KAIRUKI UNIVERSITY

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

CARDIAC CHANGES AMONG PREGNANT WOMEN WITH PRE-ECLAMPSIA AND ASSOCIATED FETAL - MATERNAL OUTCOMES AT MNAZI MMOJA TERTIARY HOSPITAL-ZANZIBAR

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A dissertation submitted to the Department of Obstetrics and Gynaecology School as partial fulfillment of the requirements for the award of the master's degree of Obstetrics and Gynaecology at Kairuki University on.

2024

CERTIFICATION

The undersigned certifies that he has read and at this moment recommends for examination by Hubert Kairuki University a dissertation entitled "**CARDIAC CHANGES AMONG PREGNANT WOMEN WITH FEATURES OF PRE-ECLAMPSIA AND ASSOCIATED FETAL-MATERNAL OUTCOMES AT MNAZI MMOJA TERTIARY HOSPITAL-ZANZIBAR"** in (partial) fulfillment of the requirements for the degree of Master of Medicine in Obstetrics and Gynecology at Kairuki University.

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DECLARATION AND COPYRIGHT

I, **Dr. Aysha Mwalim Omar** declare that this dissertation is my original work, and it has not been presented and will not be presented to any other University for a similar or any other degree award.

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DEDICATION

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LIST OF ABBREVIATIONS

ANC	Antenatal Clinic
AKI	Acute Kidney Injury
ECHO	Echocardiography
HELLP	Hemolysis, Elevated Liver enzymes, Low Platelet count
IUFD	Intrauterine Fetal Death
IUGR	Intrauterine Growth Restriction
LBW	Low Birth Weight
LNMP	Last Normal Menstrual Period
LV	Left Ventricle
LVD	Left Ventricular Dysfunction
LVM	Left Ventricular Mass
PE	Pre-eclampsia
PPH	Postpartum Hemorrhage
SBF	Small for gestational Age Baby

DEFINITION OF TERMS

Pre-eclampsia: Preeclampsia is a multisystem progressive disorder characterized by the new onset of hypertension and proteinuria or the new onset of hypertension plus significant end-organ dysfunction with or without proteinuria, typically presenting after 20 weeks of gestation or postpartum (1).

Hypertension: New onset of systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg on at least 2 occasions at least 4 hours apart after 20 weeks of gestation in a previously normotensive individual. Patients with systolic blood pressure ≥160 mmHg and/or diastolic blood pressure ≥110 mmHg should have blood pressure confirmed within a short interval (minutes) to facilitate timely administration of antihypertensive therapy.

Hypertensive Disorders of Pregnancy (HDP): A condition which is characterized by high blood pressure during pregnancy. Two significant components of HDP are pre-eclampsia and gestational hypertension.

Proteinuria: Proteinuria (≥300 mg per 24-hour urine collection [or this amount extrapolated from a timed collection], or protein:creatinine ratio ≥0.3, or urine dipstick reading ≥2+ [if other quantitative methods are not available] (2). It is an important diagnostic criterion for pre-eclampsia and indicates kidney dysfunction. In a patient with new-onset hypertension without proteinuria, the diagnosis of preeclampsia can still be made if any features of severe disease are present.

Gestational Age: The duration of the pregnancy, measured from the first day of the last menstrual period (LMP) or estimated using ultrasound measurements (3). It is expressed in weeks and is essential for determining the timing of various prenatal assessments and interventions.

High-Risk Pregnancy: A pregnancy with increased risk for adverse maternal or fetal outcomes due to pre-existing medical conditions (such as chronic hypertension or diabetes),

advanced maternal age, multiple gestations (e.g., twins), previous history of pre-eclampsia, or other factors that may predispose the woman to complications (4).

Echocardiography: A medical imaging technique that uses sound waves to create detailed images of the heart's structure and function.

Cardiac Changes: Refer to modifications in the structure or function of the heart. In the context of pregnancy, such changes can include variations in the size, shape, or pumping efficiency of the heart.

Maternal Morbidity: Health issues or complications experienced by pregnant or postpartum women during or after childbirth.

Fetal Outcomes: The health and well-being of the unborn baby, including factors like birth weight, gestational age at delivery, and mode of delivery.

ABSTRACT

Background: Pre-eclampsia, a pregnancy complication marked by high blood pressure and protein in urine, can lead to heart problems in mothers. This study investigated the link between echocardiographic abnormalities (identified through echocardiography) and maternal and fetal outcomes in Pre-eclamptic patients in Zanzibar.

Methods: A prospective cohort study enrolled 151 pregnant women with pre-eclampsia. Social-demographic characteristics of study participants were collected using a pre-designed questionnaire. Echocardiographic (ECHO) studies were performed among participants to determine cardiac changes due to preeclampsia. Participants were monitored up to delivery to determine the immediate maternal and fetal outcome. Data was analyzed using Statistical Package for Social Sciences (SPSS). Categorical variables were presented in frequency and respective percentages. Association between ECHO changes and severity of Pre-eclampsia, maternal and fetal outcome were assessed using Chi-square test. A p-value of less or equal to 0.05 was regarded as statistically significant.

Results: A total of 151 participants were enrolled in the study. Among participants, 101 (67.5%) had severe form of Pre-eclampsia. Additionally, 80 (53%) of study participants had abnormal ECHO findings with left ventricular hypertrophy the most frequent finding (22%). There were a significant association between abnormal ECHO findings and severity of Pre-eclampsia ($p<0.001$). Furthermore abnormal ECHO findings was associated with adverse maternal and fetal/ neonatal outcome; ($p<0.001$), and ($p=0.05$) respectively.

Conclusion: In this study, the majority of patients with Pre-eclampsia had abnormal ECHO findings, which was associated with severity of the disease, maternal and fetal/neonatal outcomes. To improve maternal and neonatal survival, routine cardiac screening using echocardiogram among pregnant mothers at risk for early appropriate treatment should be considered.

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CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 Introduction

Pre-eclampsia is a multisystem disorder that occurs during pregnancy, typically after 20 weeks of gestation, and is characterized by new-onset hypertension (high blood pressure) and end-organ dysfunction. It is a serious condition that can affect various organs, such as the liver, kidneys, and brain, and it may lead to complications for both the mother and the baby.

The exact cause of pre-eclampsia is not fully understood, but it is believed to involve abnormalities in the development of the placenta and the maternal immune response to the pregnancy (1,5).

Pre-eclampsia is a significant global health concern, affecting a substantial number of pregnancies worldwide. The rising prevalence of hypertension, affecting 6-8% of pregnancies, contributes significantly to severe maternal morbidity, constituting approximately one-third of cases and ranking as the second most common direct cause of maternal mortality worldwide, accounting for ≈14% (6,7).

Hypertensive disorders of pregnancy (HDP), encompassing Pre-eclampsia (PE) and Gestational Hypertension, significantly affect maternal cardiac structure and function, recognized as substantial risk factors for cardiovascular disease (8). Particularly, women with PE have a higher incidence of Left-Ventricular (LV) diastolic dysfunction and remodeling/hypertrophy compared to those with normotensive pregnancies (9). The disruptions in PE are intricately linked to increased cardiac afterload due to hypertension, leading to reduced cardiac output (10). The decreased blood volume in pregnancy affects cardiac preload, contributing to fluid extravasation, causing pulmonary edema (11,12).

Within the context of Pre eclampsia, both systolic and diastolic dysfunction coexist, with systolic dysfunction following diastolic dysfunction. A substantial 40 to 45 percent of women with Pre-eclampsia experience diastolic dysfunction, with functional differences persisting in

some up to four years post-delivery (13). This diastolic dysfunction is intricately connected to ventricular remodeling, an adaptive response to increased afterload, further emphasizing the intricate relationship between cardiovascular health and adverse outcomes in pregnancy.

Understanding the heart's structure and function during pregnancy is crucial for early problem detection. Echocardiography, a safe and non-invasive technique, assesses cardiac changes during pregnancy. Although operator-dependent, evidence for its serial use in pregnancy is lacking, highlighting the need for consistent application in studying hypertensive disorders during pregnancy. This study aims to address these gaps by examining echocardiographic alterations in pre-eclampsia patients in Zanzibar's health facilities, shedding light on implications for maternal and fetal health.

1.2 Problem Statement

Pre-eclampsia poses a significant risk to the health of pregnant individuals and their unborn children (14). In Zanzibar's health facilities, clinical parameters are primarily used to guide the diagnosis, but echocardiography (ECHO) is not routinely utilized. Clinical observations, however, suggest that Echo in Pre eclamptic cases may unveil previously undetected cardiac involvement, including systolic and diastolic dysfunction and increased left ventricular mass (15,16).

In 50 patients diagnosed with Pre-eclampsia with severe features exhibiting notable ECHO alterations examined, 46 manifest grade I diastolic dysfunction, while 4 present with grade II diastolic dysfunction, with none displaying diastolic dysfunction exceeding grade II (17,18). Analyzing the cohort of patients with ECHO abnormalities in severe Pre-eclampsia, it is also observed that 7 individuals suffer from abruptions, 9 encounter Eclampsia, and 3 HELLP syndrome while 5 experience AKI (11). Comparatively, patients exhibiting ECHO changes are more likely to deliver low birth weight infants in contrast to those with normal ECHO results. Most cases with ECHO modifications are identified beyond 35 weeks of gestation (19).

However, despite on what is known, the proportions of such abnormalities in Zanzibar's healthcare settings remains unkonwn. Additionally, the specific types of ECHO abnormalities (Left ventricular diastolic dysfunction, Left ventricular hypertrophy and Pericardial effusion) and their connection to fetal well-being in Pre-eclamptic cases remain unclear. The insufficient utilization of ECHO in Zanzibar has resulted in a knowledge gap concerning the frequency and categories of cardiac alterations in women with Pre-eclampsia. The relationship between these abnormalities and the outcomes for both the mother and the fetus is not well understood. It is essential to address these gaps through the research objectives proposed. By integrating ECHO as a standard investigative procedure.

1.3 Rationale

This study is driven by the need to enhance our understanding of Pre-eclampsia in the specific healthcare landscape of Zanzibar. The infrequent use of echocardiography (Echo) in routine Pre eclamptic cases present a unique opportunity to uncover potential cardiac complications, such as left ventricular diastolic dysfunction,Left venrticular hypertrophy and Pericarduial effusion. This aligns with the broader goal of integrating advanced diagnostic tools for a comprehensive evaluation of maternal health.

The clinical significance of adverse outcomes linked to abnormal Echo results underscores the importance of identifying and understanding cardiac involvement in Pre-eclampsia. The study emphasizes the necessity for a holistic approach in managing Pre-eclampsia, investigating if the identified cardiac changes require immediate treatment for a more effective management strategy.

1.4 Research Objectives

1.4.1 Broad Objective

To assess cardiac changes in pregnant women with features of Pre-eclampsia and associated maternal and fetal outcomes in selected health facility in Zanzibar.

1.4.2 Specific Objectives

i. To determine the proportions of pregnant women with Pre-eclampsia who exhibit echocardiographic abnormalities.
ii. To determine the association between echocardiographic abnormalities and severity of pre-eclampsia among pregnant women with Pre-eclampsia.
iii. To assess the association between echocardiographic findings and martenal and fetal/neonatal outcomes among pregnant women with Pre-eclampsia.

1.5 Research questions

i. What is the proportion of pregnant women with Pre-eclampsia admitted to maternity wards in Zanzibar health facilities who exhibit echocardiographic abnormalities?
ii. What is the association between echocardiographic abnormalities with severity of Pre-eclampsia among pregnant women with Preeclampsia?
iii. What is the association between echocardiographic findings and maternal and fetal/neonatal outcomes among pregnant women with Preeclampsia?

CHAPTER TWO

LITERATURE REVIEW

Pre-eclampsia, a pregnancy complication characterized by significantly elevated blood pressure and the potential for damage to various organs, has been associated with an increased risk of long-term cardiovascular problems for mothers. The exact etiology of pre-eclampsia, a complex pregnancy disorder, remains largely unknown. However, various factors contribute to its development, including genetic, immunological, placental, and vascular abnormalities (20). Pre-eclampsia is a serious pregnancy complication that can have severe consequences for both the mother and the baby. It affects multiple organ systems and can lead to various maternal and fetal complications. Maternal complications include Abruptio placenta, PPH, Eclampsia HELLP Syndrome and AKI. Aditionally Pre eclampsia can also cause organ dysfunction, such as liver and kidney damage, pulmonary edema, and Disseminated Intravascular Coagulation(DIC). Cardiovascular complications, such as High blood pressure, heart disease, and stroke, are more common in women with Pre-eclampsia (31,32).

Fetal and neonatal complications associated with Pre-eclampsia include Intrauterine growth restriction (IUGR), Fresh Still Birth (SBF), Intrauterine fetal death (IUFD), Preterm birth, and Low birth weight babies. Echocardiographic alteration in Pre eclamptic women have shown great impact on the outcome of both maternal and neonatal sides(33,34).

However, existing research on the specific effects of Pre-eclampsia on the heart during the pregnancy itself demonstrates some inconsistencies. Significant gaps exist in our understanding of cardiac changes in women with Pre-eclampsia, encompassing both severe and non-severe presentations of the condition. Several studies have identified alterations in the heart function of women with pre-eclampsia, particularly a weakening of the left ventricle's pumping ability (35).

Further studies have suggested a higher prevalence of abnormalities detected through echocardiography (ultrasound imaging of the heart) in women with Pre-eclampsia, especially

in those with severe cases. These studies have also found a link between impaired left ventricular diastolic function and complications of pre-eclampsia such as intrauterine growth restriction. Additionally, right ventricular dysfunction has also been associated with adverse fetal outcomes. Understanding the prevalence of these abnormalities in Zanzibar's Pre-eclamptic population could significantly inform the process of risk stratification and development of more effective management strategies (35–39).

Current research on the association between specific echocardiographic parameters and Pre-eclampsia remains inconclusive. While some studies haven't identified a statistically significant link, discrepancies in their design, sample size, and the specific cardiac measures evaluated make direct comparison difficult. This Zanzibar-based study aims to contribute valuable data by employing a standardized echocardiographic approach and including a larger sample size that is more representative of the local population. However, other studies reported no statistically significant differences in cardiac function when compared to women with healthy pregnancies. Similarly, some researches have highlighted specific abnormalities such as an increase in the mass index of the left ventricle or impaired right ventricular function. These inconsistencies highlighted the need for further investigation, particularly in under-represented populations like Zanzibar (18,35,40–44).

Further investigations suggest a potential link between specific echocardiographic abnormalities and Pre-eclampsia compared to healthy pregnancies. These abnormalities include increased prevalence of left ventricular diastolic dysfunction, as measured by the E/A wave ratio and tissue doppler imaging (45). Additionally, some studies report a higher prevalence of impaired right ventricular function in Pre-eclamptic women (46). This study can further explore the statistical significance of these specific abnormalities in the context of Zanzibar's pre-eclamptic population.

It's important to acknowledge the heterogeneity of research findings. While some studies support the presence of specific abnormalities in Pre-eclampsia, others have shown mixed

results. For instance, some studies haven't found a significant difference in left ventricular mass index between pre-eclamptic and control groups (18,47)

Research suggests a fascinating connection between how well a woman's heart functions, as measured by echocardiography, and both the health of her baby and her own well-being during pregnancies complicated by Pre-eclampsia. Impaired function of the left ventricle, the heart's main pumping chamber, specifically in its ability to relax and fill with blood (diastolic dysfunction), has been linked to a higher risk of developing serious complications associated with Pre-eclampsia, such as restricted growth of the fetus in the womb (intrauterine growth restriction) and premature delivery. Additionally, some studies point towards a potential association between right ventricular dysfunction, involving the heart's chamber responsible for pumping blood to the lungs, and adverse outcomes for the fetus. Understanding these correlations in Zanzibar can help predict and potentially prevent complications for both mothers and babies (32,39,48–50).

However, the strength of this association between cardiac function and pregnancy outcomes remains a topic of ongoing discussion. Some research hasn't found a clear link between specific measurements obtained through echocardiography and negative outcomes for the fetus or mother. These inconsistencies can be attributed to variations in how studies were designed, the number of participants involved (sample size), and the specific aspects of heart function that were assessed (51,52).

Investigating the prevalence, statistical significance, and correlation of specific echocardiographic abnormalities with fetal-maternal outcomes in Zanzibar will directly address the current knowledge gaps in this area. By quantifying the prevalence of these abnormalities and their association with pregnancy outcomes, this research can significantly improve our understanding of the cardiac effects of Pre-eclampsia in this specific population. Furthermore, statistical analysis will determine the strength and significance of these relationships, allowing for more robust conclusions to be drawn.

By tailoring treatment plans to address the specific cardiac complications associated with pre-eclampsia in this population, we have the potential to significantly improve outcomes for both mothers and babies. This targeted approach can lead to better pregnancy outcomes, potentially reducing maternal and fetal morbidity and mortality rates.

CHAPTER THREE

METHODOLOGY

3.1 Study design

This study adopted a Prospective Cohort study design to investigate the associations between echocardiographic changes observed in Pre-eclampsia and maternal-fetal outcomes within the selected healthcare facility in Zanzibar.

3.2 Study area

The study was conducted at Mnazi Mmoja Referral Mnazi Mmoja Referral Hospital, situated in Stone Town, serves as the primary referral point for all of Zanzibar. It plays a key role in providing advanced medical care and specialized services to patients from across the country. Being a referral hospital, it attracts a large and diverse population seeking comprehensive healthcare services.

The rationale behind selecting this hospital did not lie only in it's extensive reach i.e., covering diverse regions and populations but also in it's unique capability of conducting echocardiography, making it an ideal setting for assessing cardiac changes in pregnant women with severe features of Pre-eclampsia. By focusing on maternity wards within these hospitals, where pregnant women with Pre-eclampsia with severe features are admitted, the study aims to gain valuable insights into the Echocardiographic alterations prevalent in this specific group and their potential implications for maternal and fetal health.

3.2 Target Population

The target population includes all pregnant women with features of Pre-eclampsia admitted to maternity ward in Zanzibar.

3.3 Study population

This research focused on pregnant women admitted to the maternity wards in Mnazi Mmoja Referral Hospital in Zanzibar, considering the country population of approximately 1.8 million

people (53). Mnazi Mmoja Referral Hospital, located in Stone Town, serves as a referral point for the entire population of Zanzibar, offering specialized care to a broad range of patients. The selection criteria for inclusion in the study will be based on admission to these hospitals due to Pre-eclampsia, forming a specific target group for echocardiographic assessments.

3.3.1 Inclusion criteria

i. Participants admitted to the maternity ward in Mnazi Mmoja Hospital, Zanzibar. This was based on criteria for admitting patients diagnosed with Pre-eclampsia.
ii. Willingness to undergo echocardiography.

3.3.2 Exclusion criteria

i. Those who do not consent to participate in the study.
ii. Pregnant women with pre-existing cardiac conditions unrelated to Pre-eclampsia.
iii. Participants who are in the active phase of labour.
iv. Individuals with chronic kidney disease.
v. Individuals with chronic hypertensive disease.
vi. Individuals with mental related illness.

3.4 Sampling method.

This study adopted simple random sampling technique. In this technique the principal investigator created a table of random numbers by using a maternity register and then these numbers were assigned to study participants and then lottery method was used in selection of required number of participants.

Sample size

Sample size for our study was calculated using a formular for calculating sample size for infinite proportion as shown below:

$$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{ES} \right)^2$$

NB: A hypothesized frequency of 50% was used because there was no comparative prevalence from previous studies and especially from Zanzibar. Therefore, the sample size used was 151. The sample size was determined based on a 95% confidence level and a margin of error of 5%, allowing for a robust examination of the relationships between Echocardiographic changes, maternal well-being, and fetal outcomes in pregnant women diagnosed with Pre-eclampsia with severe features and without severe features.

Enrollement procedure

Participants were selected in a simple random method(rotary).The average percentage was found per day which was 2 for 90 days.

3.6 Study Variables

3.6.1 Independent variables

This is defined as presence/absence of specific echocardiographic abnormalities (LV diastolic dysfunction, LV hypertrophy, pericardial effusion) and are measured by an echocardiography i.e.,

i. **Left ventricular diastolic dysfunction:** An echocardiogram revealed

   Normal: The heart muscle relaxes and fills with blood properly between beats.

   Abnormal: This occurred when the heart's main pumping chamber (left ventricle) struggled to relax and fill with blood adequately between beats.

ii. **Left ventricular hypertrophy:** Echocardiography showed,

   Normal: The left ventricle (main pumping chamber) has a normal thickness.

   Abnormal: Echocardiogram may show increased thickness of the left ventricle wall. This suggests the heart muscle is working harder than usual to pump blood due to high blood pressure.

iii. **Pericardial Effusion:**

   Normal: No fluid buildup around the heart (pericardium).

Abnormal: The echocardiogram might show excess fluid in the pericardial sac. This can occur due to inflammation associated with severe Pre-eclampsia.

3.6.2 Dependent Variables

3.6.2.1 Maternal Outcomes

i. **Acute Kidney Injury (AKI)** which is defined by the Kidney Disease Improving Global Outcomes (KDIGO) group, as
   a) Rise in serum creatinine ≥0.3 mg/dL within 48 hours
   b) Rise in serum creatinine ≥1.5 times baseline, which is known or presumed to have occurred within the prior seven days
   c) Urine output < 0.5 mL/kg/hour for six hours

ii. **HELLP Syndrome** which was defined as a severe form of pre-eclampsia and is diagnosed when all the following are present i.e., lactate dehydrogenase (LDH) ≥ 600 IU/L: aminotransferases > 2 times of the normal and platelets < $100^* 10^9$ L.

iii. **Abruption Placenta** was defined as premature separation of the placenta from the uterine wall usually after 20 weeks gestation and diagnosed through clinical signs (abdominal pain, with or without vaginal bleeding) and ultrasound.

iv. **Postpartum Hemorrhage (PPH)** which was defined as blood loss of 1000mls, or blood loss accompanied by symptoms or signs of hypovolemia within 24 hours after childbirth.

v. **Eclampsia** which was defined as a new onset of tonic-clonic, focal or multifocal seizure with no other known causes (epilepsy, cerebral antero-ischemia or infarction, intracranial hemorrhage or drug use) in pregnant women.

3.6.2.2 Foetal Outcomes

i. **Intrauterine Fetal Death (IUFD) defined as** death of a fetus after 20 weeks gestation but before birth (>28 weeks in some definitions as still birth according to

WHO). It is confirmed by ultrasound showing no fetal heartbeat or by absence of fetal movement.

ii. **Apgar Score** defined as a total score of 7 to 10 at 5 minutes which is considered normal, and 0-6 abnormal. The baby is given a score of o to 2 on each parameter of appearance, pulse, grimace, activity and respiration.

iii. **Low Birth Weight (LBW)** defined as birth weight below a pre-defined threshold (usually <2500 grams). It was measured by weighing the newborn shortly after birth.

3.6.3 Confounding Variables

i. **Maternal Age** which is measured as years old at admission. It was confounding because it could be associated with both pre-eclampsia risk and cardiac health.

ii. **Parity** which is measured as number of previous pregnancies resulting in a viable birth past 20 weeks). It was confounding because it could influence pre-eclampsia risk.

iii. **History of Pre-eclampsia** i.e., pre-eclampsia was defined as the onset after 20 weeks of gestation of hypertension plus new unexplained proteinuria (>300 mg/24hr or urine protein/ creatinine ratio of ≥ 0.3) and/or signs of end organ damage.

iv. **History of Diabetes** which is measured as Yes/No. It was confounding because it could increase the risk of both pre-eclampsia and cardiovascular issues.

v. **Gestational Age** which was measured in weeks since last menstrual period. It was confounding because certain cardiac changes could be expected at later stages of pregnancy.

3.6.4 Control Variables

i. **Severity of Pre-eclampsia:** This study focused on including women with confirmed pre-eclampsia. i.e., *Pre-eclampsia with severe features* (new onset of persistent severe hypertension and/or signs or symptoms end organ damage. The blood criterion is SBP ≥ 160mmHg and/or DBP ≥110mmHg on atleast two measurements taken atleast 4 hours apart.) and *pre-eclasmpsia without severe features (*The blood criterion is SBP ≥

140mmHg and/or DBP ≥ 90mmHg on atleast two measurements taken atleast 4 hours apart)

ii. **Socioeconomic Status:** Factors of occupation and education level were used to account for potential socioeconomic disparities in healthcare access or underlying health conditions.

3.7 Data collection

The data collection process for this case control study involved a comprehensive and systematic approach to gather relevant information from the identified participants. The primary focus was obtaining data related to Echocardiographic changes, maternal health, and fetal outcomes.

3.7.1 Echocardiographic Assessments:

The basis of this study involves the use of echocardiography as a non-invasive imaging tool to assess cardiac function in pregnant individuals with severe features and without severe features of Pre-eclampsia. Trained sonographers conducted detailed examinations, adhering to established protocols and utilizing advanced equipment designed for maternal cardiac evaluation. The focus will be on specific parameters, notably left ventricular diastolic dysfunction, Left Ventricular Mass/Hypertrophy and Pericardial Effusion.

3.7.2 Machine and probe used:

The ultrasound machine selected for this study is the Mindray M7 Premium, equipped with a P4-2S probe. The Mindray M7 Premium is a sophisticated and technologically advanced ultrasound system known for its high-resolution imaging capabilities and versatile applications. This portable and user-friendly machine is designed to provide exceptional diagnostic performance, making it suitable for a range of medical imaging purposes.

Key Features of Mindray M7 Premium:

Portability: The M7 Premium is a portable ultrasound system, allowing for flexibility in its use across various healthcare settings.

High-Resolution Imaging: Renowned for its high-quality imaging capabilities, the M7 Premium offers clear and detailed visualization, aiding in accurate diagnostic assessments.

Versatility: This ultrasound machine is versatile, accommodating a variety of imaging needs, including obstetrics, gynaecology, cardiology, and general medical imaging.

Probe: P4-2S: The specific probe utilized in this study is the P4-2S. This probe is designed for abdominal and cardiac imaging, providing a balance between penetration depth and high-resolution imaging. It is particularly well-suited for examining structures within the abdomen and assessing cardiac function.

3.7.3 Type of echocardiography:

For this study, Transthoracic Echocardiography (TTE) was employed for patient assessment. The TTE procedure involves the following steps:

i. **Positioning the Patient:** Patients were positioned lying on their left side or back on an examination table to ensure comfort and relaxation.

ii. **Applying Gel and Placing the Transducer:** A small amount of gel was applied to the patient's chest to facilitate good contact between the skin and the transducer. The transducer was then be placed on the chest wall at specific locations to obtain various views of the heart.

iii. **Adjusting the Transducer:** The transducer was moved gently and slowly across the chest to capture images of different areas of the heart. The healthcare professional conducting the TTE adjusted the transducer's position to optimize image quality.

iv. **Capturing Images:** Utilizing the ultrasound machine, real-time images of the heart will be captured. This may include images of the heart chambers, valves, and

blood flow patterns. Various imaging modes, such as 2D, Doppler, or colour Doppler, may be used to assess the heart's structure and function.

v. **Documenting Findings:** The sonographer or healthcare professional will document any relevant findings and measurements during the TTE examination. This information will be crucial for further analysis and interpretation by a cardiologist or a trained cardiovascular technologist.

vi. **Cleaning Up:** Following the procedure, any gel residue on the patient's chest will be wiped off using a tissue or towel. Ensuring the patient's comfort, necessary instructions or information were provided.

3.8 Data Management

The collected data were de-identified before entry for storage. Anonymized data were entered into a secure electronic database while paper questionnaires and medical records were stored in a locked filing cabinet.

Concerning data quality control, double data entry was performed for a random sample of records to ensure accuracy and range checks were implemented to identify and correct out-of-range values while data cleaning procedures were applied to address missing or inconsistent data.

To add on, to ensure data security, the electronic database was password-protected with restricted access, paper records were stored in a secure location with limited access and data security protocols were followed to prevent unauthorized access or breaches.

Lastly, data retention ensured anonymized data will be retained for at least 5 years after project completion and with data archived on a secure server. Participants were informed about data retention procedures through an information sheet.

3.9 Data analysis

The data analysis was done using IBM SPSS Version 20(Name of the manufacturer, City, Country) and this data analysis was streamlined such that it answered each specific objective without neglecting the role of confounding and control variables.

Objective (i): Proportions of Echocardiographic Abnormalities

Descriptive statistics were used to determine the proportions of pregnant women with pre-eclampsia with abnormal ECHO findings including frequency and percentages of specific ECHO finds.

Objective (ii): Association between echocardiographic changes in relation to severity of Preeclampsia.

Chi-square test was used to determine the association of each specific echocardiographic abnormality between the severity of Pre eclamptic groups and interpretation identified if there was an association between the two groups.

Objective (iii): Association between Echocardiography and Outcomes (Maternal and Fetal).

Chi-square test was used to determine the association between ECHO findings and maternal and fetal outcome. A p-value of less or equal to 0.05 was regarded as statistically significant. In inferential statistics, a p-value of less or equal to 0.05 was considered statistically significant. To quantify the risk of maternal and fetal/neonatal outcome among women with abnormal findings, we calculated the relative risks with respective 95% confidence interval.

3.10 Ethical consideration

Ethical clearance was requested from Institutional Review Committee of Kairuki University and permission from Mnazi Mmoja Hospital in Zanzibar was then granted.

All participants who consented to particpate in the study were provided with comprehensive and easily to understand information about the study, including its purpose, procedures,

potential risks, and benefits, and were given ample opportunity to ask questions and make informed decisions regarding their participation.

To uphold confidentiality, secure storage systems were employed, and identities were protected when sharing results. The principal investigator continually monitored and assessed potential risks and benefits throughout the study, taking proactive measures to minimize harm to participants.

The most likely risks associated with performing ECHO among pregnant women with Pre-eclampsia are convulsions and orthostatic hypotension on supine position. To minimize these risks, blood pressure for all patients was be taken before the procedure, those with severe hypertension were medically stabilized before the procedure. Also, Magnesium Sulphate was initiated to prevent them from convulsion. To avoid orthostatic hypotension, ECHO was taken while the participant was lying supine at 45 degrees (cardiac position), and the echocardiographer took a short time possible for the procedure. Those patients who were clinically unstable were stabilized before the procedure.

Privacy was prioritized by avoiding unnecessary exposure, and counselling related to the procedure was provided to maintain the well-being of the mother.

Researchers adhered to professional integrity and transparency, ensuring accurate representation of the study's purpose and findings and lastly, results were reported objectively, avoiding conflicts of interest or misleading interpretations.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic and Clinical characteristics of the study participants N=151.

Table 1: Socio-demographic and clinical characteristics of study participants (=151)

Variable	Frequency	Percentage (%)
Age (years)		
Below 20	8	5.3
20 – 40	138	91.4
Above 40	5	3.3
Level of education		
No education	2	1.3
Primary	14	9.3
Secondary	91	60.3
College	44	29.1
Employment status		
Variable	**Frequency**	**Percentage (%)**
House wife	92	60.9
Civil servant	27	17.9
Private sector	26	17.2
Self employed	6	4
Change of husband/Partner		
Yes	27	17.9
No	124	82.1
Gravidity		
Prime gravid	58	38.4
Gravid 2	27	17.9
Gravid 3	14	9.3
> 3	52	34.4
Gestational age (weeks)		
< 30	10	6.6
30 -36	32	21.2
37 and above	109	72.2
Parity		
Para 0	72	47.7
Low parity(1-4)	60	39.7
High parity(>4)	19	12.6
History of Pre eclampsia in previous pregnancy		
Yes	12	7.9
No	139	92.1

A total of 151 pregnant women with Preeclampsia visited Mnazi Mmoja Referral hospital were enrolled into the study. The study population was predominantly young, with 91.4% of participants aged between 20 and 40 years. A smaller portion, 5.3%, were under the age of 20, while only 3.3% were over 40 years old.

Regarding pregnancy history, notable portions (38.4%) revealed to be going through their initial pregnancy (Primigravida), followed by 34.4% in more than three pregnancies while the rest had encountered one to two previous pregnancies.

The gestational age upon enrollment in the study predominantly indicated full-term deliveries, with 72.2% of women being at least 37 weeks pregnant.

4.2 Proportions of pregnant women with Pre-eclampsia who exhibit echocardiographic abnormalities.

Table 2: Distribution of ECHO findings among study participants according to severity of Pre eclampsia (N=151)

	Severity of Pre-eclampsia		**Total**
Cardiac Changes	**Pre-eclampsia without severe features**	**Pre-eclampsia with severe features**	
No cardiac change	35(23.2%)	36(23.8%)	71(47%)
LVD ONLY	2(1.3%)	6(4%)	8(5.3%)
LVM ONLY	8(5.3%)	26(17.2%)	34(22.5%)
PE ONLY	0(0%)	14(9.3%)	14(9.3%)
Both LVD and LVM	2(1.3%)	10(6.6%)	12(7.9%)
Both LVM and PE	2(1.3%)	10(6.6%)	12(7.9%)
Total	49(32.4%)	102(67.5%)	151(100%)

Among all participants, 80(53%) had abnormal ECHO findings while the most frequent abnormal finding was left ventricular hypertrophy (22.5%) . Distribution of other findings are shown in (Table 02)

4.3 Association between echocardiographic abnormalities and severity of pre-eclampsia among pregnant women with Pre-eclampsia

Table 3: Association between echocardiographic abnormalities and severity of pre-eclampsia among pregnant women with Pre-eclampsia (N=151)

Pre-eclampsia status	Cardiac changes		
	No	**Yes**	**P-value**
Not severe features	35 (50.7%)	14 (17.5%)	<0.001
Severe features	36(48.3%)	66 (82.5%)	
Total	71 (100%)	80(100%)	

In this study, there was a significant association between an abnormal echocardiographic findings with severity of Pre-eclampsia with p<0.001 (table 03)

4.4 Association between echocardiographic findings and adverse maternal outcomes among pregnant women with Pre-eclampsia

Table 4: Distribution of maternal outcomes among study participants (N=151)

	CARDIAC FINDINGS		Total
	NORMAL CARDIAC FINDINGS	ABNORMAL CARDIAC FINDINGS	
No ADVERSE MATERNAL OUTCOME	51(33.8%)	28(18.5%)	79(52.3%)
AKI	2(1.3%)	1(0.6%)	3(2%)
HELLP SYNDOME	2(1.3%)	4(2.6%)	6(4%)
ABRUPTIO PLACENTA	3(2%)	3(1.9%)	6(4%)
PPH	7(4.6%)	9(5.9%)	16(10.6%)
ECLAMPSIA	4(2.6%)	8(5.2%)	12(7.9%)
COMBINED MATERNAL OUTCOMES	2(1.3%)	27(17.9%)	29(19%)
TOTAL	71(47%)	80(52.7%)	151(100%)

Among all participants, 72 had adverse maternal outcome, in which 52(65.0%) had an abnormal echocardiographic findings and 20(28.2%%) had normal echocardiographic findings. No mortality was recorded among participants with adverse outcome. Other distribution of outcomes is as shown in the table 04.

Table 5: Association between echocardiographic findings and adverse maternal outcomes among pregnant women with Pre-eclampsia (N=151)

Adverse Maternal outcome	CARDIAC CHANGES		P-value
	No	Yes	
No	51 (71.8%)	28 (35.0%)	<0.001
Yes	20(28.2%)	52 (65.0%)	
Total	71(100%)	80(100%)	

Among 80 paricipants with abnormal ECHO findings, 52 (65%) developed adverse maternal outcomes. There was a significant association between ECHO findings and and maternal outcome with p<0.001(Table 05). Further analysis showed that participants with abnormal cardiac changes were at higher risk of developing adverse maternal outcome (RR=2.242, CI =95% ,p- value=<0.001)

4.4 The association between echocardiographic findings and maternal and fetal/neonatal outcomes among pregnant women with Pre-eclampsia (N=151)

Table 6: Distribution of neonatal/fetal outcomes among study participants

	ECHO FINDINGS (maternal)		Total
ADVERSE FETAL/ NEONATAL OUTCOMES	NORMAL ECHO	ABNORMAL ECHO	
N0 ADVERSE NEONATAL OUTCOMES	39(25.8%)	31(20.5%)	70(46.3%)
IUFD	4(2.6%)	7(4.6%)	11(7.2%)
IUGR	7(4.6%)	11(7.2%)	18(12%)
SBF	4(2.6%)	5(3.3%)	9(5.9%)
LOW APGAR SCORE	17(11.2%)	26(17.2%)	43(28.4%)
TOTAL	71(47%)	80(52.9%)	151(100%)

Out of 151 neonates/fetuses 80 had adverse neonatal/fetal outcomes among them 49(61.3%) their mothers had an abnormal echo findings and 31(38.7%) their mothers had normal echo findings (Table 06).

Table 7: Association between echocardiographic findings and adverse fetal/neonatal outcomes among pregnant women with Pre-eclampsia

Adverse fetal /neonatal outcomes	**CARDIAC CHANGES (MATERNAL)**		**P-value**
	No	Yes	
No	39 (54.9%)	31(38.7%)	
Yes	32 (45.1%)	49(61.3%)	0.047
Total	71(100%)	80(100%)	

Among neonates of 80 mothers with Pre eclampsia with abnormal ECHO findings, 49 (61.3%) had adverse neonatal outcome. There was a significant association between ECHO findings and neonatal outcome with p=0.05 (table 07) . Furthermore, neonates/fetuses from participants who had abnormal ECHO findings were at higher risk of adverse outcome (RR=1.5, CI =95% ,p value=0.047).

CHAPTER FIVE

DISCUSSION

In this study 34.4% of pregnant women with Pre eclampsia had abnomal ECHO findings. We further found that abnormal ECHO findings was a significant risk for maternal and neonatal/ fetal adverse outcomes.

The findings of this study underscore the complex nature of Preeclampsia, a syndrome marked by maternal hypertension and proteinuria, and its multifaceted impact on both the mother and fetus. The high proportion of full-term pregnancies (72.2%) among the participants, along with significant cardiovascular and educational factors, aligns with the complexity of Preeclampsia as a condition influenced by various maternal, placental, and fetal interactions. This statement reflects the findings of John Wilson who proposed that during pregnancy, the maternal cardiovascular system undergoes significant adaptations, including increased cardiac output, expanded blood volume, and reduced systemic vascular resistance. However, in Pre-eclampsia, these adaptations often become maladaptive (54).

In our study LVM, LVD and PE were myocardial parameters that have been observed resulted from Preeclamptic women with and without severe features. The LVD was only observed in Preeclamptic women with severe features.

Considering echocardiographic findings with Pre-eclampsia, studies done in India, China and United States reported that Left Ventricular Diastolic Dysfunction in Preeclampsia with severe features was in high proportion. (17,18,55). Also, Nandhini et al., 2022 observed 50 patients had abnormal echo findings in which majority had LVD (56). Whereby in our study 151 Pre eclamptic patients 80 had abnormal echocardiographic findings in which LVM were in high proportion 34(22.5%). These findings contradict our study, and it could be due to geographical conditions, races and ethnicity.

On the other hand, Thirumurugan et al., in 2024, showed that LV hypertrophy is more common in Preeclampsia than in normotensive pregnant women during the third trimester, Ferreira et al., in 2023 with numerous studies confirming increased LV hypertrophy in Pre-

eclampsia (47,57) respectively. The above two studies had similar findings with our study whereby LVM was in high frequency in Pre eclamptic women.

Regarding to the association between severity of Preeclampsia in relation to abnormal echocardiographic findings, For example Kshirsagar et al.,2022 Echocardiographic abnormalities like left ventricular hypertrophy and impaired function are more pronounced in Pre eclampsia with features, indicating a relationship between abnormal findings and severity of the Pre eclampsia also Derya et al., 2022 abnormal echocardiographic findings are significantly associated with the severity of Pre-eclampsia. Studies have shown that women with severe pre-eclampsia often exhibit left ventricular dysfunction, including diastolic dysfunction, decreased ejection fraction, and increased left ventricular hypertrophy respectively (18,58) .The above two studies have supported our findings since there was an association between severity of Preeclampsia and abnormal echocardiographic findings with the p value of <0.001 which is highly significant.

A study done by Nandhini et al,.2022 about the asociation between abnormal echocardiographic findings in Preclamptic women and adverse maternal outcomes. Whereby 50 patients with a cardiac changes, 7 patients had Abruption placenta, 9 patients had Eclampsia, 3 patients had HELLP Syndrome and 5 patients had AKI also patients with changes in ECHO had more of LBW babies compared to patients with normal ECHO (56). Comparison with our study, out of patients, 52 developed adverse maternal outcomes with abnormal echo findings. 8 patients had Eclampsia, 1 patients had AKI, 4 patients had HELLP Syndrome, 3 patients had Abruption placenta patients, 9 PPH and 27 patients had combined adverse maternal outcomes. Therefore the above two studies are almost similar to each other. maternal outcomes are similar with our study.

Regarding to adverse neonatal /fetal outcomes there was an association with an abnormal echo findings also found in which the P value was statistically significant (P value =0.047).

In our study Low apgar score and IUGR were in high percentage 28.4% and 12% respectively in comparison with Nandhinis study where by low birth weight seemed to appear more.

CONCLUSION

Majority of patients with Pre-eclampsia had abnormal ECHO findings, which was associated with severity of the disease, maternal and fetal/neonatal outcomes.

RECOMMENDATIONS

1. To improve outcomes, routine ECHO should be considered among women with Pre-eclampsia for appropriate management and monitoring.

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APPENDICES

Appendix 1: Consent form – English version

Good day! My name is …… from …… We are here to conduct research on behalf of Dr. Aysha Mwalim who is a student at Hubert Kairuki Memorial University undertaking her Masters degree on Obs and Gyn. The research is about investigating cardiac changes among pregnant women with severe features of pre-eclampsia and associated fetal-maternal outcome.

If you agree to participate, you will be asked to answer a structured questionnaire about your medical history and demographics, do echo, and allow the research team to access your medical records related to this study. The procedures involved in this study are considered minimal risk.

In terms of benefits, there may be no direct benefits to you, but the information obtained from this study may contribute to a better understanding of pre-eclampsia in high-risk pregnancies. Please be informed that all information collected will be kept confidential. Your name and any other identifying information will not be included in any reports or publications resulting from this study. Your participation in this study is entirely voluntary. You may choose not to participate, and you may withdraw from the study at any time without penalty or loss of benefits to which you are otherwise entitled.

If you have any questions about the study, please feel free to contact Dr. Aysha Mwalim Omar who is the Principal Investigator at +255 777 487 084 or Director of research at ZAHRI +255 774 021 402.

At this point, do you have any questions about the study? Do I have your agreement to proceed?

Participant's consent:

I have understood the information provided above, and I also understand the nature and purpose of the study. I have had the opportunity to ask questions, and any questions I have asked, have been answered to my satisfaction. I voluntarily agree to participate in this study.

Participant's Name: _____

Participant's Signature: _____ Date: _____

Investigator's Certification:

I confirm that the participant has been provided with the information needed to make an informed decision about participating in this study.

Investigator's Name: ……

Investigator's Signature: _____ Date: _____

Appendix 2: Consent form – Swahili version

Habari ya leo! Jina langu ni …… kutoka …… Tupo hapa kwa ajili ya kufanya utafiti kwa niaba ya Dkt. Aysha Mwalim ambaye ni mwanafunzi wa Chuo Kikuu cha Hubert Kairuki Memorial akichukua Shahada ya Uzamili katika fani ya Obs na Gyn. Utafiti huu ni kuhusu uchunguzi wa uhusiano kati ya maradhi ya moyo na kutokea kwa wanawake wajawazito walio katika hatari kubwa ya kupata dalili za kifafa cha mimba.

Ikiwa utakubali kushiriki katika utafiti huu, utaombwa kujibu maswali yanayohusu historia yako ya matibabu na kuruhusu timu ya utafiti kupata rekodi zako za matibabu zinazohusiana na utafiti huu. Utafiti huu haukadiriwi kuwa na athari kwa washiriki.

Kuhusu faida, yawezekana hakutokuwa na faida moja kwa moja kwako, lakini taarifa za utafiti huu zitachangia kuelewa vizuri zaidi kifafa cha mimba kwa wanawake wajawazito walio katika hatari kubwa. Tafadhali elewa kuwa taarifa zote zitakazokusanywa zitabaki kuwa za siri. Jina lako na taarifa nyingine yoyote ya kukutambua haitajumuishwa katika ripoti au machapisho yoyote yatakayotokana na utafiti huu. Ushiriki wako katika utafiti huu ni wa hiari. Unaweza kuchagua kutoshiriki, na unaweza kujitoa kwenye utafiti wakati wowote bila adhabu au kupoteza stahiki zako zozote.

Ikiwa una maswali yoyote kuhusu utafiti, tafadhali jisikie huru kuwasiliana na Dk. Aysha Mwalim ambaye ni Mtafiti Mkuu kupitia nambari +255 777 487 084 au Mkurugenzi wa Utafiti kutoka ZAHRI +255 774 021 402.

Je, kwa sasa una maswali yoyote kuhusu utafiti? Je, ninayo ridhaa yako kuendelea?

Ridhaa ya Mshiriki:

Nimeelewa habari iliyotolewa hapo juu, na pia ninaelewa asili na lengo la utafiti. Nimepata fursa ya kuuliza maswali, na maswali yangu yote yamejibiwa kwa kuridhisha kwangu. Kwa hiari yangu mwenyewe, nakubaliana kushiriki katika utafiti huu.

Jina la Mshiriki: _____

Saini ya Mshiriki: _____ Tarehe: _____

Uthibitisho wa Mtafiti:

Nathibitisha kwamba mshiriki amepewa habari zote anazohitaji kufanya uamuzi wa kushiriki katika utafiti huu.

Jina la Mtafiti: ……

Saini ya Mtafiti: _____ Tarehe: _____

Appendix 3: Questionnaire – English version

Section 1: Health facility information

Region: ……. District: ……

Name of Health Facility: ……

Section 2: Participant Information

A: Demographics:

No.	Question	Response
1.	Age:	☐
2.	What is your occupation	Civil servant ☐ Private ☐ Business ☐ Housewife ☐ Other specify …….
3.	What is your level of education	No formal education ☐ Primary education ☐ Secondary education ☐ College/university ☐
B: Obstetric history:		
4.	How many times have you been pregnant (gravida)?	1 ☐ 2 ☐ 3 ☐ >3 ☐
5.	How many children do you have (para)?	1 ☐ 2 ☐ 3 ☐ >3 ☐

6.	Have you experienced pre-eclampsia in a previous pregnancy?	Yes ☐ No ☐		
Section 3: Medical history				
7.	Do you currently have any of the following medical conditions?		**Yes**	**No**
		Diabetes		
8.	Are you taking any medications for diabetes presently?			
Section 4: Pregnancy details and social history				
9.	What is the gastation age? *Confirm the age in the ANC card*			
10.	Have you experienced a change in husband or partner in your marital history?	Yes ☐ No ☐		
Section 5: General wellbeing and investigation				
A. Physical Examination findings on ECHO				
11.	Examine the participant for the following conditions and tick on the appropriate box		**Yes**	**No**
		Lower limb oedema		
12.	Take the measurement for the following vital signs and record the results accordingly	Blood Pressure		
		Urine for protein		
B. History, physical examination and confirmation of pre-eclampsia during				
			Yes	**No**
13.	Take history of participants if they experience any of the following conditions and tick on the appropriate box	Headache		
		Epigastric pain		
		Blurred vision		
14.	Do physical examination of the participants to assess the following	Lower limb oedema		

15.	Take measurement of the vital sign	BP	
16.	Record the results for the following tests	Urine for protein	
		ECHO	
17.	Details of delivery	Mode of delivery	
		Weight of the baby	
		APGAR score	
		PPH	
		AKI	
		HELLP syndrome	
		Abruption placenta	

Appendix 4: Questionnaire – Kiswahili version

Sehemu ya 1: Taarifaza kituo cha Afya		
Mkoa: ……. Wilaya: …… Jina la kituo cha Afya:		
Sehemu ya 2: Taarifa za mshiriki		
Na.	**Masuali**	**Majibu**
1.	Umri:	☐
2.	Jee unafanya kazi gani?	Mtumishi wa serikali ☐ Taasisi binafsi ☐ Mfanyabiashara ☐ Mama wa nyumbani ☐ Nyenginezo……
3.	Jee una kiwango gani cha elimu?	Hukusoma ☐ Elimu ya msingi ☐ Elimu ya sekondari ☐ Elimu ya chuo kikuu ☐
B: Historia ya uzazi		
4.	Jee huu ni ujauzito wako wa ngapi?	1 ☐ 2 ☐ 3 ☐ >3 ☐
5.	Jee una watoto wangapi?	1 ☐ 2 ☐ 3 ☐ >3 ☐
6.	Jee ulishawahi kupata dalili za kifafa cha mimba katika mimba zilopita	Ndio ☐ Hapana ☐

	(kumurimuri/kiza cha macho, kiungulia, pressure kua kubwa)?			
Sehemu ya 3: Historia ya kuugua				
7.	Jee umeshawahi kuugua magonjwa yafuatayo?		**Ndio**	**Hapana**
		Kisukari		
8.	Jee kwa sasa unatumia dawa ya sukari?			
Sehemu ya 4: Taarifa za ujauzito na historia ya kijamii				
9	Jee ujauzito wako una umri gani? *Hakikisha kwa kuangalia kadi yake ya kliniki*			
10	Jee huyu ni mume/mwanamme wa mwanzo kuzaa nae?	Ndio ☐ Hapana ☐		
Sehemu ya 5: Hali ya mshiriki na vipimo				
11.	Mchunguze mshiriki haya yafuatayo na weka alama ya vyema kwenye kisanduku kinachofaa.		**Ndio**	**Hapana**
		Kuvimba miguu		
12.	Chunguza kipimo cha ishara muhimu zifuatazo na uandike matokeo ipasavyo.	Sindikizo la damu		
		Protini kwenye mkojo		
B. Historia, uchunguzi wa kimwili na uthibitisho wa kifafa cha mimba katika kipindi cha tatu cha ujauzito au kutimiza.				
			Ndio	**Hapana**
13.	Andika historia ya mshiriki iwapo amewahi kupata ya dalili zifuatazo na weka alama katika kisanduku kinachofaa.	Kuumwa na kichwa		
		Kiungulia		
		Kutoona vizuri		
14.	Mchunguze mshiriki kuangalia yafuatayo	Kuvimba miguu		
15.	Chukua kipimo cha ishara muhimu	Sindikizo la damu		

16.	Rekodi matokeo ya vipimo vifuatavyo	ECHO		
		Protini kwenye mkojo		
17.	Matokeo ya kujifungua	Mama alimwaga damu nyingi sana baada ya kujifungua		
		Zalio liliwachia kabla ya kujifungua		
		Mama amepata tatizo la figo		
		Njia ya kujifungua		
		Kilo za mtoto		
		Alama alizopata mtoto baada ya kujifungua.		

Appendix 5: Ethical Clearance Letter

HUBERT KAIRUKI MEMORIAL UNIVERSITY (HKMU)

70 Chwaku Street,
Mikocheni,
P.O BOX 65300,
Dar es Salaam,
Tanzania.

Tel: +255-22-2700021/4
Fax: +255-22-2775591
Email: irec@hkmu.ac.tz
Website: www.hkmu.ac.tz

Ref. No. HKMU/IREC/27.10/441 **09th April 2024**

Dr. Aysha Mwalim Omar,
Hubert Kairuki Memorial University,
P.O. Box 65300,
Dar es Salaam, Tanzania.

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING HEALTH RESEARCH.

I am pleased to inform you that the research titled: **Cardiac changes among pregnant women with severe features of pre-eclampsia and associated fetal-maternal outcome in Zanzibar (Omar A. M., 2024)** has been granted ethical approval.

This approval is in effect for one year from the above date. Any changes in the procedures should be reported to the Institutional Research Ethics Committee. Significant changes will require the submission of a revised request for ethical approval. You will be required to submit **study progress report** every six months.

Permission to publish your findings should be sought from the National Institute for Medical Research (NIMR) before submission to a publisher and not concurrently.

CHAIR PERSON

Name: Prof. Fredrick Kaijage

Signature:

SECRETARY

Name: Prof. Columba Mbekenga

Signature:

HUBERT KAIRUKI MEMORIAL UNIVERSITY
P. O. Box 65300
DAR ES SALAAM

HUBERT KAIRUKI MEMORIAL UNIVERSITY (HKMU)

70 Chwaku Road,
Regent Estate - Mikocheni,
P. O. Box 65300,
Dar es Salaam.
Tanzania

***Tel:** +255-22-2700021/4*
***Fax:** +255-22-2775591*
E-mail:secvc@hkmu.ac.tz
Website:www.hkmu.ac.tz

Ref. No. HKMU/PT/30.5/442 15th April 2024

Medical Officer Incharge,
Mnazi Mmoja Referral Hospital,
Zanzibar.

Re: Letter of introduction Dr. AYSHA MWALIM OMAR (MMED Part 2 – Obstetrics and Gynaecology)

The above named is a MMED postgraduate student specialising in Obstetrics and Gynaecology. As part of fulfilling her MMED programme, she plans to undertake a study titled **CARDIAC CHANGES AMONG PREGNANT WOMEN WITH SEVERE FEATURES OF PRE-ECLAMPSIA AND ASSOCIATED FETAL-MATERNAL OUTCOME IN SELECTED HEALTH FACILITIES IN ZANIZBAR.** This study was reviewed and has been granted with an ethics approval No. **HKMU/IREC/27.10/441** by the HKMU Institutional Research Ethics Committee that will be valid for one year with effect from 9th April, 2024.

This letter serves to introduce **Dr. AYSHA MWALIM OMAR** who will be conducting her study at **Mnazi Mmoja Referral Hospital in Zanzibar**, please accord her with the needed support.
Thank you for your support and cooperation in developing human resources for health in our country.

Regards,

Professor Columba Mbekenga, PhD
Director Postgraduate Studies & Research Institute

DIRECTOR POSTGRADUATE STUDIES
HUBERT KAIRUKI MEMORIAL UNIVERSITY
P. O. Box 65300
AND RESEARCH INSTITUTE

c. c. Professor Naboth Mbembati, Dean, Faculty of Medicine, HKMU
c. c. Dr. Monica Chiduo, Chair, Department of Obstetrics and Gynaecology, HKMU

Appendix 6: Cover Letter

Dr Aysha Mwalim Omar
Kairuki University
P.O.BOX 65300
12TH August, 2024

Mobile: +255 777 487 084

Email: omaraysha390@gmail.com

Director of Postgraduate Studies and Research Institute
Kairuki University
P.O.BOX 65300
Dar Es Salaam

U.F.S
Chairperson,
Department of Obstetrics and Gynaecology

Dear Prof,

RE: SUBMISSION OF DISSERTATION FOR MMED PART II FINAL QUALIFICATION EXAM

Kindly refer to the above heading.

I hereby submit my MMED dissertation entitled: **"Cardiac changes among pregnant women with features of Pre-eclampsia and associated fetal-maternal outcomes in selected health facility in Zanzibar"** as part of MMed part II Final Qualifying Examination.
Attached to this letter are (2) hard copies of my dissertation, and a Turnitin (anti-plagiarism) report checked in the department.

Yours sincerely

DR.AYSHA MWALIM OMAR
REG NO: HK/PG/OG/21/004

Appendix 7: Permission Letter from Mnazi Mmoja Referral Hospital

HOSPITALI YA RUFAA MNAZI MMOJA

ZANZIBAR

WizarayaAfya
Vuga-Zanzibar.

Simu: +255 773 833768
Baruapepe: info@mmh.go.tz
Tovuti: www.mmh.go.tz
Sanduku la Posta: 672

Tarehe: 28 / 5 /2024

Nd Aisha Mwalim
Mwanafunzi/Mfanyakazi Mtafiti
Chuo/Ofisi/Hospitali Hubert Kairuki

KUH: RUHUSA YA KUFANYA UTAFITI.

Mada ya hapo juu inahusika na barua hii.

Ombi lako la kuja kudadisi baadhi ya wagonjwa/wafanyakazi kwa lengo la kulamilisha utafiti huo limepokewa na kuzingatiwa. Ruhusa imetolewa kuja kwa ajili ya udadisi huo unaohusiana na:

Cardiac Changes Among Pregnant Women With Severe Features Of Pre Eclamsia And Associated Martenal And Fetal Outcome In Selected Health Facilitues In Zanzibar.

kuanzia tarehe ya barua hii kwa muda wa mwezi mmoja.

Unatakiwa kuwasilisha matokeo ya utafiti wako ofisini kwa Mkurugenzi Mtendaji mara baada ya kazi ya uandishi wa ripoti hiyo kumalizika na kuwasilisha kwenye Taasisi husika.

Unatakiwa kuvaa Kitambulisho chako muda wote wa kazi hii kwenye maeneo ya hospital. Pia uwe na kopi ya barua hii. Kutokana na upungufu wa wafanyakazi hospitalini hapa huruhusiwi kutumia wafanyakazi wa hospital kwa kazi yako hii.

Natanguliza shukurani za dhati kwa mashirikiano

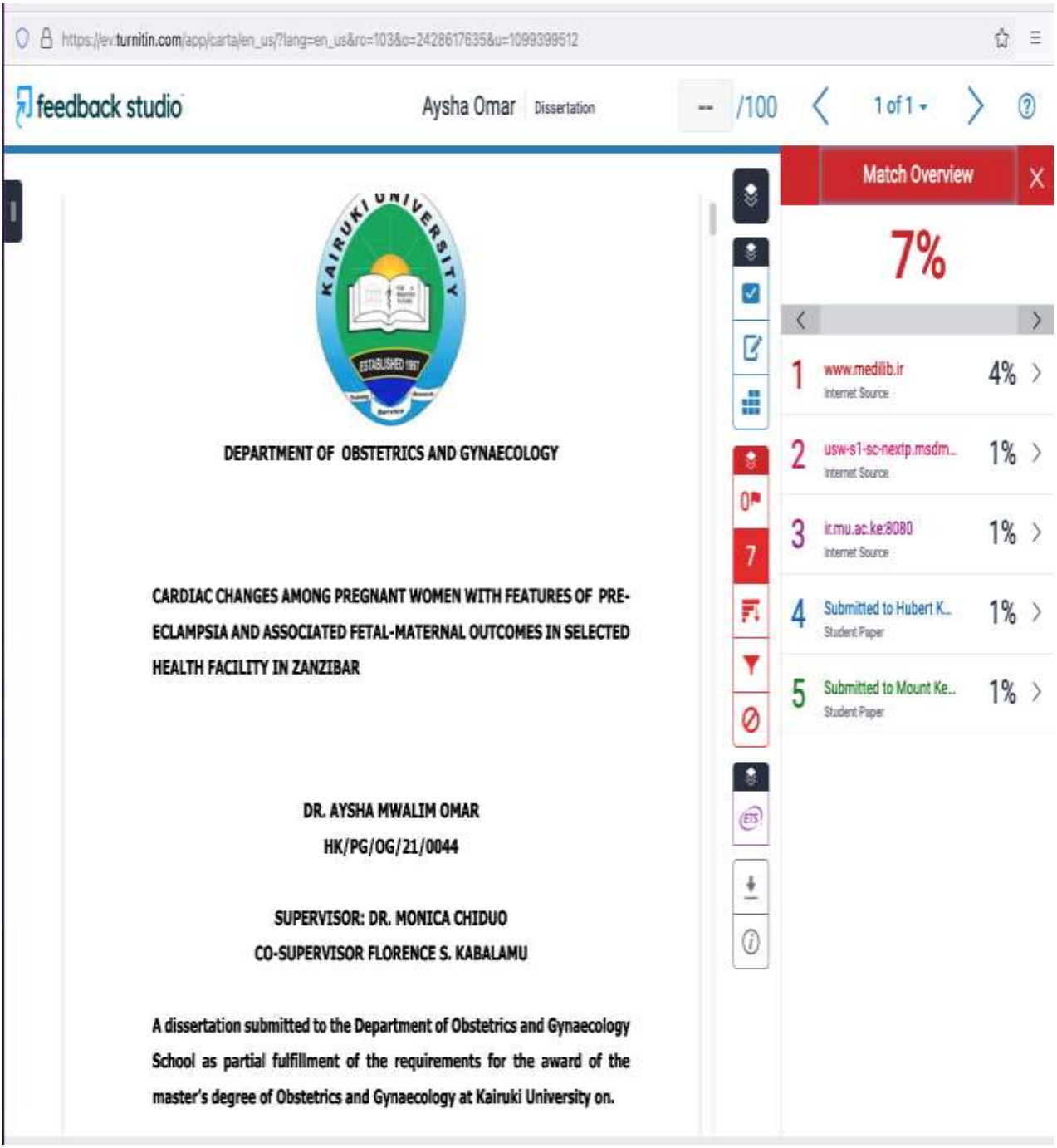
Ahsante

Hafida Sheha Hassan
/Mkurugenzi Mtendaji,
MnaziMmoja Hospital,
Zanzibar

MNAZI MMOJA HOSPITAL * Date ..... * ZANZIBAR

Nakla:
- Mkuu wa Idara HMM

Appendix 8: Plagiarism Report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CARDIAC CHANGES AMONG PREGNANT WOMEN WITH FEATURES OF PRE-ECLAMPSIA AND ASSOCIATED FETAL-MATERNAL OUTCOMES IN SELECTED HEALTH FACILITY IN ZANZIBAR
DR. AYSHA MWALIM OMAR
HK/PG/OG/21/0044
SUPERVISOR: DR. MONICA CHIDUO
CO-SUPERVISOR FLORENCE S. KABALAMU
A dissertation submitted to the Department of Obstetrics and Gynaecology School as partial fulfillment of the requirements for the award of the master's degree of Obstetrics and Gynaecology at Kairuki University on.