PREVALENCE OF CARDIOVASCULAR DISEASES AMONG PREGNANT WOMEN WHO WERE ATTENDING ANTENATAL CARE IN JIMMA UNIVERSITY MEDICAL CENTER, SOUTHWEST ETHIOPIA, FROM OCTOBER 2021 TO DECEMBER 2021

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LIST OF ACRONYMS

ANC- antenatal care

AR-Aortic regurgitation

CRVHD chronic rheumatic heart disease

CVDs-Cardiovascular disease

ECG- Electrocardiography

HD-Heart Disease

HDP-Hypertensive disorders of pregnancy

HHD-Hypertensive heart disease

JUMC-Jimma University Medical Center

MR-Mitral regurgitation

MS-Mitral stenosis

NYHA-New York heart association

PHTN-Pulmonary hypertension

PMI- point of maximal impulse

PR-Pulmonary regurgitation

PVCs- Premature ventricular beats

RHD-Rheumatic Heart Disease

TR-Tricuspid regurgitation

VHD-Valvular Heart Disease

ABSTRACT

Background

Pregnant women with underlying cardiovascular disease are at increased risk for adverse maternal and perinatal outcomes due to difficulty in tolerating the physiologic changes of pregnancy. Cardiac disease complicates 1–4% of pregnancies and, Hypertensive disorders of pregnancy affects 5 to 10% of pregnant women worldwide and, resulted in poor maternal and prenatal outcome. Rheumatic heart disease is the commonest cardiac disease among pregnant women with heart disease in developing countries. Despite all this, there is no adequate finding on the overall prevalence of cardiovascular diseases among pregnant women in the study setting as well as in the country.

Objectives: -*The aim of the study was to assess the prevalence of cardiovascular diseases among the third trimester pregnant women who had antenatal care follow up at Jimma University Medical center from October 2021 to December 2021.*

Methods:-*An institution based cross sectional study was conducted among pregnant women who had antenatal care follow up. Data was collected by using structured questionnaire; and it was then entered to Epi data and exported to SPSS Version 26 for statistical analysis. Descriptive data summarizations and presentations was done. Logistic regression was computed to assess statistical association, and significance of statistical association was considered to be significant if P-value ≤ 0.5.*

Result: - *A total of 156 pregnant women were enrolled in this study. The overall prevalence of cardiovascular diseases was 16.7%; of which 10.3% had hypertensive disorders of pregnancy and 6.4% had cardiac diseases. Of those with hypertensive disorders of pregnancy, preeclampsia accounted for 6.4% followed by gestational hypertension (2.6%) and chronic hypertension (1.3%). Of those with cardiac diseases, chronic rheumatic heart disease accounted for 3.2%.atrial septal aneurysm (1.9%) and hypertensive heart disease (1.3%). In those with rheumatic heart disease, mitral valve lesions were the prominent finding. T wave abnormalities were the most common electrocardiography finding.*

Conclusion:-*The prevalence of cardiovascular diseases among the third trimester pregnant women were high in the study institution. So, screening all pregnant women with electrocardiography and echocardiography is important.*

Keywords:-*Cardiovascular diseases; pregnancy; electrocardiography; echocardiography; Ethiopia*

CHAPTER ONE: INTRODUCTION

1.1 Background

Cardiovascular disease is one of the leading causes of non-obstetric maternal death during pregnancy (1) and cardiac disease during pregnancy is a major problem worldwide (2)**.** Maternal cardiovascular disease complicates between 1 and 4% of all pregnancy and responsible for 10-15% of maternal death (2–4).Although the prevalence is low, but now a days it has become the leading cause of maternal death globally. Since more women with congenital or acquired heart disease are reaching child bearing age due to improved medical and surgical care, the incidence of cardiovascular disease in pregnancy is increasing (2).

Heart disease in pregnancy represents a spectrum of etiologies including; cardiomyopathies, valvular heart disease (VHD), pulmonary hypertension (PHTN), and adult congenital heart disease (5) and also ischemic heart disease and cardiac arrhythmias-(6). Of these rheumatic heart disease (RHD) is the most common in developing countries, mitral stenosis (MS) being the predominant lesion among all presentations, whereas cardiomyopathies and congenital heart disease are more common in developed countries (7).

One of the most common cardiovascular conditions encountered during pregnancy is hypertension either as hypertensive disease of pregnancy or chronic hypertension. According to European society of cardiology 2011 report, hypertensive disorders are the most frequent cardiovascular events during pregnancy (1). Hypertensive disorders of pregnancy (HDP) include; preeclampsia, eclampsia, gestational hypertension, chronic hypertension, and chronic hypertension with superimposed preeclampsia. HDP affects 5 to 10% of pregnant women worldwide and, results in poor maternal and prenatal outcome. It is the second common cause of maternal death worldwide (8,9).

The pregnant women are in a marked hyper-dynamic and volume-overloaded state as a result of physiological changes during pregnancy. Cardiac output increases by 30-50% during pregnancy and further increases during labor and delivery (10)**.**Women with underlying heart disease cannot tolerate these additional hemodynamic burden of pregnancy which may exaggerate the underlying disease, resulting in increased morbidity and mortality to the mother, fetus or both (2).

1.2 Statement of the problem

Cardiovascular diseases (CVDs) remain the leading cause of disease burden in the world and are the leading cause of global mortality and a major contributor to disability. Prevalent cases of total CVD nearly doubled from 271 million in 1990 to 523 million in 2019, and the number of CVD deaths steadily increased from 12.1 million in 1990, reaching 18.6 million in 2019 (11). The leading causes of heart failure in Sub-Saharan Africa are hypertensive heart disease, cardiomyopathy, and rheumatic heart disease, with ischemic heart disease accounting for <10% of cases compared to >50% in high-income countries (12).

The age-standardized CVD prevalence and mortality rates in Ethiopia from the Global Disease Study from 1990-2017 were 5534, and 182.63 per 100 000 population, respectively. The top three prevalent CVDs were ischemic heart disease, rheumatic heart disease and stroke in descending order and CVDs are the leading cause of mortality in Ethiopia (13).

A retrospective cross-sectional study done in Ethiopia on the prevalence of rheumatic heart disease in a major referral cardiology clinic among 7576 records analyzed 4151 cases were caused by RHD which constituted 54.8% of the cases. The second most prevalent disease was hypertensive heart disease (HHD) which constituted 13.6% that was followed by congenital heart disease with 9% prevalence rate(14)

Patterns of cardiac disease at cardiac clinic in Jimma University Specialized Hospital showed that three quarters of cardiac diseases were due to RHD, HHD and cardiomyopathy in decreasing order of frequency (15). The study conducted in 2017 reported that prevalence of definite RHD in rural Ethiopia was 3.7 % on population based echocardiographic study in Jimma Zone, South West Ethiopia (16). A research done in Kenya showed the point prevalence of RHD-associated cardiac lesions was 5.0/1,000 and the point prevalence of all clinically significant lesions was 21.6/1,000 (17) .

Cardiac diseases occur in 2–4 % of pregnancies (18). A study done in Saint Paul's Hospital Millennium Medical College revealed that 10.3% of pregnant mothers had cardiovascular disease and a relatively high proportion of rheumatic heart disease among pregnant mothers (1). An echocardiographic study done in Eritrea on prevalence of subclinical rheumatic heart disease in pregnant women showed 2.3% of them were found to have subclinical RHD (19).A study done in Jimma University sowed that among pregnant women with VHD ,majority had RHD; and MS was the commonest valve lesion. More than half were in either New York Heart Association class (NYHA) III or IV heart failure and had left ventricular dysfunction(20)

A systematic review and meta-analysis done in Ethiopia in 2020 showed the pooled prevalence of hypertensive disorder of pregnancy to be 6.82 % (8).

Despite all these, only few published findings are available concerning cardiovascular diseases during pregnancy in Ethiopia and the national policy of Ethiopia does not give more emphasis on the burden of

cardiovascular diseases in pregnancy. So, this study is aimed at showing and filling the gaps in JUMC as well in the regional and national level by assessing the burdens of cardiovascular diseases among pregnant women. By doing so, it will be an input for health care workers, policy makers, researchers and to the health system of the country so as to improve the quality of health care in Ethiopia.

CHAPTER TWO: LITERATURE REVIEW

Cardiac disease is an important cause of maternal mortality and morbidity both in antepartum and postpartum period. The overall incidence of heart disease in pregnancy is <1%-(7)**.** Cardiovascular disease complicates 1–4% of pregnancies ,with a higher prevalence when including hypertensive disorders and is the leading cause of maternal death (21).In developing countries RHD is the commonest type of heart disease, whereas cardiomyopathies and congenital heart disease are more common in developed countries (22)**.**

A study done on maternal and fetal outcome in pregnancy with heart disease in tertiary care hospital in India showed, the prevalence of heart disease amongst all pregnancies found in hospital was 4.3%. The principal cause of cardiac lesion was RHD (56.6%) while congenital heart disease was seen in 13.3%. Among the women who had RHD, MS seen in (23.3%) and was most common lesion and, multiple cardiac lesions seen in (24.4%) women. Among the women with congenital cardiac disease, mitral valve prolapse was most common constituting (5%) of cases. Cardiomyopathy also constituted (7.3%) (7). In another study done in Iraq on clinical pattern and prevalence of heart disease among pregnant women presented to cardio-maternal unit, the main diagnosis of heart disease during pregnancy was valvular heart disease 34.1%, followed by congenital heart disease 30.5%, cardiomyopathy 29.8%, pulmonary hypertension 4%, and ischemic heart disease 1.6%. Among subtypes of the main heart diseases in pregnant women, the most clinical pattern was:-prosthetic heart valve (26.7%) in valvular heart disease, both atrial septal defect and ventricular septal defect (35%) in congenital heart disease, and peripartum cardiomyopathy (76%) among cardiomyopathies. (4).

In USA a study done on Neonatal and Maternal Outcomes in Pregnant Women with Cardiac Disease among the 2,284,044 women composing the study population, 0.2% women had HD and 99.8% did not. Of the women with HD, 17% had cardiomyopathy, 40% had VHD, 35% had Adult congenital heart disease and 8% had pulmonary hypertension (5)**.** A study done by Yassin K, et al. on Epidemiology of Cardiac Disease during Pregnancy in Khartoum Hospital, Sudan among 75 pregnant women in heart disease showed that 60% was rheumatic heart disease, 26.7% was congenital heart disease and 13.3% was other acquired heart disease (23)**.**

In Ethiopia a study done on Prevalence and patterns of Cardiovascular Diseases among Pregnant Mothers Attending Antenatal care at Saint Paul's Hospital Millennium Medical College, Addis Ababa. A total of 398 pregnant mothers who were on follow up at ANC clinic were randomly selected for clinical and echocardiographic evaluation in their 3rd trimester of pregnancy. The mean age was 27 (±4.6) years and their age ranged between 18-40 years. In general, 10.3% pregnant mothers had cardiovascular disease with

clinical evaluation and echocardiography. 8.3 % of the mothers have at least one echocardiographic abnormality out of which 2.3% had significant rheumatic valvular heart disease. 1.0% of the mothers have moderate-severe pulmonary hypertension. 2 % of them were known hypertensive, 1.8 % were known diabetic and 0.8 % were having renal diseases (1)**.**

A study done in Jimma University medical center by Moges Beriye et al showed that the prevalence of VHD in pregnant women was 0.6%. Out of a total of 29 pregnant women 28 (96.6%) had rheumatic heart disease. MS (75.9%) was the most frequent mitral valve pathology and 16 (55.2%) had severe MS (20). Another study also showed MS to be the most common lesion in pregnant women with RHD (24)

A systematic review and meta-analysis done in sub-Saharan Africa including 70 studies showed the pooled prevalence of hypertensive disorders of pregnancy (all types combined), chronic hypertension, gestational hypertension, preeclampsia, and eclampsia were 8%, 0.9%, 4.1, 4.1%, and 1.5% respectively (25)**.**Hospital based cross-sectional study that was conducted on all mothers who gave birth in the labor ward of Jimma University Specialized Hospital from April 1, 2009 to March 31, 2010. The overall prevalence of hypertensive disorders of pregnancy was 8.5%. Severe preeclampsia accounted for 51.9% of the cases followed by eclampsia (23.4%) (26). But a study done among pregnant women attending ante natal care at Gondar town health Institutions, North West Ethiopia 2017, the prevalence of hypertensive disorder of pregnancy were 16.8 % (27).The prevalence of preeclampsia in different parts of Ethiopia was different: Dessie referral hospital (8.4%) (28) and Mettu Karl referral hospital (12.4%) (29).

A study done on Electrocardiographic Changes during Pregnancy at Third Trimester showed increase in heart rate, decrease in PR interval , T wave abnormalities mostly in lead V1, V2, V3, V4, III and aVF, and increased occurrence of Q waves mostly in the bipolar leads. The QRS frontal axis showed increased tendency to shift towards left with advancing pregnancy. There was also significant increase in QT and QTc interval and the amplitude of various waves seemed to be decreased (30). Another study done on Electrocardiographic changes in hypertensive disorders of pregnancy showed that heart rate increases progressively throughout the pregnancy, reaching a peak during the third trimester. Gestational age also impacts QRS complex and T waves, promoting a leftward axis shift as pregnancy progresses. In particular, a leftward deviation of the mean QRS axis during the second and third trimesters of pregnancy and then rightward before delivery is observed in the majority of women. PR interval exhibits a significant reduction in the mean values during pregnancy, while the QRS amplitude generally increases slightly in the late pregnancy (but without a clear evidence of left ventricular hypertrophy). No clinically significant changes occur in other ECG intervals (including QT interval) or cardiac rhythm (31). Another study showed deviation of QRS axis towards left as pregnancy advanced, significant increased incidence of occurrence of prominent Q waves in lead II, III and aVF and, T-wave abnormalities like flat and inverted T-waves in

lead III, V1 – V3 were more frequent (32). Usually certain degree of tachycardia in pregnancy is expected, so relative shortening of all intervals like PR, QRS, and QT are expected (33,34) . Premature atrial and ventricular beats (PVCs) are common in pregnancy, occurring in 59% of pregnancies in one study (35)

Asymptomatic pericardial effusions (often trace or mild) are common in pregnancy occurring in approximately 40% of women, in the third trimester. They are thought to be related to hormone mediated volume retention and are most often clinically silent, resolving within 6 weeks postpartum (36) .The prevalence of atrial septal aneurysm in one study was 5.67% (37)

CHAPTER THREE: SIGNIFICANCE OF THE STUDY

Due to physiologic changes during pregnancy, pregnant women with cardiovascular disease have difficulty in tolerating these changes and are at risk of fetomaternal complications. So, assessing the burden of cardiovascular disease among pregnant women gives us a chance to optimize the care, establish cardio-maternal unit, to prevent fetomaternal complications. By doing so it will give a scientific-feedback to the policy makers, clinicians and at most to the health system of the country. Since there is no base line study done in this area, it will have a scientific benefit and give an entry point for other researchers

CHAPTER FOUR: OBJECTIVES

4.1. General objectives

To assess the prevalence of cardiovascular diseases among the third trimester pregnant women who were attending antenatal care in Jimma University Medical Center (JUMC), Southwest Ethiopia from October 2021 to December 2021.

4.2 Specific objectives

- To determine the prevalence of cardiac disease among the 3rd trimester pregnant women who were attending ANC in JUMC from October to December 2021.
- To determine the pattern of cardiac diseases among the 3rd trimester pregnant women who were attending ANC in JUMC from October to December 2021.
- To determine the prevalence of hypertensive disorders of pregnancy among the 3rd trimester pregnant women who were attending ANC in JUMC from October to December 2021.

CHAPTER FIVE: METHODES AND MATERIALS

5.1 Study area and period

The study was conducted in Jimma town, JUMC, which is a tertiary comprehensive hospital with a catchment population of 20 million people. Jimma town is located 352 km South West of Addis Ababa. The study period was from October 2021 to December 2021.

5.2 Study design

Was institution based cross-sectional study

5.3 Source population

All pregnant women who were enrolled to ANC at JUMC during the study period

5.4 Study population

All pregnant women who were in the 3rd trimester of pregnancy and had antenatal care follow up at JUMC, selected by systematic random sampling technique.

5.5. Inclusion and exclusion criteria

5.5.1 Inclusion criteria

- All women with confirmed 3rd trimester pregnancy (Since the reference literature I used for sample size calculation and most other references did study on 3rd trimester pregnancy and most of the physiologic changes of pregnancy occur after the 2nd trimester) &
- Who were willing to participate in this study and gave their consent

5.5.2 Exclusion criteria

- All women who were in the first and second trimester pregnancy (reasons as mentioned above)
- All non-pregnant women who came for preconception counseling
- All the 3rd trimester pregnant women who refused to give their consent

5.6 Sample size and sampling procedure

5.6.1 Sample size

Was calculated using single population formula.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where,

n= sample size

Z= standard normal distribution value at 95% confidence level of a/2= 1.96

P= 10.3%, prevalence of cardiovascular diseases, St. Paul's Hospital Millennium Medical College (1)**.**

d = margin of error= 5%

n = (1.96)2 0.103(1-0.103)/0.0025= 141.97=142

Adding 10% non-response rate = 156

5.6.2 Sampling procedure

By using systematic random sampling method, the 3rd trimester pregnant women who had ANC follow up during the study period were included in the study. Clinical screening, echocardiography using My alpha lab (ESAOTE S.p.A, SN; 50384) and Samsung (Model: ACCUVIX XG) machines and, electrocardiography with model of the machine: SE-1200 Express were done. Blood pressure was measured at both arms and the higher was taken. It was measured at the ANC and echocardiography room after 30 minutes of rest. The term raised BP was used if the study participant had two of the measurements in the hypertensive range. Urinalysis, renal function tests, liver enzymes and complete blood count were done for those who had hypertension.

5.7 Variable of the study

5.7.1 Dependent variables

- Cardiac disease
- Hypertensive disorders of pregnancy

5.7.2 Independent variables

Socio-demographic characteristics: -Age, education level, occupation, marital status, place of residence, income of the family, religion and ethnicity.

Medical, obstetrics and gynecologic factors:

-Hypertension, diabetes, kidney disease, Smoking,

- Gravidity and parity, gestational age, number of living children

-contraceptive use and type before the index pregnancy,

-Functional status, previous history of admission and/or treatment due to cardiovascular disease, type of cardiovascular disease, family history of chronic illnesses

5.8. Operational definition

- **Cardiac disease** –includes VHD, cardiomyopathies, ischemic heart disease, hypertensive heart disease, adult congenital heart disease , cardiac arrhythmias, pulmonary hypertension, pericardial disease (5,6)
- **Hypertensive disorders of pregnancy-** includes preeclampsia, eclampsia, gestational hypertension, chronic hypertension, and chronic hypertension with superimposed preeclampsia(8,9)

5.9. Data collection procedures

Data was collected using a structured questionnaire written in English and was translated to the local language the study participant can understand/speak. It was collected from the study participant or caregivers and patients' medical record.

Data was collected by four medical doctors and supervised by one supervisor and the principal investigator. The data collectors applied hand sanitizer, used gloves and face masks and the study subjects also used face masks. Social distance kept as much as possible

5.10. Data quality control

Quality of data was maintained by one day training of the data collectors. Pretesting of the questionnaire as a pilot was undertaken before the actual data collection. All filled questionnaires was checked for completeness and cleaned manually before the analysis by the principal investigator.

5.11. Data processing and analysis

The questioners was coded and entered into Epidata version 3.1statistical software and then exported into Statistical Package for Social Science (SPSS) version 26 for further analysis. Data was summarized and presented using descriptive statistics. Logistic regression was computed to assess statistical association, and significance of statistical association was considered to be significant if P-value ≤ 0.5.

5.12. Ethical consideration

Ethical clearance was obtained from Institutional Ethical Review Committee of Jimma University. An official letter of cooperation from the Institutional Ethical Review Committee of Jimma University was given to JUMC. The objective of the study was explained to study participants. Verbal consent was obtained from each participant before interview started and participant's anonymity and confidentiality was kept.

CHAPTER SIX: RESULTS

6.1 Socio-demographic characteristics of the study participants

The mean age of the study participants was 25.97(4.6 SD), with a minimum of 18 and maximum of 37 years. Majority of the participant pregnant mothers were from the Oromo ethnic group (61.5%) followed by the Amhara ethnic group (16.7%) and Dawuro (6.4%).The Majority of them were Muslim by religion (54.5%) followed by Orthodox Tewahdo Christian (28.2%) and Protestant (16%).

The educational status of the majority of the participants were elementary school (32.1%) followed by higher education (28.8%) and secondary school (28.2). The occupational status of majority of the participants were housewife (61.5%) and, monthly income of majority of them was not adequate (48.7%).Majority of them were married (99.4%).Most of the study participants were from Jimma Zone, mostly from Jimma town. Socio-demographic characteristics are summarized in table 1 below.

Table 1 Socio-demographic characteristics of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.

Variable		FREQEUNCY	PERCENT
Age	≤25	83	53.2
	26_35	68	43.6
	≥36	5	3.2
Ethnicity	Oromo	96	61.5
	Amhara	26	16.7
	Dawuro	10	6.4
	Yem	7	4.5
	Kaffa	7	4.5
	Gurage	5	3.2
	Other	5	3.2
Religion	Muslim	85	54.5
	Orthodox Tewahdo Christian	44	28.2
	Protestant	25	16
	Adventist	2	1.3
Educational Status	No formal education	17	10.9
	Elementary school	50	32.1

	Secondary school	44	28.2
	Higher education	45	28.8
Occupational Status	Housewife	96	61.5
	Merchant	4	2.6
	Employee	45	28.8
	Daily labourer	11	7.1
Monthly income	Adequate	29	18.6
	More than enough	1	0.6
	Not adequate	76	48.7
	No income	50	32.1
Marital Status	Married	155	99.4
	Widowed	1	0.6

6.2 Obstetric characteristics of the study participants

Majority of the study participants were gravida two to four and the parity of most of them was one to four. All of the study participants had at least one ANC visit and majority had 4 visit. Majority of the study participants were on contraception methods before the index pregnancy and depo provera was the most frequently used. The pregnancy was planned in most of them. Obstetric profile is summarized in table 2.

Table 2 Obstetric profile of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.

Variable		Frequency	Percent
Gravidity	1	52	33.3
	2-4	92	59
	≥5	12	7.7
Parity	0	62	39.7
	1-4	93	59.6
	≥5	1	0.6
ANC visit	Yes	156	100
	No	0	0

No- of ANC visit	1	24	15.4
	2	19	12.2
	3	33	21.2
	4	47	30.1
	>4	33	21.2
Use of contraception method before the index pregnancy	Yes	118	75.6
	No	38	24.4
Type of contraceptive Method	OCP	19	12.2
	Implanon	45	28.8
	Depo provera	63	40.4
	IUCD	4	2.6
Pregnancy	Planned	132	84.6
	Unplanned	24	15.4

6.3 Medical history of the study participants

Nine (5.8%) of the study participants had previous admission; of whom three of them were admitted because of cardiovascular disease and six of them were admitted for other than cardiovascular diseases. Five (3.2%) of the study participants were diagnosed to have cardiovascular diseases before the index pregnancy; of whom two (1.3%) were hypertensive and three (1.9%) were known to have cardiac disease.

Eight (5.1%) of the study participants had known comorbid chronic illness other than cardiovascular disease and thirty three (21.25%) of the study participant had family history of chronic illness, among them majority had family history of hypertension 26(16.7%). Medical history is summarized in table 3 below.

Table 3 Medical history of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.

Variables		Frequency	Percent
Dyspnea		27	17.3
NYHA class of dyspnea	1	26	16.7
	2	1	0.6
Orthopnea		5	3.2
PND		4	2.6
Palpitation		20	12.8
Duration of palpitation	<1 minute	13	8.3
	>1 minute	7	4.5
Palpitation started	Before the pregnancy	5	3.2
	During the pregnancy	15	9.6
Associated condition with the palpitation	Exercise	13	8.3
	Stress	10	6.4
	Anxiety	5	3.2
	Coffee intake	5	3.2
	Salbutamol	1	0.6
	Feeding	1	0.6
	Presyncope	5	3.2
Cough	Dry	15	9.6
	Translucent sputum	2	1.3
Chest pain	Pleuritic	4	2.6
	Coughing, respiration	4	2.6
Leg swelling		14	9
Recent onset RUQ/epigastric pain		7	4.5
Recent onset headache		10	6.4
Known chronic illness	Hypertension	2	1.3
	cardiac	3	1.9
	Other	8	5.1
Family history of chronic illness	Hypertension	26	16.7
	Diabetes mellitus	6	3.8

	cardiac	3	1.9
	Bronchial Asthma	2	1.3

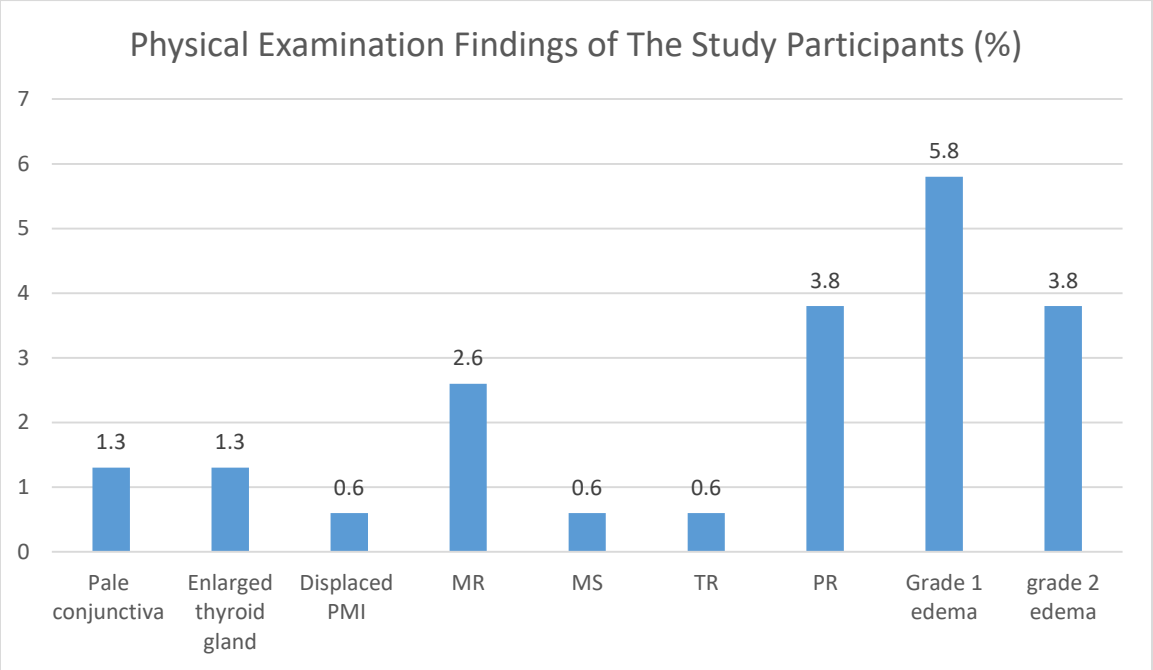
Among the study participants, 27(17.3%) had dyspnea and most of them were in NYHA class I. The frequency and percent of orthopnea, PND and palpitation were 5(3.2%), 4(2.6%) and 20(12.8%) respectively.

6.4 Physical examination findings of the study participants

The mean pulse rate was 91.62(SD=10.9) with a minimum of 60 and maximum of 122.The mean systolic blood pressure was 115.54mmHg (SD = 13.7) and the minimum was 90 mmHg and the maximum was 162mmHg and the mean diastolic BP was 74.69mmHg (SD = 10) and the minimum was 60mmHg and the maximum was 110mmHg.The mean respiratory rate was 20.72(SD =1.6) with minimum of 20 and maximum of 36.The temperature and oxygen saturation were with in normal range for all of the study participants.

From the study participants, 16(10.3%) had hypertensive disorders of pregnancy. Physical examination findings are summarized in bar graph 1 below.

Bar graph 1 - Physical examination findings of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.



During physical examination of the study participants; two (1.3%) had pale conjunctiva, two (1.3%) had enlarged thyroid gland, one (0.6%) had displaced PMI, nine (5.8%) had murmurs from whom PR and MR were the frequent findings and fifteen (9.6%) had leg edema.

6.5 Electrocardiogram findings of the study participants

Most of the study participants, 132(84.6%), had at least one electrocardiography (ECG) abnormality. From whom, thirty four (21.8%) had sinus tachycardia, two (1.3%) had sinus bradycardia, six (3.8%) had premature ventricular beats and nine (5.8%) had left axis deviation, among them two of them had HDP and one of them had RHD. Nine (5.8%) pregnant mother had counterclockwise rotation of transition zone, four (2.6%) had left anterior hemi-block, one (0.6%) had LVH and one (0.6%) had short PR interval. General ECG abnormalities are summarized in table 4 below.

Table 4 General ECG abnormalities of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.

Variables		Frequency	Percent
Sinus tachycardia		34	21.8
Sinus bradycardia		2	1.3
Premature ventricular beats		6	3.8
Left axis deviation		9	5.8
Short PR interval		1	0.6
Counter clockwise rotation of transition zone		9	5.8
Left anterior hemi-block		4	2.6
LVH		1	0.6
Poor R wave progression		9	5.8
P wave	Biphasic -V1 and lead 2	2	1.3
	Inverted -lead 3	1	0.6
	Peaked -V1	2	1.3
T wave changes		103	66
Q wave changes		26	16.7
Low voltage		16	14.7
S1Q3T3		1	0.6

ECG findings of T wave, Q wave and voltage abnormalities are presented in table 5 below.

Table 5 ECG findings of T wave, Q wave and voltage abnormalities of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.

Lead	T wave inversion No-(%)	T wave flattening No-(%)	Peaked T wave No-(%)	Q wave No-(%)	Low voltage No-(%)
No-(%)	83(53.2)	47(30.1)	3(1.9)	26(16.7)	16(10.2)
V1	75(48.1)	10(6.4)	1(0.6)	1(0.6)	2(1.3)
V2	21(13.5)	6(3.8)	2(1.3)	-	2(1.3)
V3	7(4.5)	6(3.8)	2(1.3)	-	5(3.2)
V4	2(1.3)	5(3.2)		-	2(1.3)
V5	1(0.6)	7(4.5)		-	3(1.9)
V6	-	8(5.1)		-	3(1.9)
Lead 1	-	2(1.3)		2(1.3)	3(1.9)
Lead 2	1(0.6)	4(2.6)		-	3(1.9)
Lead 3	37(23.5)	33(21.2)		18(11.5)	8(5.1)
aVL		8(5.1)		5(3.2)	9(5.8)
aVF	4(2.6)	15(9.6)		-	11(7.1)
aVR	-	1(0.6)		-	1(0.6)

T wave changes occurred in 103(66%) of the study participants. T wave inversion occurred with a frequency of 83(53.2%) and most of the inversion occurred in V1 75(48.1%) followed by lead III 37(23.5%) and V2 21 (13.5%).T wave flattening occurred with a frequency of 47(30.1%) and most of the flattening occurred in lead III 33(21.2%) followed by aVF 15 (9.6%) and V1 10(6.4%).Peaked T wave occurred in 3(1.9%) of the study participants mostly fromV1 to V3.

Q wave occurred in 26(14.7%) of the study participants and mostly in lead III, 18(11.5%), followed by aVL, 5(3.2%).Low voltage of the ECG was seen in 16(10.2%) of the study participants mostly in aVF, aVL and lead III.

6.6 Echocardiography findings of the study participants

Most, 121(22.4%), of the study participants had at least one abnormal echocardiography finding and among them 64(41%) had abnormal valvular lesions. Among those with valvular lesions, 5 (3.2%) had chronic rheumatic heart disease whereas 59(37.8%) had physiologic valvular lesions. Echocardiography abnormalities are summarized in table 6 below.

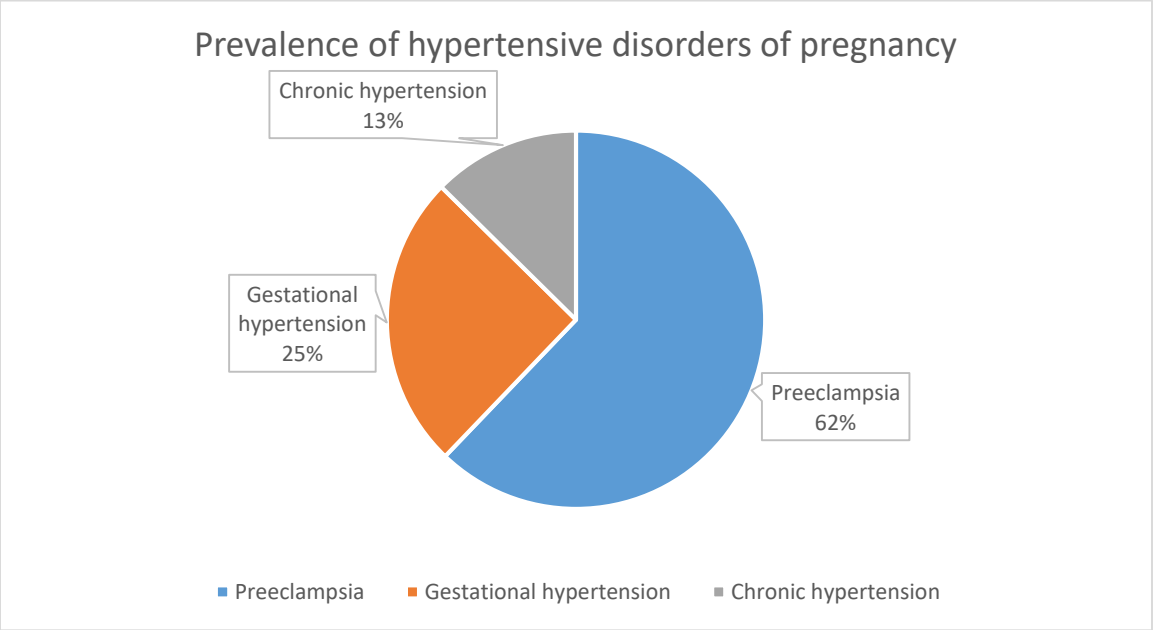
Table 6 Echocardiography abnormalities of the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.

Variables		Frequency	Percent
Echocardiography	Abnormal	121	77.6
Valvular lesions		64	41.0
Mitral stenosis	Moderate	1	0.6
	Severe	1	0.6
Mitral regurgitation	Mild	4	2.6
	Moderate	4	2.6
	Severe	1	0.6
Aortic regurgitation	Mild	2	1.3
Tricuspid regurgitation	Mild	8	5.1
	Moderate	1	0.6
Pulmonic regurgitation	Mild	57	36.5
Causes of valvular lesions	CRVHD	5	3.2
	Physiologic	59	37.8
LVH	Mild	3	1.9
	Moderate	3	1.9
Diastolic dysfunction	Grade 1	2	1.3
Hypertensive heart disease		2	1.3
Pulmonary hypertension	Moderate	2	1.3
Pericardial effusion	Mild	92	59
Atrial septal aneurysm		3	1.3

Four (2.6%) study participants had anemia. One study participant had abnormal liver enzyme, AST, and the value was 67(1.8x elevated).The other liver enzymes were with in normal range. Five (3.2%) of the study participants had proteinuria.

The prevalence of hypertensive disorders of pregnancy is depicted below in the pie chart.

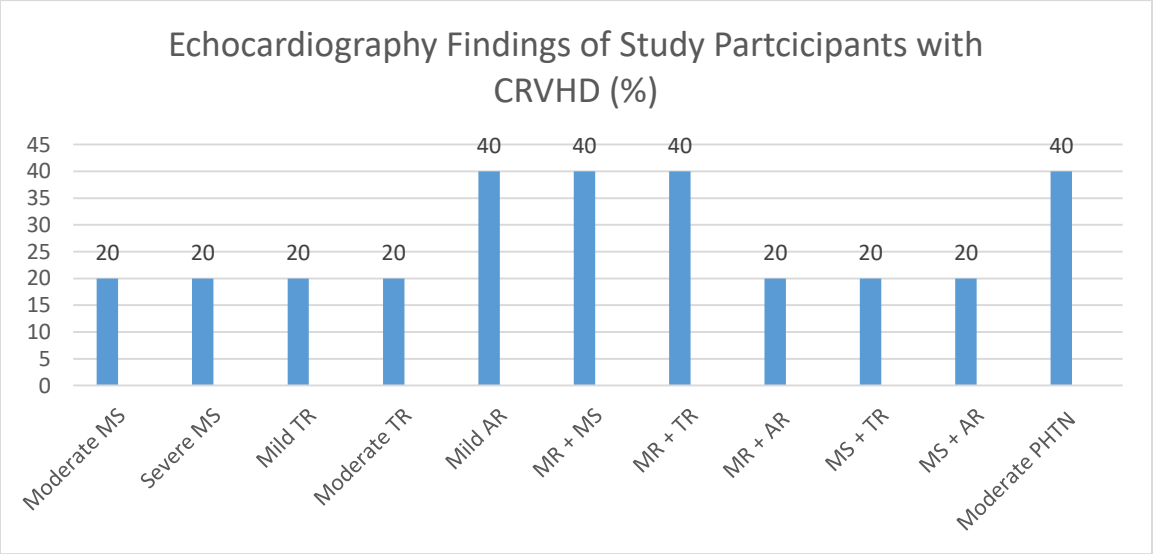
Pie chart –Prevalence of HDP among the 3rd trimester pregnant women who were attending ANC follow up clinic at JUMC, Southwest Ethiopia, 2022.



Among hypertensive disorders of pregnancy, preeclampsia was the predominant finding of which preeclampsia with severity features accounted for 37%.

Echocardiography characteristics of study participants with CRVHD are presented in bar graph 2 below.

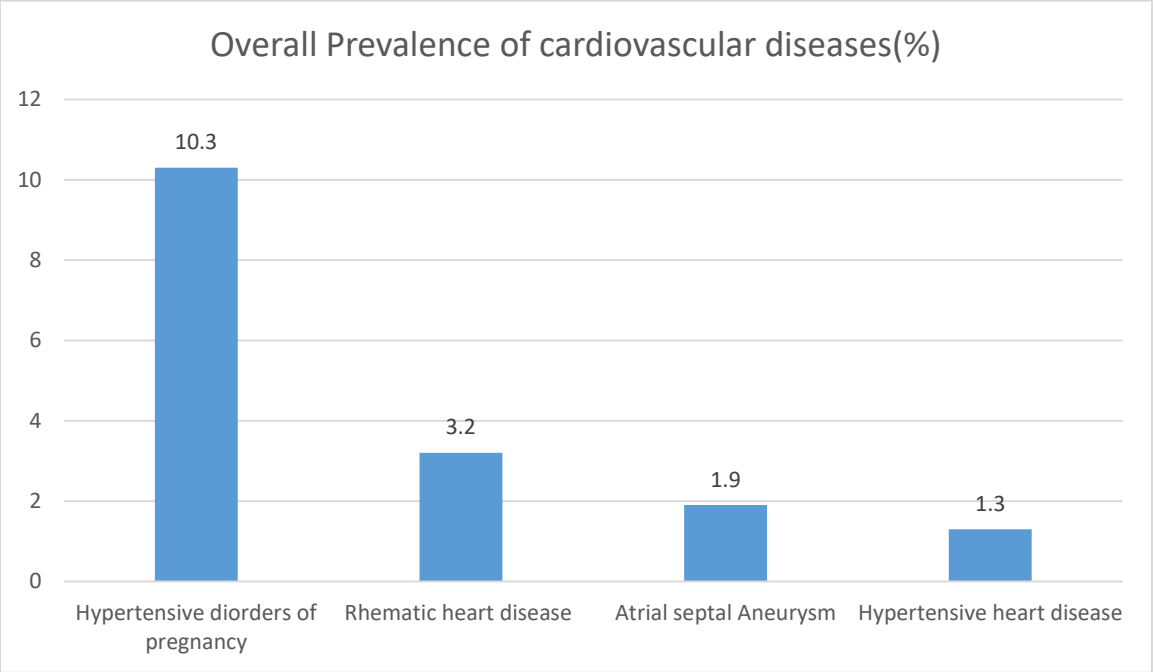
Bar graph 2 – Echocardiography findings of study participants with CRVHD who were attending ANC follow-up clinic at JUMC, Southwest Ethiopia, 2022.



Among those with CRVHD, all of them were in NYHA class 1 dyspnea, one had orthopnea and two had palpitation.

The overall prevalence of cardiovascular diseases among the third trimester pregnant women who were attending ANC is depicted below in the bar graph 3 below.

Bar graph 3 - Overall prevalence of cardiovascular diseases among the 3rd trimester pregnant women who were attending ANC follow up clinic at JUMC, Southwest Ethiopia, 2022.



CHAPTER SEVEN: DISCUSSION

From the result of this study, the prevalence of cardiovascular diseases among the third trimester pregnant mothers who were attending ANC at JUMC was 16.7%. HDP and CRVHD were the predominant findings. Of which HDP accounted for 10.3%, CRVHD accounted for 3.2%, atrial septal aneurysm accounted for 1.9% and HHD accounted for 1.3%. Summing up all cardiac conditions together, the prevalence of cardiac disease was 6.4%. The overall prevalence of cardiovascular diseases was higher because of the increased prevalence of hypertensive disorders of pregnancy. In addition, one of the study participants had both HDP and CRVHD and, two of the study participants had both HDP and HHD.

HDP was the predominant finding in this study which occurred in 16(10.3%) of the study participants; of which preeclampsia accounted for 6.4% followed by gestational hypertension which accounted for 2.6% of cases. This findings was higher than the previous study done a decade ago in Jimma University specialized Hospital, in which the overall prevalence of HDP were 8.5% from which severe preeclampsia was the predominant finding (51.9%) (26) which may be due to the increased burden of HDP from the previous study. The same was true in this study also, preeclampsia was the predominant finding which accounted for 62% of cases. The prevalence of preeclampsia in this study was lower than that of the studies done in Dessie referral hospital (8.4%) (28)and Mettu Karl referal hospital (12.4%) (29). The prevalence of HDP in this study was also higher than a study done in St. Paul's Hospital Millennium medical college in which the prevalence of HDP was 6.5% (1). But, it was lower than a study done among pregnant women attending ante natal care at Gondar town health Institutions, North West Ethiopia 2017, in which the prevalence of hypertensive disorders of pregnancy was 16.8 % (27)**.**

CRVHD was the second predominant finding in this study, as it is the common finding in developing countries, occurred in 5(3.2%) of the study participants which was nearly similar to the study conducted in 2017 which reported that prevalence of definite RHD in rural Ethiopia to be 3.7 % on population based echocardiographic study in Jimma Zone, South West Ethiopia (16)**.** In this study, 5(3.2%) of the study participants had MR (4 moderate and 1 severe), 2(1.3%) of them had MS (1 moderate and 1 severe), 2 (1.3%)of them had TR (1 mild and 1 severe) and 2(1.3%) of them had mild AR. Two patients had moderate pulmonary hypertension. Mitral valve lesions were the commonest findings, from which MR was the predominant finding in contrary to other studies in which MS was the most common rheumatic valvular lesion encountered during pregnancy (20,24)**.** This finding is similar to other studies done in India and Sudan (7,23) in which rheumatic heart disease was the predominant cardiac finding in pregnant mothers. But the prevalence of RHD in this study was higher than the study done in St. Paul's Hospital ,Ethiopia and, Eritrea which showed to be (2.3%) (1,19)**.** This might show the high burden of the disease

in this study area as compared the other study areas mentioned above. In this study the mean age was 25.8 and the range was 23-30 which is similar to age range of RHD. Since RHD is the disease of poverty, all of the cases with RHD had no enough income. Among them, 60% had no adequate income and 40% had no income at all.

The 3rd predominant finding in this study was atrial septal aneurysm which occurred in 3(1.9%) of the study participants. This finding was lower than that of the study done in Turkey in which the prevalence of atrial septal aneurysm was 5.67% (37). Since the study countries and the sample sizes are different, this might the reason for the difference. No similar study in the country to compare and contrast it.

The other major finding in this study was HHD which occurred in 2 (1.3%) of the study participants. Both of those study participants had moderate LVH and grade 1 diastolic dysfunction. This could be due to undiagnosed chronic hypertension with superimposed preeclampsia.

When we see the echocardiography findings, most of them had benign findings; 92(59%) of the study participants had mild pericardial effusion. This is thought to be related to hormone mediated volume retention mostly during the 3rd trimester pregnancy. This result was higher than other studies in which the prevalence of pericardial effusion in 3rd trimester pregnancy was 40% (36). This might need another study in the other parts of the country to compare and contrast and to see the real difference with the other studies. The other common finding in this study was mild regurgitation 59(37.8%), mostly from the pulmonic valve, which is due to the physiologic change in pregnancy. This is similar with other researches which showed valvular regurgitation in pregnancy is common in tricuspid and pulmonic valves (36).The prevalence of LVH in this study was 3.8 % which is less than other study in which the prevalence was 5-10% (36)**.** In this study, 3(1.9%) of the study participants with moderate LVH had hypertensive disorders of pregnancy and 3 (1.9%) of the study participants with mild LVH had normal blood pressure. Blood pressure and LVH had significant correlation at the 0.01 level (2 tailed), Pearson correlation. The ejection fractions of the study participants were with in normal range.

Most of the study participants, 132(84.6%), had at least one ECG abnormality. T wave changes occurred in 103(66%) of the study participants. T wave inversion occurred in 83(53.2%) and most of the inversions occurred in V1,75(48.1%) followed by lead III, 37(23.5%) and V2 ,21 (13.5%).T wave flattening occurred in 47(30.1%) and most of the flattening occurred in lead III ,33(21.2%) followed by aVF, 15 (9.6%) and V1, 10(6.4%). Peaked T wave occurred in 3(1.9%) of the study participants mostly fromV1 to V3.In the above description , the summation of T wave inversion with its components as well as T wave flattening is greater than the total T wave changes because one case may have more than one T wave abnormalities. This is similar with the study done in Nepal among 3rd trimester pregnant women which

showed: - T wave inversion occurred mostly in V1 (88.3%), V2 (60%), lead III (43.3%) and T wave flattening occurred mostly in lead III (50%), V3 (30%) and aVF (13.3%) (30)**.** This finding is also similar with another study which showed:-T wave inversion occurred mostly in V1 (84%), lead III (54%),V2 (20%) and T wave flattening occurred lead III (26%) and V1 (6%) (32)**.**

Sinus tachycardia occurred in 34(21.8%) of the study participants ;this is because heart rate increases progressively with pregnancy, reaching a peak during the 3rd trimester (30,31,33,34)**.** Nine (5.8%) had left axis deviation which is similar with other studies (30,32,34);among them 2 of them had hypertensive disorders of pregnancy and one of them had chronic rheumatic valvular heart disease. One (0.6%) had short PR interval which is common in pregnancy due to physiologic changes and similar findings were seen also in another studies (30,31,33,34)**.** Six (3.8%) of the study participants had premature ventricular beats which is due to physiologic changes of pregnancy but the result of this study was lower than other studies which showed premature beats to be 59%% (35)**.**This could be due to the single ECG recording we used for our study as this can miss some PVCs. In this study Low voltage of the ECG was seen in 16(10.2%) of the study participants mostly in aVF, aVL, lead III which is similar finding with another study (30) .Nine (5.8%) pregnant mother had counterclockwise rotation of transition zone, 4 (2.6%) had left anterior hemi-block, 1(0.6%) had LVH and 2(1.3%) had sinus bradycardia.

Twenty six (16.7%) of the study participants had Q wave in any lead ;mostly occurred in lead III which accounted for 11.5% followed by aVL which accounted for 3.2% and 1.3% in lead 1. Similar finding was seen in a study done in Nepal in which the increased number of Q waves appeared in 3rd trimester pregnancy highly statistically significant in lead III (35%), II(30%) and aVL (18.3%) and statistically significant in lead I(18.3%) (30). Another study also showed similar findings with significantly increased occurrence of prominent Q waves in lead III (40%), aVF (38%) and II (26%) in 2nd and 3rd trimester of normal pregnancy (32)**.**

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATION

8.1 CONCLUSION

The prevalence of cardiovascular diseases among the 3rd trimester pregnant women who were attending ANC follow-up clinic at JUMC was 16.7%; of which hypertensive disorders of pregnancy accounted for 10.3% and cardiac diseases accounted for 6.4% .From hypertensive disorders of pregnancy, preeclampsia was the commonest finding accounting for 6.4% followed by gestational hypertension (2.6%). From the cardiac diseases RHD was the predominant finding accounting for 3.2% of cases followed by atrial septal aneurysm (1.9%) and HHD (1.3%). In the case of RHD, mitral valve involvement was the predominant finding and MR was the commonest one and 1.3% of them have moderate pulmonary hypertension.

Most of the ECG findings showed T wave changes, mostly inversion followed by flattening. T wave inversions were commonly seen in V1 (48.5%) followed by lead III (23.5%) and V2 (13.5%). T wave flattening were seen commonly in lead III (21.2%) followed by aVF (9.6%).

Echocardiography findings showed mostly mild pericardial effusion and mild valvular regurgitation, commonly from pulmonary valve. Most ECG and Echocardiography findings are physiologic changes of pregnancy. So, interpretation should be with consideration of these findings.

8.2 RECOMMENDATION

The prevalence of cardiovascular diseases among the third trimester pregnant women were high in the study institution. So establishment of cardio-maternal unit is very important so as to optimize feto-maternal care and improve the care.

There is significant correlation of HDP and LVH, screening ECG and echocardiography is important to uncover this findings early as treatment will have impact on the outcome

Post-partum follow-up ECG and echocardiography is very important for those with abnormal findings to see changes and to know time of normalization and if not normalized to act accordingly.

Strength of the study

This is the 1st prevalence study in the country which includes the ECG and echocardiography findings of 3rd trimester pregnant mothers and also findings of atrial septal aneurysm. It can be used as a base line study and can give an entry point to other researchers for further study.

Limitations of the study

The study was done in a single center, so it is difficult to generalize. Also the outcome was not known and lack of follow-up ECG and Echocardiography to see changes of the abnormalities are some of the limitations.

REFERENCES

1. Bacha D, Abera H, Adem A, Tadesse F, Bekele D. The occurrence and pattern of cardiovascular diseases among pregnant mothers attending Saint Paul's Hospital in Addis Ababa. Ethiop Med J. 2019;57(4):309–14.

2. Biswas S, Mandal I, Khan Mandal A. Heart Disease in Pregnancy and its Feto-Maternal outcome. IOSR J Dent Med Sci e-ISSN [Internet]. 2016;15(11):92–6. Available from: www.iosrjournals.org

3. Roos-Hesselink J, Baris L, Johnson M, De Backer J, Otto C, Marelli A, et al. Pregnancy outcomes in women with cardiovascular disease: Evolving trends over 10 years in the ESC Registry of Pregnancy and Cardiac disease (ROPAC). Eur Heart J. 2019;40(47):3848–55.

4. Farhan HA, Yaseen IF. Heart disease in pregnancy-Clinical pattern and prevalence: Initial data from the first cardio-maternal unit in Iraq. BMC Res Notes [Internet]. 2019;12(1):10–3. Available from: https://doi.org/10.1186/s13104-019-4523-6

5. Owens A, Yang J, Nie L, Lima F, Avila C, Stergiopoulos K. Neonatal and maternal outcomes in pregnant women with cardiac disease. J Am Heart Assoc. 2018;7(21).

6. Gelson E, Johnson M. Effect of maternal heart disease on pregnancy outcomes. Expert Rev Obstet Gynecol. 2010;5(5):605–17.

7. Salam S, Mushtaq S, Mohi-ud-Din K, Gul I, Ali A. Maternal and fetal outcome in pregnancy with heart disease in tertiary care hospital in India. Int J Reprod Contraception, Obstet Gynecol. 2017;6(9):3947.

8. Tesfa E, Nibret E, Gizaw ST, Zenebe Y, Mekonnen Z, Assefa S, et al. Prevalence and determinants of hypertensive disorders of pregnancy in Ethiopia: A systematic review and meta-analysis. PLoS One [Internet]. 2020;15(9 September):1–21. Available from: http://dx.doi.org/10.1371/journal.pone.0239048

9. Berhe AK, Kassa GM, Fekadu GA, Muche AA. Prevalence of hypertensive disorders of pregnancy in Ethiopia: A systemic review and meta-analysis. BMC Pregnancy Childbirth. 2018;18(1):1–11.

10. Schmaltz AA, Neudorf U, Winkler UH. Outcome of pregnancy in women with congenital heart disease. Cardiol Young. 1999;9(1):88–96.

11. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. J Am Coll Cardiol. 2020;76(25):2982–3021.

12. Yuyun MF, Sliwa K, Kengne AP, Mocumbi AO, Bukhman G. Cardiovascular diseases in sub-saharan Africa compared to high-income countries: An epidemiological perspective. Glob Heart. 2020;15(1):1–18.

13. Ali S, Misganaw A, Worku A, Destaw Z, Negash L, Bekele A, et al. The burden of cardiovascular diseases in Ethiopia from 1990 to 2017: evidence from the Global Burden of Disease Study. Int Health. 2020;1–9.

14. Id MHA, Woldehanna F, Hunegnaw S, Janssens L. Prevalence of rheumatic heart disease in a major referral cardiology clinic in Ethiopia : A retrospective cross-sectional study. 2021;30:1–11. Available from: http://dx.doi.org/10.1371/journal.pone.0246519

15. Habte B, Alemseged F, Tesfaye D. The Pattern of Cardiac Diseases at the Cardiac Clinic of Jimma University Specialised Hospital, South West Ethiopia. Ethiop J Health Sci. 2011;20(2).

16. Gemechu T, Mahmoud H, Parry EHO, Phillips DIW, Yacoub MH. Community-based prevalence study of rheumatic heart disease in rural Ethiopia. Eur J Prev Cardiol. 2017;24(7):717–23.

17. Snelgrove JW, Alera JM, Foster MC, Kipchumba CN, Bloomfield GS, Silversides CK, et al. Prevalence of Rheumatic Heart Disease and Other Cardiac Conditions in Low-Risk Pregnancies in Kenya : A Prospective Echocardiography Screening Study. 2021;16(1):1–10.

18. Rezk M, Gamal A. Maternal and fetal outcome in women with rheumatic heart disease: a 3-year observational study. Arch Gynecol Obstet. 2016;294(2):273–8.

19. Otto H, Sæther SG, Banteyrga L, Haugen BO, Skjærpe T. High prevalence of subclinical rheumatic heart disease in pregnant women in a developing country: An echocardiographic study. Echocardiography. 2011;28(10):1049–53.

20. Beriye M, Araya F, Ahmed Y, Ali E. Feto-maternal complications and outcomes of pregnant women with valvular heart disease in a Tertiary Center in Ethiopia. 2021;

21. Ramlakhan KP, Johnson MR, Roos-Hesselink JW. Pregnancy and cardiovascular disease. Nat Rev Cardiol [Internet]. 2020;17(11):718–31. Available from: http://dx.doi.org/10.1038/s41569-020-0390-z

22. Abhilashi K, Tiwary B, Sinha A, Kiran S. Epidemiology and maternal and fetal outcome of heart disease during pregnancy : A tertiary care center experience. 2018;2(July):128–30.

23. Elfil AMH YK. Epidemiology of Cardiac Disease during Pregnancy in Khartoum Hospital, Sudan. J Womens Heal Care. 2015;04(02):4–7.

24. Echocardiography in pregnant women. 2006;(20):169–73.

25. Gemechu KS, Assefa N, Mengistie B. Prevalence of hypertensive disorders of pregnancy and pregnancy outcomes in Sub-Saharan Africa: A systematic review and meta-analysis. Women's Heal. 2020;16.

26. Wolde Z, Segni H, Woldie M. Hypertensive disorders of pregnancy in jimma university specialized hospital. Ethiop J Health Sci [Internet]. 2011;21(3):147–54. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22434994%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3275872

27. Walle TA, Azagew AW. Hypertensive disorder of pregnancy prevalence and associated factors among pregnant women attending ante natal care at Gondar town health Institutions, North West Ethiopia 2017. Pregnancy Hypertens [Internet]. 2019;16(March):79–84. Available from: https://doi.org/10.1016/j.preghy.2019.03.007

28. Tessema GA, Tekeste A, Ayele TA. Preeclampsia and associated factors among pregnant women attending antenatal care in Dessie referral hospital , Northeast Ethiopia : a hospital-based study. 2015;1–7.

29. Belay AS, Wudad T. Prevalence and associated factors of pre- eclampsia among pregnant women attending anti-natal care at Mettu Karl referal hospital , Ethiopia : cross-sectional study. 2019;1–8.

30. Chaudhary S, Saha CG, Sarkar D. Electrocardiographic Changes During Pregnancy at Third Trimester: A Comparative Study. Med J Shree Birendra Hosp. 2016;14(2):41–6.

31. Angeli F, Angeli E, Verdecchia P. Electrocardiographic changes in hypertensive disorders of

pregnancy. Hypertens Res. 2014;37(11):973–5.

32. M S. Electrocradiographic Q RS Axis, Q Wave and T-wave Changes in 2 nd and 3 rd Trimester of Normal Pregnancy. J Clin Diagnostic Res. 2014;

33. Sumalatha B, Jyotsna M, Indrani G. Electrocardiographic Changes during Normal Pregnancy. Indian J Cardiovasc Dis Women WINCARS. 2017;02(03):035–8.

34. Uma V, Devi S. Electrocardiographic Changes during the Third Trimester of Pregnancy : A Cross Sectional Study. Sch Journalof Appl Med Sci [Internet]. 2016;4(8E):3054–7. Available from: www.saspublisher.com

35. Williams DS, Mikhova K, Sodhi S. Arrhythmias and Pregnancy: Management of Preexisting and New-Onset Maternal Arrhythmias. Cardiol Clin [Internet]. 2021;39(1):67–75. Available from: https://doi.org/10.1016/j.ccl.2020.09.013

36. Afari HA, Davis EF, Sarma AA. Echocardiography for the Pregnant Heart. Curr Treat Options Cardiovasc Med. 2021;23(8).

37. Küçükoğlu MS, Sinan ÜY, Yıldızeli B. Ten-year outcome of chronic thromboembolic pulmonary hypertension patients in a tertiary center. Anatol J Cardiol. 2020;23(2):105–9.

ANNEX I- CONSENT FORM

Greetings! My name is Dr. Temare Birhanu a final year Internal Medicine resident doing research on prevalence of cardiovascular disease among pregnant women in JUMC which is important to improve our quality of health care. You are one of the candidates for the study. I would like to assure that your name will not be mentioned in the questionnaire and the information that you will give will be kept confidential and only used for research purpose. You have the full right to refuse to take part or interrupt the interview at any time. But the information you will give is quite useful to achieve the objective of the study.

The questionnaire has four parts: - 1st interview, 2nd physical examination, 3rd electrocardiography and echocardiography and 4th urine and blood tests. It will take around 40 minutes and you will not be provided any incentives or payment to take part in this project.

This research will be reviewed and approved by Institutional Ethical Review Committee of Jimma University. If you have any question you can contact the principal investigator by the address provided below.

Name of principal investigator: Dr. Temare Birhanu

Mobile no-: +251910802399 E-mail addresses: temarebirhanu16@gmail.com

Are you willing to participate in the interview? A. Yes B. No

If yes, signature_____

Name and signature of the physician who fills the questionnaire _____/_____

Date _____

Thank you!

CONSENT FORM/ AFAAN OROMOO –VERSION/

Unkaa eeyyamama tahu hirmataa/ttuu/ qoraannoo, ittin gafatamu/

Dura dursee Akkam nagaya jirtu!!

Maqaan koo Dr. Tamaaree Birhaanuu jedhama, barata waggaa xumuura/ebbiifama/ ispeeshalistii dhiibee keessooti.Qoraannoo Waa'ee facaatii dhukkuba onnee fi hiidda dhiigaa, dubartoota ulfaa keessatti, jiddu gala yaala fayyaa yuunivarsiiti jimmaati adeemsisudhaf. Bu'aan qoraannoo kana qulqulli'inna tajaajila yaala kennamu fooyyessuf ni gargaara. Isin/ati/ namoota qorannoo kana keessatti hirmachuuf barbachisa tahan keessa nama tokkoo. Kanin isinif mirkaneessu barbadu, maqaan keessan/kee/ guuca kanarratti hin barrayuu, akkasumas icciitiin infoormeshiin funaname kan tikfamee fi qorannoo barbaadame qofaf kan oluudha. Akkasumas hirmachuu didu fi gaafii fi deebii addan kutuuf mirga guutuu qabdu, garuu hirmachuudhan infoormeeshiinin sirra argamu, kayyoo qorannoo kana galmaan gahuf baay'ee barbaachisadha.

Qorannoo kanaaf kan barbachisu, gaafii fi deebii afaanin, qorannoo qaama fi laboraatorii, akkasumas, qorannoo onneef kan olu ,Eleektirokardiyoogiraaf fi Ekookardiyoogiraafi dha. Gaafii fi deebiin kun gara naannoo daqiiqaa afurtaama(40) fudhachu danda'a. Akkasumas faayidan addaa yookin kanfaalti qoraannoo kana keessatti hirmachuu keetif si kennamu hin jiru.

Qoraannoo kana keessatti hirmachudhaf fedhii qabadu?

A) Eeyyeen
B) Lakkii hin barbaduu

Yoo eeyyeen tahe:
Mallaattoo----------
Guyyaa----------

Qoraatan : Dr.Tamaaree Birhaanuu.

Lakkofsa bilbila +251910802399, E-mail addresses: temarebirhanu16@gmail.com

Maqaa fi mallattoo hakima yaalaa gaaffiwwan guutu_____/_____

Galaatooma!!

CONSENT FORM AMHARIC VERSION

ለጥናት እና ምርምር ተሳታፊ የስምምነት መጠይቅ

ሰላም እንዴት ነዎት ውድ የጥናታችን ተሳታፊ። ስሜ ዶ/ር ተማረ ብርሃኑ ይባላል የ ሦስትኛ ዓመት የውስጥ ደዌ ህክምና ረዚደንት ስሆን ጅማ ዩኒቨርሲቲ ህክምና ማእከል ከሚመጡ ነፍሰ ጡር እናቶች መካከል ምን ያህሉ የልብ እና የግፊት ብሽታ እንዳለባቸው ለማወቅ ያለመ ጥናት እና ምርምር እያካሄድኩኝ እገኛለሁኝ። ጥናቱም የጤና ሥርዓቱን ጥራት ለማሻሻል ያግዛል። እርስዎም በጥናቱ ከሚሳተፉት መካከል ነዎት። አስረግጬ የምነግረዎት ስምዎት በመጠይቅ ወረቀቱ ላይ አይገለጽም፤የሚሰጡት መረጃም ምስጢራዊነቱ የተጠበቀ ነው፤ ለጥናት እና ምርምር ሥራው ብቻ ይውላል።በጥናት እና ምርምሩ አልሳተፍም የማለት፤የመሳተፍ እና ጀምረው በማንኛውም ሠዓት የማቋረጥ መብት አለዎት። ነገር ግን እርስዎ የሚሰጡን መረጃ የጥናቱን ዓላማ ለማሳካት በጣም አስፈላጊ ነው።

መጠይቁ አራት ክፍሎች አሉት። 1ኛ ቃለ መጠይቅ፣2ኛ አካላዊ ምርመራ፣3ኛ ሁለት ዓይነት የልብ ምርመራዎች (ኤለክትሮ እና ኢኮ ካርዲዮአግራፊ)፣ 4ኛ የ ሽንት እና የደም ምርመራዎች። መጠይቁ 40 ደቂቃ ያህል ይወስዳል። በጥናቱ በመሳተፍዎትም ምንም ዓይነት ጥቅማ ጥቅም ወይም ክፍያ አይሰጥዎትም።

ጥናትና ምርምሩም በጅማ ዩኒቨርሲቲ ኢንስቲቱሽናል ኢቲካል ሪቪው ኮሚቴ ታይቶ ይረጋገጣል።

ማንኛውም ዓይነት ጥያቄ ካለዎት የጥናቱን ዋና ተመራማሪ በሚከተለው አድራሻ ማግኘት ይችላሉ።

የጥናቱ ዋና ተመራማሪ _ዶ/ር ተማረ ብርሃኑ

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በጥናት እና ምርምሩ ለመሳተፍ ፈቃደኛ ነዎት? ሀ_አዎ ነኝ ለ_አይደለሁም

ለመሳተፍ ፈቃደኛ ከሆኑ፣ ፊርማዎትን ይፈርሙልን፤_____

መጠይቁን የሚሞላው ሐኪም ስም እና
ፊርማ_____/_____

ቀን_____

አመሰግናለሁ።

ANNEX II-QUESTIONNAIRE

QUESTIONNAIRE FOR PREVALENCE OF CARDIOVASCULAR DISEASE AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE AT JUMC (**PROSPECTIVE**)

Questionnaire identification number_____

Address; Region_____ Zone_____ Wereda_____ Kebele _____House No-___

S.NO-	**Questions**	**Response categories**	**Skipping**
PART I: MEDICAL HISTORY			
1.	Age	_____years	
2.	Ethnicity	**1.** Oromo **2**. Amhara **3**.Tigre **4**.Dawuro **5**.Yem **6**.Kaffa **7**.Gurage 8.other (specify)_____	
3.	Religion	1. Muslim 2. Orthodox Tewahdo Christian 3. Protestant 4. Catholic 5.Other (specify),_____	
4	Educational status	1. Can't read and write **2.** Read and write **3.** Elementary School (1 – 8) 4**.** Secondary school (9 -12) 5.Higher education (specify) _____	
5	Occupation	1. Housewife 2. Merchant 3.Employee 4.Daily labourer 5. Student 6. Other (specify),_____	
6	Monthly income	1.Adequate 2.More than enough 3.Not adequate 4.No income	
7.	Marital status	1. Single 2.Married 3.Divorced 4. Widowed 5. Separated	
8	Previous Admission?	1. Yes (if Yes, proceed to Q8.1) 2. No	If no skip To Q9
8.1	If yes, indication	1. Cardiovascular disease 2. Other (specify)_____	
9.	Do you have known cardiovascular disease?	1. Yes (if Yes, proceed to Q9.1-9.3) 2. No	If no ,**skip** to Q10
9.1	If yes, type of cardiovascular disease?	1. Cardiac 2. Hypertension 3.Other(Specify)_____	
9.2	When was the diagnosis made?	1. During this pregnancy 2. Before this pregnancy	
9.3	Types of medication being taken?	1. Diuretics 2. Antihypertensive 3.Other (specify),_____	
10	Do you have dyspnea?	1. Yes (if Yes, proceed to Q10.1) 2. No	If no,skip to Q11.
10.1	If yes, NYHA class?	1. I 2. II 3. III 4. IV	
11	Do you have Orthopnea?	1. Yes 2. No	
12	Do you have paroxysmal nocturnal dyspnea?	1. Yes 2. No	If no,skip to Q13.
13	Do you have palpitation?	1. Yes (if Yes, proceed to Q13.1-13.4) 2. No	If no, skip to Q14.
13.1	Duration of palpitation?	1. < 1 minute 2. >1 minute	
13.2	When did palpitation started?	1. Before this pregnancy 2. During this pregnancy	
13.3	Associated conditions with the palpitation?	1. Exercise 2. Stress 3.Anxiety 4.Coffee intake 5.Medications 6.Other (specify),_____	
13,4	Is there pre syncope/syncope?	A. Yes 2. No	
14	Do you have cough?	1. Yes (if Yes, proceed to Q14.1) 2. No	If no,skip to Q15.
14.1	If yes, its character?	1. Dry 2. Yellowish sputum 3. Purulent 4. Semi-translucent	
15	Do you have chest pain?	1. Yes (if Yes, proceed to Q15.1-15.4) 2. No	If no, skip to Q16.
15.1	If yes, its character?	1.Squeezing with radiation 2.Pleuritic 3.On exertion 4.At rest 5.Other (specify), _____	

15.2	Aggravating factors for the chest pain?	1.Exercise 2.Heavy meal 3.Supine position 4.Coughing ,respiration 5.No	
15.3	Relieving factors for the chest pain?	1. Rest 2. Leaning forward or sitting position 3. Medication intake 4. No	
15.4	Duration of chest pain?	1. <10 minutes 2. 10-30 minutes 3. >30 minutes	
16	Do you have body swelling?	1. Yes (if Yes, proceed to Q16.1) 2. No	If no, skip to Q17.
16.1	If yes, its pattern of progression?	1. From feet upward 2. Form abdomen downward 3.From face downward	
17	History of body weakness/paralysis?	1 .Yes 2.No	
18	Do you have mouth deviation?	1.Yes 2.No	
19	Do you have difficulty of speech?	1.Yes 2.No	
20	Do you have known chronic illness?	1. Yes (if Yes, proceed to Q20.1-20.3) 2. No	If no, skip to Q21.
20.1	If yes, which of the following?(>1 is possible)	1. Diabetes mellitus 2. Renal disease 3.Other (specify), _____	
20.2	Are you on medications?	1. Yes 2. No	
20.3	Medication type being taken?	_____	
20.4	When was the diagnosis made?	1. during this pregnancy 2. Before this pregnancy	
21	Do you have family history of the following diseases? (encircle, >1 is possible)	1, Cardiac disease 2. Hypertension 3. Diabetes mellitus 4.Renal disease 5.Other (specify),_____ 6. No	If no, skip to Q22.
22	Do you smoke cigarettes?	1. Yes (if Yes, proceed to Q22.1-22.2) 2. No	If no,skip to Q23
22.1	If yes, current or former?	1. Current smoker 2. Former smoker	
22.2	If yes, pack years?	_____	

PART II: OBSTETRIC HISTORY

23	Gravidity	_____	
23.1	Parity	_____	
23.2	Abortion	_____	
23.3	Still birth	_____	
24	Gestational age(select among the three and fill the blank space)	1.LNMP _____week 2. Obstetric ultrasound _____week 3. Months of amenorrhea if she does not know her LNMP or no obstetric ultrasound _____months	
25	Pregnancy	1. Planned 2. Unplanned	
26	Do you have ANC follow up?	1. Yes (if Yes, proceed to Q26.1) 2. No	If no,skip to Q27.
26.1	If yes, no- of visits?	1.1 2. 2 3. 3 4. 4 5. >4	
27	Were you on contraception methods before this pregnancy?	1.Yes (if Yes, proceed to Q27.1-27.2) 2.No	If no,skip to Q28.
27.1	If yes, type?	1. Oral contraceptives 2. Depo provera 3. Implanon 4.Intrauterine contraceptive devices 5.Other (specify),_____	
28	History of recent onset RUQ abdominal /epigatric pain?	1.Yes 2.No	
29	History of recent onset Headache?	1. Yes 2. No	
30	History of recent onset blurring of vision?	1.Yes 2.No	
31	History of loss of consciousness?	1.Yes 2.No	

PART III:PHYSICAL EXAMINATION FINDINGS

32	Pulse rate	_____	
33	Pulse rhythm	1. Regular 2. Irregularly irregular 3. Regularly irregular	
34	Blood pressure	A. 1st measurement right arm_____ left arm_____	

		B. 2nd measurement right arm_____ left arm_____	
35	Respiratory rate	_____	
36	Temperature		
37	Oxygen saturation	_____	
38	Conjunctiva	1. Pink 2. Pale	
39	Is there jaundice?	1. Yes 2. No	
40	Is there lip cyanosis?	1.Yes 2.No	
41	Is there hand/finger cyanosis?	1. Yes 2. No	
42	Thyroid gland	1. Enlarged 2. Not enlarged	
43	Signs of respiratory distress?	1.Yes 2.No	
44	Are there crackles?	1. Yes (if Yes, proceed to Q34.1) 2. No	If no,skip to Q45
44.1	If yes,	1. Basal 2. Infrascpular 3. Suprascapular	
45	Jugular venous pressure?	1. Raised 2. Not raised	
46	Location of point of maximal impulse (PMI)?	_____	
47	Is there murmurs?	1. Yes (if Yes, proceed to Q47.1) 2. No	If no,skip to Q48.
47.1	If Yes, which of the following? (More than one is possible)	1.Mitral regurgitation 2.Mitral stenosis 3.Aortic regurgitation 4. Aortic stenosis 5. Tricuspid regurgitation 6. Pulmonic regurgitation 7. Other (specify),_____	
48	Other findings on auscultation (cardiovascular /respiratory)		
49	Is there tender hepatomegaly?	1. Yes 2. No	
50	Are there signs of peritoneal fluid collection?	1.Yes 2.No	
51	What is the fundal height by Leopold's maneuver?	_____weeks	
52	Is there edema?	1. Yes (if Yes, proceed to Q52.1) 2. No	If no, skip to Q53.
52.1	If yes, grade is?	1. I 2. II 3. III 4 .IV	
53	Is there clubbing?	1. Yes (if Yes, proceed to Q46.1) 2. No	If no, skip to Q54.
53.1	If yes, grade is?	1. I 2. II 3. III	
PART IV: INVESTIGATIONS			
54	**Electrocardiography**	1. Normal 2. Abnormal(if abnormal proceed to 54.1-54.10)	If normal, skip to Q55.
54.1	If abnormal, what abnormalities of rate and rhythm found?	1. Sinus tachycardia 2.Sinus bradycardia 3. Atrial fibrillation 4.Premature ventricular beats 5.Other (specify),_____ 6.No abnormality	
54.2	Axis	1. Left axis deviation 2. Right axis deviation 3. Extreme axis deviation 4. Normal	
54.3	Signs of ischemia	1.Q waves on 2 consecutive leads, specify_____ 2.ST segment elevation, specify_____ 3.ST segment Depression, specify_____ 4.Other (specify),_____ 5.No signs of ischemia	
54.4	Q wave in any lead(specify)	1. Yes (specify) _____ 2. No	
54.5	Interval abnormality(specify)	1. Yes (specify) _____ 2. No	
54.6	Rotation of transition zone	1. Clockwise 2. Counter clockwise 3. Normal	
54.7	Conduction abnormalities	1.1st degree heart block 2. 2nd degree heart block 3.3rd degree heart block 4. Left bundle branch block 5. Right bundle branch block	

		6. Hemiblocks (specify),_____ 7.No conduction abnormality	
54.8	Types of ventricular hypertrophy?	1. Left ventricular hypertrophy 2. Right ventricular hypertrophy 3.No ventricular hypertrophy	
54.9	T wave changes	1.Inversion(specify)_____ 2. Flattening (specify)_____ 3.Others_____ 4.No abnormality of T wave	
54.10	Other ECG abnormalities		
55	**Echocardiography**	1. Normal 2. Abnormal (if abnormal, proceed to 55.1-55.11)	If normal, skip to Q56.
55.1	If valvular heart disease which one is/are detected?	1.Mitral stenosis 1.1 Mild 1.2 Moderate 1.3 Severe 1.4 Critical 2.Mitral regurgitation 1.1 Mild 1.2 Moderate 1.3 Severe 3.Aortic stenosis 1.1 Mild 1.2 Moderate 1.3 Severe 4.Aortic regurgitation 1.1 Mild 1.2 Moderate 1.3 Severe 5.Tricuspid regurgitation 1.1 Mild 1.2 Moderate 1.3 Severe 6.Pulmonary regurgitation 1.1 Mild 1.2 Moderate 1.3 Severe 7. Other Specify_____ 8. No valvular abnormality	
55.1.1	Causes of valvular heart disease	1.Chronic rheumatic valvular heart disease 2. Physiologic 3 Congenital valve disease. 4.Other (specify)_____	
55.2	Wall motion abnormalities	1. Regional 2. Global 3. No	
55.3	If left ventricular hypertrophy	1. Mild 2.Moderate 3. Severe 4. No left ventricular hypertrophy	
55.4	Hypertensive heart disease	1. Yes 2.No	
55.5	If cardiomyopathies , which one?	1. Dilated Cardiomyopathy 2. Hypertrophic Cardiomyopathy 3. Restrictive Cardiomyopathy 4. Peripartum Cardiomyopathy 5. No cardiomyopathy	
55.6	If congenital heart disease	1. Atrial septal defect 2. Ventricular septal defect 3. Patent Ductus Arteriosus 4. Tetralogy of fallot 5. No congenital heart disease	
55.7	If pulmonary hypertension	1. Mild 2. Moderate 3. Severe 4. No pulmonary hypertension	
55.8	If ejection fraction, range is?	1. <40% 2. 41-49% 3 .50-74% 4. >75%	
55.9	If diastolic dysfunction	1. Mild 2. Moderate 3. Severe 4. No diastolic dysfunction	
55.10	If pericardial effusion	1. Mild 2. Moderate 3. Severe 4. No pericardial effusion	
55.11	Others		
56	**Obstetric ultrasound index**		
57	Complete blood count	1. Normal 2. Abnormal	If normal, skip to Q58.
57.1	If abnormal, which one? And fill it in the blank space.	1.White blood cell count_____2.Platelets _____ 3.Hemoglobin /hematocrit_____/_____ 4.Mean corpuscular volume_____	
58	Blood group and RH		

59	Renal function tests	1. Normal 2. Abnormal	If normal, skip to Q60.
59.1	If abnormal, the value is	1.Creatinine _____Blood urea nitrogen_____	
60	Liver enzymes	1. Normal 2. Abnormal	If normal, skip to Q61.
60.1	If abnormal, fill it in the blank space.	1.Alanine aminotransferase _____ 2.Aspartate aminotransferase_____	
61	Urine analysis	1. Normal 2. Abnormal	
61.1	If Abnormal	1.Protein_____+ 2.Blood_____+ 3.Leukocytes _____ 4.Casts _____Other(Specify)_____	

Thank you for your cooperation.

DECLARATION

I, the undersigned, internal medicine 3rd year resident declare that this thesis is my original work in the partial fulfilment of the requirements of specialty certificate in Internal Medicine

Name: Dr. Temare Birhanu Gebre

Signature: _____

Place of submission: Jimma University Institute of Health, Medical Faculty, Department of Internal Medicine.

Date of Submission: _____

This thesis has been approved by the university advisors.

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2. Dr. Elsah Tegene	_____	_____
3. Mr. Teshome Kabeta	_____	_____