. Both 1 &2" 4. Packed	
1.12	Do you visit Health Center during pregnancy for ANC	88. No 1. Yes	
1.13	If yes to the above question, how many?	1. Once 2. Two times 3. Three times 4 Four times	
2. Clinical information			
2.1	Did the child have diarrhea within the last two weeks?	□No □Yes □Unknown	
2.2	Did the child have fever within the last two weeks?	□No □Yes □Unknown	
2.3	Does the child have history of malaria disease?	□No □Yes □Unknown	
3. Nutrition information			
3.1	Current height of the child	…….cm	
3.2	Current weight of the child	…….kg	
3.3	Does the child ever breast fed	□No □Yes □Unknown	**1**

3.3.1	If yes for Q.no 3.3 for how long does he /she fed?	□ more than 2 years □ for 2 years □ less than 2 years	**1**
3.4	Does the child ever breast exclusively?	□No □Yes □Unknown	
3.4.1	If number 3.2 is yes specify duration	□ 6 and more than 6 month □ for 6 month □ less than 6 month	
4	**current child feeding status**		
4.1	Breast milk	□ No □ Yes □ Unknown	
4.2	Commercial infant formula	□ No □ Yes □ Unknown	**1**
4.2.1	If number 4.2 is yes does the child feeds protein-based iron containing Cow's milk	□ No □ Yes □ Unknown	
4.2.2	If number 4.2 is yes when does the child started feeding		
4.2.3	If number 4.2 is yes average amount the child consumed per day (in ML)		
4.2.4	If number 4.2 is yes yes when does the child stopped feeding		
4.2.5	If number 4.2 is NO does the child consumed Non-iron containing Soya protein based formula	□ No □ Yes □ Unknown	
4.2.6	If number 4.2.5 is NO When does the child started feeding		
4.2.7	If number 4.2.5 is yes average amount the child consumed per day (in ML)		
4.2.8	If number 4.2.5 is NO When does the child stop feeding		
4.3	Does the child drink tea?	□ No □ Yes □ Unknown	
4.3.1	If the answer for question no 4.3 is how often times the child drinks tea with in week	□ all week days □ some times	
5	**current solid food feeding status of the child**		
5.1	Does the child feed any solid food	□ No □ Yes □ Unknown	

5.1.1	If the answer for Question number 5.1 is yes How often your child does consumes meat?	1= Once or more than once /day 2= 1-3 /week 3= Once or twice /month 4 = Occasionally (holiday, weeding, ceremony etc.) 5 = Never	
5.1.2	If the answer for Question number 5.1 is yes How often does your child consumes fruits like (Orange, Banana, Mango, lemon)?	1= Once or more than once /day 2= 1-3 /week 3= Once or twice /month 4 = Occasionally (holiday, weeding, ceremony etc.) 5 = Never	
5.1.3	If the answer for Question number 5.1 is yes How often does your child consumes Commercial infant cereal/pure	1= Once or more than once /day 2= 1-3 /week 3= Once or twice /month 4 = Occasionally (holiday, weeding, ceremony etc.) 5 = Never	
5.1.4	If number 5.1 is yes When does the child starts feeding Commercial infant cereal/pure(age in complete months)		
5.1.5	If number 5.1 is yes When does the child stop feeding Commercial infant cereal/pure((age in complete months)		
5.2	During pregnancy, did the mother receive iron supplementation?	☐ Yes ☐ No ☐ Unknown	
6	Hemoglobin count of the child during an interview	…….in gm/dl	

Thank you for your genuine information.

Annex IV:መጠይቅ

አዲስአበባዩኒቨርሲቲ

የጤናሳይንስኮሌጅ

የሕክምናላቦራቶሪሳይንስት/ክፍል

ዕድሜያቸውከ6-59
ወርለሆኑህፃናትየደምማነስየሚታይባቸውህፃናትብዛትመጠንናተያያዥተግዳሮቶችዙሪያለመገምገምየተዘጋጀመጠይቅ፡፡

በአዲስአበባዩኒቨርሲቲጤናሳይንስኮሌጅየሕክምናናላቦራቶሪሳይንስት/ክፍልበማስተርስዲግሪተማሪየመመረቂያጥናትላይእንዲሳተፉተጋብዘዋል፤እባክዎበዚህጥናትለመሳተፍከመስማማትዎበፊትከዚህቀጥሎየሚገኘውንምንባብበጥሞናያንብቡናግልፅያልሆነልዎትማንኛውንምሃሳብይጠይቁ፡፡

1. **ርዕስ፡-**የጥናቱርዕስዕድሜያቸውከ6-59 ወርበሆኑህፃናትየደምማነስየሚታይባቸውህፃናትብዛት (መጠንና) ተያያዥተግዳሮቶች
2. **መግቢያ፡-**
   የደምማነስበአለምላይከባድየጤናችግርእየፈጠረያለሲሆንከሰሀራበታችባሉሀገራትያሉግማሽያህሉህፃናትበደምማነስየተጠቁናቸው፡፡እንዲሁምበኢትዮጵበተመሳሳይሁኔታለትምህርትባልደረሱህፃናትላይየጤናችግርእየፈጠረያለነው፡፡
3. **የጥናቱዓላማ፡-**ዕድሜያቸውከ6-59ወርበሆኑህፃናትየደምማነስየሚታይባቸውህፃናትብዛት (መጠንና) ተያያዥተግዳሮቶችበቀራንዮጤናጣቢያሊታከሙበሚመጡህፃናትየደምማነስለመከላከልየሚሆኑስትራቴጂለማውጣትይረዳል፡፡
4. **በዚህጥናትመሳተፍየሚያስከትላቸውችግሮችምንድንናቸው?**
   ከጥቂትሰኮንድየህመምስሜትበጣትላይበሚወስድየደምናሙናወቅትበስተቀርየደምናሙናበሚሰበስብበትወቅትምንምአይነትችግርበህፃናትላይአይፈጠርም፡፡
5. **በዚህጥናትመሳተፍየሚስገኛቸውጥቅሞችምንድንናቸው?**
   ይህጥናትምንምአይነትገንዘብለተሳታፊዎችአይሰጥም፡፡ነገርግንየደምናሙናውጤትከህፃናትሐኪምዎጋርምክክርይደረግበታል፡፡
6. **የሕክምናመረጃዬበሚስጥርተጠብቆመቆየትየሚችለውእንዴትነው?**
   ስለራስዎየሰጡትማንኛውምመረጃናከህፃናቱላይየተወሰደውናሙናላይየተገኘውየላቦራቶሪውጤትየሚውለውለጥናቱዓላማብቻነው፡፡ይህንማህደርሊያገኙየሚችሉትየተወሰኑየጥናቱተባባሪሰራተኞችብቻናቸው፡፡
7. **በዚህጥናትተሳታፊበመሆኔመብቶቼምንድንናቸው?**
   ይህጥናትበፍፁምፍቃደኝነትላይየተመሰረተነው፡፡በጥናቱውስጥያሉትንተሳትፎበማንኛውምጊዜየማቋረጥሙሉመብትየተ

ጠበቀከመሆኑምበላይራስዎንከጥናቱበማግለልዎምክንያትየሚቀርብቦትምንምአይነትየጤናጣቢያውአገልለግሎትአይኖር ም።በጥናቱለመሳተፍቀሪ (ኮፒ) የስምምነትወረቀትለራስዎይወስዳሉ።።

8. **ጥያቄካለኝወይምችግርቢያጋጥመኝምንማድረግይገባል?**
   ይህንጥናትበተመለከተወይምከዚህጥናትጋርበተዛመደመልኩስለሚያጋጥሙድንገተኛአደጋዎችወይምጥያቄካለዎትበሚከተ ለውአድራሻይጠቀሙ።።

ዘውዱጅሩ……..ሞባይል 09 15 99 35 83

ለተጨማሪመረጃዎችየአዲስአበባዩኒቨርሲቲየሕክምናላቦራቶሪሳይንስት/ክፍልይጠይቁ

ስልክ፡- 215+ 112 75 51 70

ለመሳተፍይስማማሉ?	እስማማለሁ	☐
	አልስማማም	☐

የስምምነትቅጽ

የሚስጥርቁጥር_____ **የተሳታፊስም**_____

ለዚህጥናትመረጃናየስምምነትቃሌንየሰጠሁትበአጠቃላይሁኔታውንበመረዳትናበፍፁምፍቃደኝነትነው፡፡በተጨማሪጥያቄለመ ጠየቅተፈቅዶልኝለማወቅየፈለኩትንያህልማብራሪያአግኝቻለው፡፡እኔበሙሉስምምነትልጄበዚህጥናትእንዲሳተፍፍቃዱንእሰጥ ቻለው፡፡የደምናሙናከልጄላይእንዲወስድናየጥናቱተሳታፊእንዲሆንእንዲሁምበማንኛውምሰዓትከጥናቱልጄንማግለልመብቴየተ ጠበቀእንዲሆንተገልፆልኛል፡፡

9. የተሳታፊው/ዋፊርማየጣትአሻራ_____
   (የስምምነትቅጽንማንበብለማይችሉተሳታፊዎችየአማካሪነርስ

   ስም_____
   ፊርማ_____
   ቀን_____

ተ.ቁ	ጥያቄዎች	ምርጫዎች፣ባዶቦታወይምመልስመስጫ
1.	**የማህበራዊእናስነህዝብየተመለከተመጠይቅ**	
1.1	የህጻኑ(ዋ) ዕድሜ	.....ወር
1.2	የህጻኑ(ዋ) እናትወይምአሳዳጊዋእድሜሙሉበሆነአመት	……አመት
1.3	የህጻኑ(ዋ) ጾታ	1.ወ 2.ሴ
1.4	የህጻኑ(ዋ) እናትወይምአሳዳጊዋሃይማኖት	1.ኦርቶዶክስ 2.እስልምና 3.ፕሮቴስታንት 4.ካቶሊክ 5.ሌላካለይገለጽ……
1.5	የህጻኑ(ዋ) እናትወይምአሳዳጊዋየትምህርትደረጃ	1.ማንበብናመጻፍየማይችል 2..ማንበብናመጻፍየሚቸል 3.አንደኛደረጃ(1-8) 4.ሁለተኛደረጃ(9-12) 5.ኮሌጅእናከዚያምበላይ
1.6	የህጻኑ(ዋ) እናትወይምአሳዳጊዋየስራሁኔታ	1. የግልስራ 2. የቤትእመቤት 3. የመንግስትስራ 4. ነጋዴ 5. ሌላካለይገለጽ……
1.7	የህጻኑ(ዋ) እናትወይምአሳዳጊዋየጋብቻሁኔታ	1. ያገባች 2. ያላገባች 3. የተፋታች 4. ባሏየሞተባት 5. ከባሏጋርየተለያች
1.8	የህጻኑ(ዋ) እናትወይምአሳዳጊዋአማካይወርሃዊገቢ	……(ብር)
1.9	ምንያህልልጆችበህይወትአልዎት	……..
1.10	የሚኖሩበትየቤትአይነት	1. የጋራመኖሪያቤት 2. የግልተከራይ 3. የግልቤት 4. የመንግስትቤት
1.11	የመጠጥውሃአቅርቦትአይነት	1. የቧንቧውሃ 2. .የታሸገውሃ 3. ሁለቱንም 4. የምንጭ (የኩሬ) ውሃ
1.12	ህጻኑ(ዋ) እናትወይምአሳዳጊዋበእርግዝናዋወቅትበጤናተቋምየእርግዝናክትትልአድርገዋል	0. አይደለም 1. አዎ
1.13	ለተ.ቁ 1.12 መልስዎአዎከሆነምንያህልጊዜ	1. አንድጊዜ 2. ሁለትጊዜ 3. ሶስትጊዜ 4. አራትጊዜ
2	**የጤናእናጤናነክመረጃ**	
2.1	ባለፉትሁለትሳምንታትልጅዎተቅማጥነበረው	0. አልነበረውም 1. አዎ 2. አላወቅም
2.2.	ባለፉትሁለትሳምንታትልጅዎትኩሳትነበረው	0. አልነበረውም 1. አዎ 2. አላወቅም
2.3.	ልጅዎከዚህቀደምየወባታማሚነበር	0. አልነበረውም 1. አዎ 2. አላወቅም

3	**ስነምግብንበተመለከተየተዘጋጀመጠይቅ**	
3.1.	የህጻኑ(ዋ) ወቅታዊቁመት?	……ሴ.ሜ
3.2.	የህጻኑ(ዋ) ወቅታዊክብደት?	……ኪግ
3.3.	ልጅዎጡትጠብቷል?	0. አይደለም 1. አዎ
3.3.1.	ለጥያቄቁጥር 3.3 መልስዎአዎከሆነልጅዎከተወለደበዋላለምንያህልጊዜጠብቷል?	1… ከ 2 አመትበላይ 2…2 አመት 3.… ከ 2 አመትበታች
3.4	ልጅዎከተወለደበኋላጡትብቻጠብቷል	0. አይደለም 1. አዎ
3.4.1	ልጅዎከተወለደበኋላጡትብቻየጠባውምንያህልጊዜነው?	1.6 ወርእናከዚያምበላይ 2.ከ 6 ወርበታች
4	**ልጅዎአሁንየሚመገበውምግብሁኔታጋርየተያያዘመጠይቅ**	
4.1	ልጅዎአሁንየጡትወተትይጠባል	0. አይደለም 1. አዎ
4.2	የገበያዱቄትወተትይመገባል	0. አይደለም 1. አዎ
4.2.1	ለጥያቄቁጥር 4.2 መልስዎአዎከሆነየሚጠቀመውየገበያወተትበፋብሪካየተቀናበረየ አይረንከምችትያለውየላምወተትነው	0. አይደለም 1. አዎ
4.2.2	ለጥያቄቁ 4.2.1 አዎከሆነመጠቀምየጀመረበትዕድሜይግለጹ	
4.2.3	በአንድቀንበአማካይምንያህልየላምወተትይጠቀማልበ(ሚ.ሜ)	
4.2.4	ለጥያቄቁ 4.2.1 አዎከሆነመጠቀምያቆመበትዕድሜይግለጹ	
4.2.5	ለጥያቄቁ 4.2.1 መልስዎአይደለምከሆነህፃኑየሚመገበውየአይረንከምችትየሌለ ውበፕሮቲንየበለጸገየዱቄትወተትነው	0. አይደለም 1. አዎ
4.2.6	ለጥያቄቁ 4.2.1 አዎከሆነመጠቀምየጀመረበትዕድሜይግለጹ	
4.2.7	በአንድቀንበአማካይምንያህልየአይረንከምችትየሌለውበፕሮቲንየ በለጸገየዱቄትወተትይጠቀማልበ(ሚ.ሊ)	
4.2.8	ለጥያቄቁ 4.2.1 አዎከሆነመጠቀምያቆመበትዕድሜይግለጹ	
4.3.	ልጅዎሻይይጠጣል	0. አይደለም 1. አዎ
4.3.1.	ለተ.ቁ 3.4 መልስዎአዎከሆነበሳምንትምንያህልጊዜሻይይጠጣል	1.ሁሉምቀናቶች 2. አልፎአልፎ
5	**የልጅዎደረቅምግብአመጋገብንየተመለከተመጠይቅ**	
5.1	ልጅዎማንኛውንምደረቅምግብይመገባል	0. አይደለም 1. አዎ
5.1.1.	ለተ.ቁ 5.1 መልስዎአዎከሆነስጋምንያህልጊዜይመገባል??	1.አንዴናከዛበላይበቀን 2.ከ1-3 ጊዜበሳምንት 3.አንዴወይምሁለቴበወር 4. ለበዓላት፣ለሠርግ (አልፎአልፎ) 5. ምንምአይመገብም

5.1.2.	ለተ.ቁ 5.1 መልስዎአዎከሆነየፍራፍሬአይነቶች(ብርቱካን፣ሙዝ፣ማንጎ፣ሎሚየመሳሰሉትን) ምንያህልጊዜይመገባል???	1.አንዴናከዛበላይበቀን 2.ከ1-3 ጊዜበሳምንት 3.አንዴወይምሁለቴበወር 4. ለበዓላት፣ለሠርግ (አልፎአልፎ) 5. ምንምአይመገብም
5.1.3	ለተ.ቁ 5.1 መልስዎአዎከሆነከጥራጥሬተመጥኖየተዘጋጀምግብ (ምጥን) ምንያህልጊዜይመገባል???	1.አንዴናከዛበላይበቀን 2.ከ1-3 ጊዜበሳምንት 3.አንዴወይምሁለቴበወር 4. ለበዓላት፣ለሠርግ (አልፎአልፎ) 5. ምንምአይመገብም
5.1.4	ለተ.ቁ 5.1 መልስዎአዎከሆነከጥራጥሬተመጥኖየተዘጋጀምግብ (ምጥን)መመገብየጀመረበትእድሜ	
5፣1.5	ለተ.ቁ 5.1 መልስዎአዎከሆነከጥራጥሬተመጥኖየተዘጋጀምግብ (ምጥን)መመገብያቆመበትእድሜ	
5.2	በእርግዝናወቅትእናትየውየአይረንከምችትያለበትእንክብልወስደዋል	0. አይደለም 1. አዎ
6	**የልጁ(ድቷ) ሄሞግሎቢንመጠን**	**……..ግ/ዲ.ሊ**

ለመረጃዎአመሰግናለው

Protocols

B. Specimen collection and preparation

Capillary, venous or arterial blood may be used. EDTA or heparin should be used as an anticoagulant, preferably in solid form to avoid dilatational effects. Tubes containing fluoride should not be used. Mix all specimen tubes thoroughly in a mechanical mixer for at least 2 minutes or invert the tube 8-10 times by hand. Hemoglobin remains unchanged for days, provided that the blood does not become infected. If the specimen has been stored in a refrigerator, it will be viscid and the blood should be allowed to warm up to room temperature before mixing.

Materials required

Cotton Swab, 70 % Alcohol, Test tube, Blood lancet, Micro cuvette, Microscope slide

B. **Principle of Hemocue 301**

The system consists of an analyzer together with micro cuvettes. The micro cuvettes serve both as a pipette and as a measuring cuvette. A blood sample of approximately 10 micro litter is drawn into the cavity by capillary action. The measurement takes place in the analyzer, which measures the absorbance of whole blood at aHgb/HgbO_2isobestic point. The analyzer measures at two wave length (506 and 880nm) in order to compensate for turbidity. The HemocueHb 301 is calibrated against the hemoglobincynide (HiCN) method, the international reference method for the determination of the hemoglobin concentration in blood. The system is factory calibrated and needs no further calibration.

C. Quality control

The HemocueHb 301 Analyzer has an internal quality control the "self-test". Every time the analyzer is turned on, it will automatically verify the measurement performance. This test is performed at regular intervals if the analyzer remains switched on. Upon passing the self-test, the display will show the Hemocue symbol and three flashing dashes, indicating that the analyzer is ready to perform a measurement. An error code will be displayed if the theselftest fails. Follow local guidelines regarding quality control procedures. If a quality control test is to be performed, only use controls recommended by Hemocue, see relevant package for more information.

D. Expected values

Children 11.0-14.0g/dl

Woman 12.0-15.0g/dl

Men 13.0-17.0g/dl

Children, 2 years to teenage, gradually increase to adult values. Due to a wide range of condition (dietary, geographical, etc.)Which affect normal values, it is recommended that each laboratory establish its own normal range.

Measuring range

Displayed range: 0-25.6g/dl.

E. Limitations

Do not premeasured the micro cuvette

Mixing sample for an extended period can produce increased oxygen pressure and viscosity that may give falsely results.

Limited number of samples from individuals with sickle cell has been tested.

Limited number of samples from individuals with thalassemia has been tested.

Value above 23.0 g/dl must be confirmed using a suitable laboratory method.

F. Procedure

To perform the test, the cuvette holder should be in its loading position. The display will show three flashing dushs and the hemoCue symbol. Remove a hemoCueHb 301 microcuvette from the vial. Make sure the patient's/blood donor's hand is warm and relaxed. Use only the middle or ring finger for sampling. Avoid fingers with rings on.

Clean with disinfectant and allow drying completely or wiping off with a dry, lint-free wipe.

Using for thumb, lightly press the finger from the top of the knuckle towards the tip.

Puncture the finger using the lancet. Wipe away the first 2 or 3 drops of blood.

Fill the micro cuvette in one continuous process. DO NOT refill! If look for air bubbles in the filled micro cuvette a second sample is to be taken, fill a new cuvette from a new drop of blood.

Wipe off excess blood from the outside of the cuvette. DO NOT touch the open end of the micro cuvette.

Place the filled micro cuvette in the cuvette holder within 40 second after filling. Gently touch the cuvette holder

After approximately 10 seconds, the hemoglobin value is displayed.

Always handle blood specimens with care, as they might be infectious. Consult local environmental authorities for proper disposal(52,53).

Wright staining

Method

1. Cover the blood film (preferably methanol prefixed) with undiluted stain but do not flood the slide. If using a dropper bottle count the number of drops required to cover the film.

Note: The undiluted stain not only acts as fixative but also partially stains the smear. This

Stage is required to obtain the best possible staining results.

2. Add the same volume of buffered water as stain issued of pH 6.8 buffered water. The diluted stain should not overflow. Ensure the water is well mixed with the stain by blowing on the diluted stain or mixing the stain and water using a plastic bulb pipette. Allow to stain for 5minutes (time may require adjusting).

Note: Diluting the stain in buffered water brings about full staining of the blood cells.

The exact staining time to use should be decided when a new batch of stain

is prepared.

3. Wash off the stain with tap water (filtered if not clean). Do not tip off the stain, because this will leave a fine deposit covering the film. Wipe the back of the slide clean and stand it in a draining rack for the smear to dry. The blood film should appear neither too pink nor too blue (check results microscopically).

Quality control

● When a new batch of stain is prepared, decide the best staining time to use, e.g. stain films

Made from the same blood at different times, e.g. 5, 7, 10, 12, 15 minutes. Compare the results

With a stained control blood film.

● Check the pH of newly prepared buffered water and re-check it at weekly intervals. The pH of the buffered water used to dilute the stain must be correct. It is mainly responsible for the staining reactions.

● Maintain consistency in the staining procedure by following exactly a standard operating procedure (SOP). If the quality of staining changes, always report this to the person in charge of

The laboratory and ensure the fault is rectified. The staining procedure should be checked at the beginning of each week.

Tap water: If the tap water is highly acidic, resulting into pink a blood film or highly alkaline, resulting in to blue a blood film, try using boiled cooled water or filtered rain water. If neither of these is suitable, wash the film with pH 6.8 buffered water.

Declaration

I, the undersigned, declare that this MSc thesis is my original work, has not been presented for a degree in Addis Ababa University or any other universities. I also declare that all sources of materials used for the thesis have been duly acknowledged.

Name of the candidate: ZewduJiru
Signature_____
Place: Addis Ababa University, Department of Medical Laboratory Sciences
Date of submission_____/_____/_____

This thesis has been submitted with my approval as university advisors.
Name of advisor: Dr. Aster Tsegaye (MSc, PhD)
Signature _____
Date of submission_____/_____/_____

Name of advisor: JemalAlemu (BSC, Msc, PhD candidate)
Signature _____
Date of submission_____/_____/_____