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Hematological abnormalities and Associated Risk Factors Among Pregnant Women Attending Antenatal Care at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia

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This is to certify that the thesis prepared by MogesHaftu, entitled: “ Hematological Profile and Associated Risk Factors Among Pregnant Women Attending Antenatal Care at TikurAnbessa Specialized Hospital,Addis Ababa, Ethiopia “ is submitted in partial fulfillment of the requirements for Master of Science degree in Clinical Laboratory Sciences (Hematology and Immunohematology Specialty Track) complies with the regulations of the University and meets the accepted standards with respect to originality and quality

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Abbreviations and acronyms

AAU	Addis Ababa University
ANC	Anti Natal Care
BB	Blood Bank
CBC	Complete Blood Count
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
HLA	Human Leukocyte Antigen
NRA	National Regulatory Authority
PDMP	Plasma-Derived Medicinal Product
PRP	Platelet-Rich Plasma
RBC	Red Blood Cell
RTTI	Relevant Transfusion-Transmitted Infection(s)
SOP	Standard Operating procedure
TASH	TikurAnbessaSpecialized Hospital

Operational definitions

Anemia:- hemoglobin concentration less than 11g/ dl for pregnant women.

Hematological profile: Red blood cells, Red blood cell indices, Hematocrit, Hemoglobin, White blood cells, differential white blood cell and platelets value of pregnant women

Mild anemia: when the hemoglobin concentration of pregnant women is between 10.0-10.9 g/dl.

Moderate anemia: when the hemoglobin concentration of pregnant women is between 7.0-9.9g/dl.

Severe anemia: when the hemoglobin concentration of pregnant women is less than 7g/dl

Abstract

Background: During pregnancy there is changes in hematological parameters as to balance the requirements of the growing fetus and placenta . hematological markers could have effect on the pregnancy and it's final fate. Among the various abnormalities anemia and low platelet count are the most frequently encountered problem.

Objectives: We determined the selected hematological profile and risk factors among pregnant women attending antenatal care at TikurAnbessa Specialized Hospital, Michu Clinic, AddisAbeba, Ethiopia from September 2021 - February 2023.

Methods: We have recruited 406 pregnant mothers at TikurAnbessaSpecialized Hospital, MichuClinic ,Addis Ababa Ethiopia between September 2021 to February 2023 GC. following a cross-secetionalapproach. Clinical information and maternal age, gestational age and other information were collected using a structured data collection format that were done by an interviewer. Five milliliters of venous blood was collected using EDTA tubes from each pregnant women and using Sysmex KX-21N blood analyzer complete blood count (CBC) were determined. The results were analyzed using measure of central tendencies by applying stactical for package social science version 23 softwares. The findings was displayed with texts, figures and tables.

Results: Pregnant women have mean age of 28.4 +/- 5.06SD. The mean White cell , red cell and platelet count of the pregnant mothers were 7.71 ± 2.62 , 4.23 ± 0.35 million and 234.56 ± 28 thousand per micro liters of blood respectively. Pregnant women having history of abortion and with low income had low hemoglobin and hematocrit value. Based on this finding, being pregnant was found to reduce the level of hemoglobin and hematocrit measurements with P-values for Hgb (0.01) and HCT (0.02).

Conclusion: This study found that the level of hemoglobin and hematocrit among the pregnant women were low. Hence regular hemoglobin and other common hematological measurement is important in the time of pregnancy and mother's awareness has to be improved on the importance of nutrition during pregnancy

Keywords – Hematological profile, pregnant women, risk factor, TikurAnbessa Specialized Hospital

1. Introduction

1.1 Background

Pregnancy is influenced by many factors, some of which include culture, environment, socioeconomic status, and access to medical care [1]. Pregnancy manifests a number of changes in the mother physiology including complete blood count (CBC). Hemodilution and expansion of plasma is attributed to blood alteration.. Variations of red cell indices and iron parameters of the mother play a major role in determining the birth outcome [2].

Fetal hematopoiesis is an essential processes which is critical for the development of the fetus and maintain hemostasis by reducing blood loss during delivery as a result of changes happned during pregnancy [3]. Low red cell count or hemoglobin concentration and low platelet count are the frequently encountered alteration during pregnancy and anemia affects half a billion women of reproductive age worldwide . In 2011, 29 % of non-pregnant women and 38 % of womenwith age between 15-49 yrs develop anemia while they are pregnant [4]. Such situation is more serious in countries under developing categories as the incidence is also linked with unfavorable outcomes to the mothers and the developing fetus including death. It is estimated that 56 % of mothers in the developing world are thought to be anemia according to the report from WHOM [5].

Pregnancy advances low hemoglobin level in a continuous manner [7-8]. Iron deficiency is largely responsible for low hemoglobin [6]. Approximately, 2 billion peoples worldwide suffer from Iron deficiency anemic. According to WHO, 11gm/dl hemoglobin and 7gm/dl is considered as anemia and severe anemia among women who are pregnant. The center for disease control and prevention defines anemia as less than 11g/dl in the first and third trimester and less than 10.5gm/dl in second trimester [9].

Pregnancy is associated with low white blood cell count particularly the neutrophil cell associated with pregnancy induced physiological stress.. But the full sequential changes of the various cell types responsible for this observed leukocytosis has not been clearly in all geographical locations and conditions. Likewise platelet number is reduced during pregnancy

[10-14].

The mechanisms for changes in hematological parameters in pregnancy might be associated with dilution phenomenon and platelet destruction. During pregnancy there is relatively hypercoagulable state with an increased platelet activity and consumption. This combined with the hem dilution state leads to a mean platelet count that is slightly lower than that in the non-pregnant state [10].

Due to population specificity and varying results of different studies a consensus could not be reached so far so as to define the cut off values in general. During pregnancy screening, diagnostic and continuous monitoring of all the parameters is undertaken according to the available data to assure both maternal and fetal wellbeing. Low hemoglobin in the blood is common in pregnant mothers which can continue to fall as the pregnancy advances and impact on outcomes of mother and child. Deficiencies in folic acid, Iron, B12, linked with loss of blood, suppression of marrow, hemolytic states, and other malignancies are the most common causes of anemia. Moreover, severe anemia during pregnancy is associated with prematurity, spontaneous abortions, low birth weight, operative delivery, postpartum hemorrhage and fetal death [11].

Iron deficiency is largely responsible for low hemoglobin level which is exaggerated during pregnancy as there is high demand for development of the fetus. Being multigravida has higher chance of developing iron deficiency anemia than the primigravida ones. Serum ferritin, serum iron and serum transferrin receptors can help to stratify individuals who are at risk of developing this deficiency even before it gets manifested [12].

1.2. Statement of the Problem

With the advent of many interventions to improve maternal and child health, pregnant women have become the focus of many health programs [13]. Although pregnancy-induced changes occur in hematological values, very few laboratories provide specific reference ranges for pregnant women [14].

One of the confusing concepts in pregnancy-related anemia is the issue of reference range that are commonly determined or established from women who are not pregnant and this could result in misinterpretation of laboratory findings and clinicians may not be confident to take appropriate decisions on the pregnant mothers [15-17]. With this context, regular assessment of pregnant mothers for any alteration of blood parameters is essential to understand the degree of changes through the time of conception [18-19].

In Ethiopia, like other African countries, many pregnant women develop anemia but still they do not know and go to health facilities to do hematological profiles because of this they are not getting proper treatment and medication on time [20]. Addis Ababa, like all the other regions, is estimated to have a high burden of hematological abnormalities in pregnant women [21] despite of this there is not enough published research that indicates the hematological profile and associated risk factors among pregnant mothers in the region and really it is very difficult to control and prevent the complications that would be developed especially during delivery. Therefore, this study will be very important to fill this gap.

1.3. Study significance

Determination of complete blood count profile of pregnant women is important to identify common hematological disorders during pregnancy that will in turn enhance for antenatal care services of both mother and fetus.

The finding of this study could also benefit health care providers while they evaluate and manage pregnant women and the fetus.

The findings obtained in this work also help all concerned officials to emphasize on the problem and take quality improvement measures given to pregnant women during antenatal follow up.

This study will have a significance importance on providing a baseline data for those who need to do their similar works.

2. Literature review

In developing nations including Ethiopia, pregnancy induced anemia is a matter of concern as it is a causes for high morbidity and mortality of the pregnant women, fetus and neonates apart from poor cognitive development of the fetus [22].

According to a research conducted at Katihar Medical College & Hospital, Bihar, in India showed that, among 400 pregnant women, 88.5% of pregnant women were found to be anemic; maximum in the age group of less than 18 years. Additionally, Participants mean age was 23.58 years, parity 2.38, gestational period 27.36 weeks, Interval between previous & index pregnancy 1.267 years, calorie intake 2032.30 Kcal per day and protein intake was 66.52 grams per day. In this study Anemia was significantly associated with age, parity, gestational age and inversely related to religion, birth interval, type of the family, socioeconomic and educational status, calories and protein intake. Finally, this study concluded that the incidence of undiagnosed anemia among pregnant mothers was very high and were associated with age, parity, gestational age, and birth interval, and diet, socioeconomic and educational status [23].

According to the study that was conducted in Niger Delta, the following findings were noted. The mean age of the study participants were (mean \pm SEM, 29.37 \pm 0.126 yrs.). In this study the overall mean gestational age was 21.64 \pm 0.211 weeks (median 20 weeks). Hemoglobin Hgb concentration ranged from 4.3 g/dl to 17.0 g/dl (mean \pm SEM, 11.62 \pm 0.033 g/dl). 318 of the pregnant women had hemoglobin values less than 11.0 g/dl (Hgb<11.0g/dl) representing 23.2% (95% CI; 11.55 – 11.68). The mean Hb concentration of 12.57 \pm 0.11 g/dl for the non-pregnant control women was significantly higher than that the mean of 10.04 \pm 0.5 g/dl recorded for the pregnant women ($p < 0.05$). The results also revealed 16.7% of the control group to be anemic (Hgb< 12.0 g/dl; mean \pm SEM, 11.57 \pm 0.174 g/dl). The difference in percentages of anemia between the non-pregnant control group (16.7%) and the pregnant group (23.2%) was significant ($P < 0.05$) [24].

One study conducted in Cameron, revealed that the average hemoglobin levels of pregnant women was significantly different with changes in trimester ($p < 0.05$). The mean HCT value of

pregnant women in the 1st trimester was higher than the values in the 2nd trimester and in the 3rd trimester; with a significant difference between values in the 1st and 2nd trimester ($p < 0.05$) and in the 1st and 3rd trimester ($p < 0.05$). The mean RBC values follow the same trend as those of the mean HCT values. The mean MCV value in pregnant women in the 2nd trimester was significantly higher compared to the value in the 3rd trimester ($p < 0.05$). The mean values of the rest of the parameters (MCH, MCHC, WBC and PLT) was not statistically different with trimester level. Age, gestation of mothers, ABO blood type, and history of abortion was linked with anemia. Mothers in the 2nd trimester had two fold chance of developing anemia than the other trimester. Women who had 1 to 3 times abortions had 4 times chance of getting anemia than women with out history of abortion. [25].

A study done at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, showed that pregnant women in the 2nd trimester had high level of anemia (16.7 %) and prevalence of anemia were common among mothers with previous pregnancy (12.4%); mothers with multigravida (12.7%); mothers with a single child (17.6 %) ,among mothers who had abortion history (14.3%) and among women who did not consume animal products and meat and vegetables and fruits respectively (16.7 % and 33.3 %) [26].

Mean hematocrit level of pregnant women at TikurAnbessaHospital, AA, Ethiopia was found to be 0.36 (36%) and 1.1%; 17.8% and 80.9 % of the mothers had severe, mild and moderate ;Level of an anemia respectively. Overall 17.29 % were anemic and 23.37% for primigravida and multigravida respectively. The prevalence of anemia in multipara was more 24.44% (33/135) than primipara 22.22% (26/117) and in those who were nulliparous 25/143 (17.48%). Anemia was also found to increase as the gestational age increases, showing the highest prevalence in the third trimester 35.48% (33/93) than second 21.64% (29/134) and first trimester 13.09% (22/168). Women with birth interval of less (32/93(34.4%)) than those with an interval of greater than or equal to two years 29/159 (18.23%) and women with no history of delivery 23/143(16.08%) [27].

2.1. Hematological profile

A Study conducted in Libya suggested increased white blood cell count is observed while the women is pregnant and mainly due to neutropenia seen during the 2nd months of pregnancy which consistently increased throughout the gestation time. On the other hand platelets and lymphocyte number is reduced at term in contrast with before the time of conception and there is increase in total blood volume at term and peripartum hemorrhage.. About 75% of cases of platelets changes are associated with pregnancy, 15%–20 % were secondary to blood pressure changes 3%–4 % might be linked with autoimmune conditions and 1%–2 % comprises rare constitutional thrombocytopenia [28].

2.2. Risk factors

Study done in Southern Ethiopia showed that pregnant women mean age of 28.7 ± 5.8 yrs, family size of 4.8 ± 1.8 were found to be anemic ,with burden of 23.2 % and it was associated with parasitic infection ,where 31.9 % of pregnant mothers had evidence of intestinal parasites including Hook worm (10.7%) and *Ascaris lumbricoide* (11.7 %) . Interestingly, no severe anemia was reported but 33.3 % and 66.6% of them had moderate and mild anemia respectively (29).

Anemia burden is consistently increased from the 1st to 3rd trimester with rate of 11.5 %, 23.8 % and 28.3 % respectively indicating how the problem is serious Mothers who did not have iron supplementation, low economic group ,mother with low dietary diversity score ,mothers in the 2nd and 3rd trimester and those who were infected with Hook worm were significantly prone to anemia [29].

2.3

Conceptual FrameWork

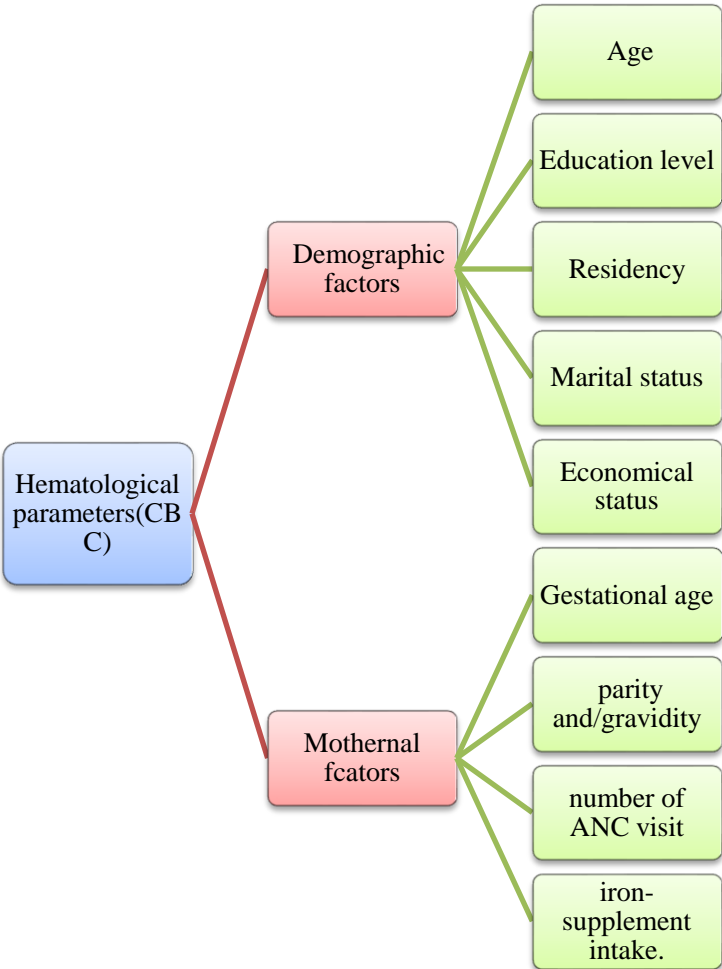


Figure 1: Conceptual frame work of the study.

3. Objectives

3.1 General Objective

To determine Hematological profile and associated risk factors among pregnant women attending antenatal care at TikurAnbessa Specialized Hospital, Addis Ababa, Ethiopia from September 2021 - February 2023 GC.

3.2 Specific Objectives

- To determine the common blood profile of mothers with pregnancy .
- To assess risk factors associated with hematological profile of pregnant women.

4. Hypothesis

- Hematological profile of pregnant women's are expected to be affected by pregnancy

5. Methods and Materials

5.1 Study Area

This work was done at TikurAnbesa Specialized Hospital, found in Addis Ababa main city of the country . The hospital is under Addis Addis Ababa University , college of health Sciences that provides both degree and graduate level education in many health Science field including medicine. More than 2000 thousands staff are serving with various speciality and sub-speciality clinics. including out-patients like hematology, oncology, dermatology, neurology, surgical, gynecology, ortho, diabetics, antenatal, GI, chest, staff clinic...etc. The hospital has more than 700 beds. Hematological profile of Blood samples collected from pregnant woman will be performed at TikurAnbesa Specialized Hospital laboratory department [30].

5.2 Study Design and Period

This study was conducted during September 2021 to Feb, 2022 GC using a cross-sectional approaches.

5.3 Populations

5.3.1. Source Population

All pregnant women attending Anti-natal care services at TikurAnbessa Specialized Hospital in medical college Addis Ababa, Ethiopia from September 2021 - February 2022GC.

5.3.2 Population of interest

The study subjects were all women who were pregnant attending the Anti-natal care services in the health facilities who satisfy the inclusion points .

5.4 Eligibility Criteria

5.4.1 Criteria for inclusion

All pregnancy women attending antenatal care services were targeted for this study.

5.4.2 Pregnant mothers excluded

All pregnancy and seriously ill pregnancy women who were attending antenatal care services were not included in this study.

5.5 Sample Size Determination and Sampling Techniques

5.5.1 Sample Size Determination

The following formula was applied to estimate the minimum number of study participants :

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

n= Number of mothers with pregnancy from finite population.

Z= The critical value corresponding to the 95 % confidence level =1.96.

d= The margin or errors = 5 % (0.05).

P = Proportion .For this study purpose proportion 39.97%(0.3997)of anemia was taken as Antenatal care service among pregenant woman [31].

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

$$n = (1.96)^2 \frac{0.3997(1-0.3997)}{(0.05)^2}$$

$$n = 368.7 = 369$$

Finally, add a 10% non-respondent rate total of **369** individuals

Constringency = sample size + 10% = 369x 10% = 37. n = 369 + 37 =**406**

So the lest number of pregnant women for this work were 406

5.5.2 Method of Sampling

We have used purposive sampling methods until the sample size is reached .

5.6. Variables of Interest

5.6.1 Outcome Variables

Hematological profile

5.6.1.1 Independent Variables

Socio demographic variables: Age, occupation, residence, educational status, number of pregnancy and marital status, Clinical factors Gestational age, parity and/gravidity, number of

ANC visit, iron-supplement intake.

5.7 Measurement and data Collection

5.7.1.Data Collection Procedures

We have used a pretested questionnaires with pilot study to capture demographic data of mothers with pregnancy including age, occupational status, marital status , and information pertaining to pregnancy. The data was collected by trained persons in the form of interview. .

5.7.2 Blood Collection Procedure

About 5 ml of blood was drawn with EDTA tubes from the antecubital and median cephalic veins of the fore arm following standard procedures. The collected blood was labeled and transported to the hematology laboratory for analysis.

5.8 Laboratory Analysis

We used sysmex KX-21N automated hematology analyzer to determine complete blood cell count and other parameters. It is a three part differential count which applies the electrical impedance and direct detection of red blood cells, platelets, white blood cells , hemoglobin and packed cell volume using the generated current . It can analyze 60 tests per hour. Red cell indices are derived accordingly.

5.9. Data Management and Quality Assurance

We have followed the preanalytical and analytical and post analytical quality measures throughout the study. Including the pilot tests to shape the study protocols.

5.9.1. Pre-analytical Measures

We have followed the quality of the data by closely looking the data collectors and provide feedback on daily bases. Venous blood collection was done following standard protocols by considering the volume of blood in accordance with the EDTA tube . After sample collection there was no delay for analysis and we checked the presence of hemolysis before analysis

5.9.2. Analytical

During analysis we have used low, high and normal level of control cells. inline with the SOP of the laboratory This is essential to check the actual hematological measurement is in accordance with the analytical sensitivity of the instrument.

5.9.3 Post analytic

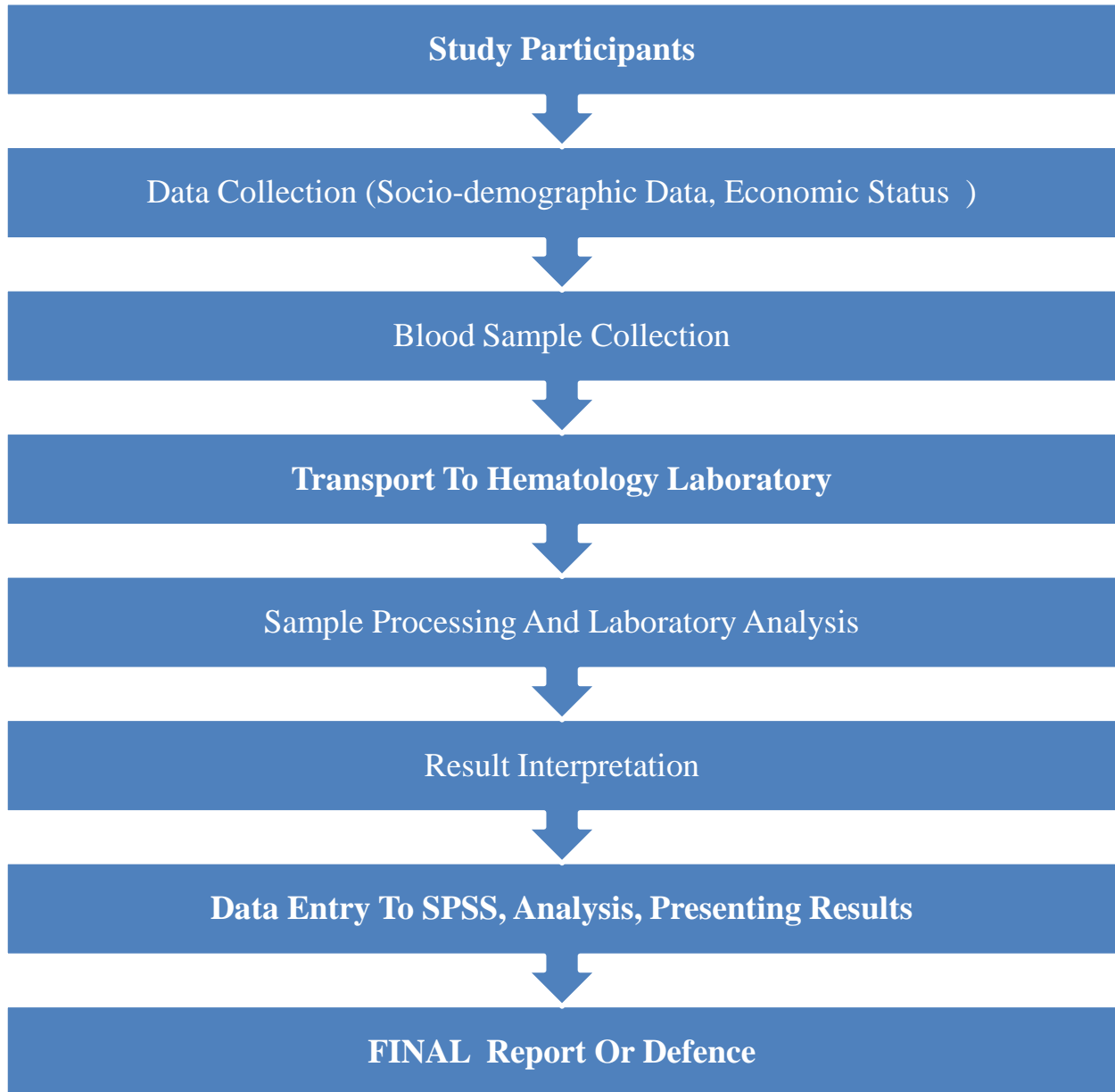
We interpret the complete blood cell count generated with analyzer on daily bases and each results were transferred to Microsoft excel sheet. Blood samples were kept for 24 hours after analysis incase there is a need for further analysis. Likewise the questionnaires were also checked for completeness and properly ordered for data entry.

5.10 . Data Analysis

Once the data is collected it was entered and checked for completeness using Microsoft excel and transferred to SPSS version 26 soft wares for analysis. We used descriptive statistics to compute the mean, median and SD of complete blood cell count . We have also applied χ^2 to see differences among the various variables.. For level of significance p value below 0.05 was taken as a cutoff. In addition to this multivariate analysis using logistic regression model was computed to know factors which independently influence the occurrence of dependent variables.

2.4

Workflow



5.11 Ethical Considerations

Approval of the proposal and ethical clearance was secured after the departmental research and ethics committee reviewed the protocols (MLS, CHS, AAU). Official cooperation letters were obtained from Addis University Laboratory department at TikurAnbessa Specialized Hospital. Participants provided their consent after getting adequate information about the study. . Permission was also obtained from TikurAnbessa Specialized Hospital laboratory department where the study was conducted.

5.12 Dissemination of Results

We have compiled the findings in thesis format and it was submitted to the Department of Medical Laboratory Sciences, College of Health Sciences, Addis Ababa University. Moreover, we will disseminate the findings in different workshops and manuscripts will be prepared for publication.

6. Results

6.1 characteristics of the pregnancy women

In this study, 406 pregnant mothers attending antenatal care at TikurAnbesaSpecialized hospital were enrolled and the descriptive statistics showed that they belongs to age range of 18 to 48 yrs with mean age of 28.38(SD \pm 5.025).

From the 406 total participants of this study, 353/406(86.9%) were from urban residence and the rest 501/406 (13.1%) were from rural residential. The majority of the study participants 384/406 (94.6%) were married and 19/406 (4.7%) were single. The majority of the study participants, 226 (55.7%) were unemployed, 85/406 (20.9%) were self-employed, of the total of 406 study participants it was found that 305 /406 (75.1%) were from low socio economic income where as a significant number of the study participants 99/406(24.4%) were from middle socio economic income (**Table 1**)

Table1. :Socio Demographic Characteristics of Pregnant Women Attending ANC at TikurAnbesa specialized hospital from September2021 – February 2023

Variables	Frequency		
	No	%	
Residence	Urban	353	86.9
	Rural	53	13.1
Income	Low	305	75.1
	Middle	99	24.4
	Higher	2	0.5
Educational status	Illiterate	28	6.9
	Primary	160	39.4
	Secondary	118	29.1
	Diploma	90	22.2
	Other	10	2.5
Marital status	Married	384	94.6
	Divorced	2	0.4
	Widowed	1	0.2
	Single	19	4.7
Occupational status	Government employed	64	15.7
	Non government	31	7.6
	Self employed	85	20.9
	Unemployed	226	55.7

Two hundred forty two (59.9 %) of the study participants were on their 3rd trimester where as about 98/406(23.21%) were on their 2nd trimester. Thirty nine, (9.9 %) of pregnant women had history of blood loss during the pregnancy. Around 110 /406 (27.1%) of the study participants had history of previous abortion. It was also found that 277/406(68.3%) of them had history of previous pregnancy .(table 2)

Table 2. Obstetric and other health care related Characteristics of Pregnant Women Attending ANC in Tikuranbesa specialized hospital from September2021 – February 2023

Variables		Frequency	Percentage(%)
Trimester	1sttrimester	66	16.9
	2ndtrimester	98	23.2
	3rdtrimester	242	59.9
PreviousPregnancy	No	129	31.7
	Yes	277	68.3
Gravidity	1	128	31.7
	2-4	237	58.5
	≥5	41	9.9
Numberofchild None	None	177	43.7
	1	121	29.9
	2	73	18.0
	≥3	35	8.5
Space b/n the current pregnancy and the last child	<1 year	174	43.0
	1 year	17	4.2
	2 year	30	7.4
	3 year	47	11.6
	4 yearandabove	139	33.8
Bloodloss	No	367	90.1
	Yes	39	9.9
Abortion	No	296	72.9
	Yes	110	27.1
Numbe0rofabortion	No	296	72.9
	Once	81	19.7
	Two and above	29	7.4
Frequencyofeating fruitandvegetable	None	5	1.1
	everyday	141	35.2
	every2days	83	20.4
	Oncein a week	172	42.3
	Oncein a month	5	1.1

The average red blood cell count of the study participants were 4.23+/- 0.35 billion cells per liter, regarding the hemoglobin value of the pregnant women , it was found that the average hemoglobin value was 11.8+/- 1.00 mg/dl. The other hematological test which was conducted to

the pregnant women was HCT, therefore the average HCT value of the study participants were 35.6+/-3.05.the average white blood cell count of the pregnant women was 7.71+/-2.62 thousand cells per milliliter cube. Regarding the platelet count, the average platelet count of the study participants was 234.56+/-8.28.

In this study it was also found that the low hemoglobin value and the low heamatocrit value were statistically associated with pregnancy and the findings of the P-value were 0.01 and 0.02 respectively (Table3).

Table 3. Hematological profile of Pregnant Women Attending ANC at Tikuranbesa specialized hospital from September2021 – february 2022 and association with pregnancy

Parameters	Pregnant women (n=406) mean and SD	Pvalue
RBC×10 ¹² /L	4.23±0.35	0.22
Hb(g/dl)	11.8±1.00	0.01
HCT(%)	35.6±3.05	0.02
MCV(fl)	92.54±3.22)	0.41
MCH(pg)	29.06±1.60	0.023
MCHC(%)	31.5±1.21	0.33
RDW(%)	13.50±0.62	0.246
WBC×(10 ⁹ /L)	7.71±2.62	0.5
Lymphocyte(%)	27.54±7.21	0.32
MID(%)	6.36±2.63	0.1
Neutrophil(%)	66.54±8.22)	0.32
PLT×(10 ⁹ /L)	234.56±8.28	0.54

In this study comparatively increased WBC count was found on pregnancy who were on their 3rd trimester, 7.71+/-2.62 when compared with their 1st and 2nd trimester. whereas decreased WBC count was found on those who were on their 2nd trimester,7.24+/-2.32 than those who were on

their 1st and 3rd trimester.

Comparatively increased red blood cell count was found on pregnant women who were on their 2nd trimester, 4.99+/-0.33 than those who were on their 1st and 3rd trimester. Regarding platelets it was found that the highest platelet count was found on pregnant women who were on their 2nd trimester, 254.09+/-32.2 thousand per/ul than their counter parts.

The highest White blood cell ,Red blood cells count , and platelet count was found on the pregnant women who were on their 3rd ,2nd ,2nd trimester respectively (Table 4).

Table 4:Comparison of hematological profile (Mean +/- standard deviation) based on trimester of Pregnant Women Attending ANC at Tikuranbesa specialized hospital from September 2021 – February 2023

Parameter	1 st trimester(n=	2 nd trimester(n=	3 rd trimester(n=
WBC (10 ⁹ / L)	7.53±1.85	7.24±2.32	7.71±2.62
Lymphocyte (%)	28.32±4.72	27.30±5.65	27.82±6.04
Mid(%)	6.69±2.00	6.43±3.23	6.45±2.42
Neutrophils (%)	66.55±2.61	66.12±3.17	69.11±7.05
RBC (10 ¹² /L)	4.23±0.38	4.99±0.33	4.11±0.34
Hb (g/dl)	12.35±0.32	11.68±0.95	11.93±0.43
HCT (%)	37.9±3.02	36.74±2.59	35.72±2.06
MCV (fl)	91.98±2.29	92.03±2.06	90.42±3.44
MCH (pg)	30.13±1.81	29.25±1.16	28.02±1.54
MCHC (%)	31.52±1.01	31.32±1.06	31.21±1.34
RDW (%)	13.05±0.55	13.42±0.47	13.28±0.32
Platelet (10 ⁹ /L)	252.65±43.73	254.09±32.22	226.2±64.02

7. Discussion

The findings of this study revealed that the mean hemoglobin (Hb) level (11.8 ± 1.0 g/dL), hematocrit (HCT) value ($35.6 \pm 3.05\%$) in pregnant women were significantly lower than normal hematological profiles, with a p-value of 0.01 and 0.02 respectively and indicating statistical significance. These results align with the findings of Verma et al. in India, which reported decreased RBC count, hemoglobin concentration, and HCT levels during pregnancy, along with an elevated mean corpuscular hemoglobin (MCH) value(20). Similarly, Elgari (2013) observed notable reductions in RBC count, hemoglobin, HCT, and MCHC of the pregnant mothers (51). Furthermore, a study by Ichipi-Ifukor et al. in Nigeria also reported significantly reduced packed cell volume ($32.58 \pm 4.01\%$) and hemoglobin levels (10.00 ± 1.28 g/dL) among pregnant mothers (38).

These findings collectively highlight the common hematological changes that occur during pregnancy across different populations, further emphasizing the importance of monitoring these parameters for maternal health. The findings of this study revealed a decrease in hemoglobin (Hb) levels (11.68 ± 0.95 g/dL) and hematocrit (HCT) values ($36.74 \pm 2.59\%$) during the 2nd trimester than the 1st trimester (Hb: 12.35 ± 0.32 g/dL; HCT: $37.9 \pm 3.02\%$). These results are in accordance with findings by James et al., which reported similar decreases in Hb (12.73 ± 1.14 , 11.41 ± 1.16 , and 11.67 ± 1.18 g/dL) and HCT ($37.05 \pm 2.96\%$, $33.12 \pm 3.00\%$, and $34.03 \pm 2.97\%$) across the 1st, 2nd and 3rd trimesters, respectively(52). Likewise, Akinbami et al. documented HCT values of $32.07 \pm 6.80\%$, $29.76 \pm 5.21\%$, and $33.04 \pm 3.88\%$ for the respective trimesters(10). However, these findings contradict from another study done in Ethiopia (34) that reported lower hemoglobin and packed cell volume during the 1st trimester than, 2nd trimester and dropped again in the 3rd trimester (39). The reduction in hemoglobin levels during pregnancy is primarily attributed to physiological changes, such as plasma volume expansion outpacing the increase in erythrocyte volume, resulting in hemodilution (11).

The red cell distribution width (RDW) is not different between pregnant women I ($13.67 \pm 0.77\%$). However, trimester-specific analysis showed a slight increase in RDW values (1st trimester: $13.05 \pm 0.55\%$; 2nd trimester: $13.42 \pm 0.47\%$; 3rd trimester: $13.28 \pm 0.32\%$), with a significant difference observed between the first and third trimesters. These findings align with Purohit et al., who reported RDW values of $14.07 \pm 1.01\%$, $15.07 \pm 1.01\%$, and $18.9 \pm 3.85\%$ across the three trimesters(40).

The mean white blood cell (WBC) count, significantly higher ($7.53 \pm 1.85 \times 10^3/\mu\text{L}$) and neutrophil count ($66.55 \pm 2.61\%$) in pregnant women ($P < 0.001$)(19). Similar trends were reported by Pughikumo et al., who documented a WBC count of $6.86 \pm 1.54 \times 10^3/\mu\text{L}$, and Okpokam et al., who found a significantly higher WBC count ($8.3 \pm 5.94 \times 10^3/\mu\text{L}$) in pregnant women(37). Leukocytosis during pregnancy is often attributed to physiological stress and the body's efforts to bolster the fetal immune system. This is achieved through selective immune tolerance, immune suppression, and immune modulation, alongside robust antimicrobial immunity. Additionally, studies have noted that lymphocyte proliferation in response to various agents is impaired during pregnancy, suggesting the presence of an immunosuppressive factor in maternal serum. This dynamic balance is critical for maintaining maternal-fetal immune harmony (11).

This study was observed decrease in platelet (PLT) count among pregnant women (252.65 ± 43.73) and (291.34 ± 70.67). These findings are consistent with Nigerian studies conducted that reported PLT counts of 202.17 ± 48.75 and 224.8 ± 75.2 respectively, (938). Similarly, Ifeanyi et al. documented PLT counts of 122 ± 3.4 and 198.5 ± 5.6 for pregnant and non-pregnant women(10,37,51).

Although this study noted a slight decrease in platelet count across trimesters, the differences were not statistically significant. The reduction in PLT count during pregnancy is likely the effect of dilution of blood and platelet damage as they pass through the maternal circulation. Anemia burden in the current study is inline with many previous study done in Ethiopia (45,48,55,56,57) but lower than other reports of the country (29,49,59,60,62,63). The discrepancy results could be number of study participants in each study, study settings,

and living condition of mothers . Additionally, improved living standards, enhanced health education, and the administration of iron supplements during antenatal care (ANC) likely contributed for low burden of anemia . Most cases of anemia (94.1%, or 16 out of 17) in this study were classified as mild (Hb 10.0–10.9 g/dL), with only 5.9% (1 out of 17) presenting as moderate anemia (Hb 7.0–9.9 g/dL) which is lower than previous studies done in Different parts of Ethiopia (49,57,61)... The discrepancy may be due to improved health education on anemia prevention and management, as well as differences in time and location between the current and earlier studies. In terms of anemia types, Normocytic Normochromic type was observed in 70. 6 % of mothers which is in line with a study done in Gondar and Turkey (55, 64). . Anemia during pregnancy is often influenced by various socioeconomic and health factors, underscoring the need for continued public health efforts to address its root causes.

Finally, the study highlighted that lymphocyte proliferation in response to various agents is impaired during pregnancy, suggesting the presence of an immunosuppressive factor in maternal serum. This complex immune adjustment ensures both maternal and fetal well-being during pregnancy.

7.1. Strength and Limitation of the study

Strength

- This study comprises relatively large sample size

Limitation

Being a cross-sectional study design it does not show the trend of the hematological profile in the study settings. difficult to make generalization . Moreover, We are unable to includes data of pregnant mothers during ANC time and follow up.

8. Conclusion

In this study we found that the mean hemoglobin (Hb) level hematocrit (HCT) value in pregnant women were (11.8 ± 1.0 g/dL), ($35.6 \pm 3.05\%$) respectively. The mean hemoglobin (Hb) level hematocrit (HCT) value in pregnant women was significantly lower than normal hematological profiles, with a p-value of 0.01 and 0.02 respectively and indicating statistical significance.

In this stud, there were no statistically significant difference in red cell distribution width (RDW) between pregnant women overall ($13.67 \pm 0.77\%$).

All in all 15.5 % of pregnant women had anemia with mild type is the dominant one among the study mothers. . Normocytic and normochromic anamiea was also common.

9. Recommendation

According to our findings, we strongly recommend pregnant women has to be screened for the presence of anemia throughout the three trimester of pregnancy using complete blood cell count to take timely intervention. Moreover, policy makers and health care providers should work together the impact of hematological abnormalities on the pregnant women and the fetus. Longitudinal studies are also encouraged.

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11. Annexes

Annex 1: Patient information sheet

My name is MogesHaftu and I am MSc student in hematology Addis Ababa . I am doing a research on hematological profile among pregnant women attending ANC at TikurAnbessa specialized hospital, medical college Addis Ababa, Ethiopia.

Purpose of the study

The purpose of the study is to assess the hematological profile and risk factors associated among pregnant women. Hematological abnormalities have sever health complications on the pregnant women as well as on the fetus therefore it needs urgent and proper management, therefore this study could be of paramount importance.

Participation: I am asking you to participate voluntarily in this study. If you agree to participate you will be asked to response to short questionnaire interview, and then I will take 5 ml of blood for laboratory analysis.

Risks associated: there is no any risk for participating in this study except that you will spend a maximum of 30 minutes for interview and you will give 5 ml of blood for laboratory analysis

Benefits: you will not pay anything for the laboratory analysis and If there is any abnormality finding in laboratory examination the result will be reported to your physician for appropriate treatment and management

Incentives: there are no any special incentives that you will be given for participating in this research.

Confidentiality: All information you give and data obtained from laboratory analysis will be kept confidential. The blood you give for this research can also be used for further analysis and investigation and will be communicated only to responsible figure. Formats containing data will be kept locked.

Sharing the result Report will be written about the finding of the study, either through publication or any other means the result will not bear any information relevant to your personality in anyway.

Therefore you are kindly requested to participate in study and 5 ml of blood is required for serological test and face to face interview is employed to collect data concerning risk factor and will take a maximum of 30 minutes.

Contact

If the study subjects have question or problem concerning the study, they can contact the principal investigator at any time using the following address

Mr. MogesHaftu, Hematology department ,Addis Ababa University

Cell phone +251927780097 Email:haftumoges12@gmail.com

ምመልኩከሰውነትዎጋርየሚዘመድሉንፍጥነትንምመረጃአይይዝም።.

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አድራሻ

የጥናቱርዕሰጉዳዮችጥናቱንበተመለከተጥያቄወይምችግርካለባቸውየሚከተሉትንአድራሻበመጠቀምዋናመርማሪውንበማንኛውምጊዜማነጋገርይችላሉ።

ሞገስሃፍቱ፣ሄማቶሎጂዲፓርትመንት፣አዲስአበባዩኒቨርሲቲ።ሞባይልስልክ+251927780097

ኢሜል: haftumoges12 @ gmail.com

Annex 3: Consent form

Written consent Greetings

Hello! My name is _____ from Addis Ababa, University. I am
MSc student

I am conducting a study on hematological profile and associated risk factors among pregnant women. You are kindly requested to participate in the study, which will have importance in improving maternal and child health in particular and health of the society in general. The interview will take about 30 minutes. No information concerning you, as individual will be passed to another individual or institution without your agreement. Your participation is voluntary and you have the right to not participate fully or partially. If you agree to be included in the study I will start my questions by asking general identification points. Only honest answers would contribute to improvement of health planning. "May I continue?"

If yes, continue interviewing

If No, thank and stop interviewing

Name of the interviewer _____ Sign _____ Date _____

Name of the supervisor _____ Sign _____ Date _____

Structured questionnaire for pregnant women

Research Title: Hematological profile and associated risk factors among pregnant women attending antenatal care in TikurAnbessa Specialized Hospital, Michu clinic, Addis Ababa, Ethiopia

Note: Please Encircle or Write the appropriate answer on the provided space.

No.	Variable	Response
1	Age	1. Less than or equal to 18 years 2. 18-34 years 3. above 35- years
2	Marital Status	1. Single 2. Married 3. Divorced 4. Widowed
3	Education level	1. Illiterate 2. Primary 3. Secondary 4. Diploma and above
4	Residence	1. Rural 2. Urban
5	Occupation	
6	Nutritional status	
7	Economic status	
8	Number of pregnancy	1. First 2. Second 3. Third or above
9	Do you have bleeding	1. Yes 2. No
10	Do you take have habit of drinking alcohol?	1. Yes 2. No
11	If your answer for Q#10 is yes, for how much?	1. 500ml/day 2. Above 500ml
12	Do you have history of cancer disease?	1. Yes 2. No
13	Have you history of liver disease	1. yes 2. No
14	If your answer to Q#13 is yes, do you take medication	1. Yes 2. No

Amharic version

ማሳሰብያ: እባክዎትክክለኛውን መልስ ያክብቡ ወይም ይፃፉ።

ተ.ቁ	ጥያቄዎች	መልስ
1	እድሜ	
2	የጋብቻ ሁኔታ	1. ያላገባ/ች 2. በትዳር ላይ 3. የፈታ/ች 4. በሞት ምክንያት የተለያዩ
3	የትምህርት ደረጃ	1. ያልተማረ 2. አንደኛ ደረጃ (1-8) 3. ሁለተኛ ደረጃ (9-12) 4. ዲፕሎማ/ድግሪ ናከዛበላይ
4	መነሻ	1. ገጠር 2. ከተማ
5	ስራ	
6	የአማካኝ ገቢ ሁኔታ	
7	በወር የሚያገኙት ገቢ	
8	የእርግዝና ቁጥር	1. መጀመሪያ 2. ሁለተኛ 3. ሶስተኛ ወይም ከዚያ በላይ።
9	የደም መፍሰስ ስርዓት ወይስ ቃል	1. የለም 2. አዎ
10	የአካል እንቅስቃሴ ስያዘውት ራሱ?	1. አዎ 2. አላዘውትርም
11	አልኮል የመውሰድ ልምድ አሎት?	1. የለም 2. አዎ
12.	ለተራ ቁጥር 12 መልስ ያስቀመጡ ሆነ በቀን ስንት?	1. 500 ሚሊ 2. ከዛበላይ
13.	የጉበት በሽታ ተይዞ ያወቃል	1. አዎ 2. የለም
14	ለተራ ቁጥር 14 መልስ ያስቀመጡ ሆነ መድሃኒት ወስድዋል	1. አዎ 2. የለም

ስለትብብር ዎ አመሰግናለሁ!

Annex 3. Laboratory Result

Code.....

Date of Sample Collection -----

Sample Collected By -----

Lab Analysis Done By

Name.....

Sig.....

Date.....

Thank you so much!!

Declaration

Assurance of principal investigator

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the research publications office in effect at the time of grant is forwarded as the result of this application.

MSc candidate: MogesHaftu (BSc MSc- candidate)

Signature _____

Date of Submission _____

Approval of Advisors

Name of Advisor: FekaduUrgesa (BSc,MSc, Assistant Professor, PhD fellow)

Signature _____

Date _____

Place: Addis Ababa, Ethiopia

Name of Advisor: MogesWordofa (BSc, MSc, Assistant Professor)

Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia

Name of Advisor: Dr. ShiferawNegash (MD, Associate Professor)

Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia