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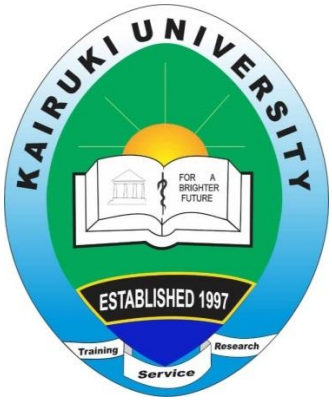

THYROID FUNCTION DERANGEMENT AMONG PATIENTS WITH HEART FAILURE ATTENDING MEDICAL CLINICS IN DAR ES SALAAM.

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN INTERNAL MEDICINE AT KAIRUKI UNIVERSITY

2025

CERTIFICATION

It is hereby certified that the undersigned have read and hereby recommend the acceptance by Kairuki University of a Dissertation titled: *"THYROID FUNCTION DERANGEMENTS AMONG ADULT HEART FAILURE PATIENTS ATTENDING MEDICAL CLINIC IN DAR ES SALAAM"* in partial fulfillment of the requirements for the degree of Master of Medicine in Internal Medicine of Kairuki University.

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I, CHRISTINE R. YONAZI, hereby declare that this dissertation is my effort and original work and that it has not been presented and will not be presented to any other University for a similar degree or any other academic award.

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DEDICATION

I dedicate this work to my parents, my siblings, my husband Samwel, and our children, Ezekiel and Eileen. This accomplishment is shared with each of you. My gratitude is endless for your sacrifices, your unwavering encouragement, and the strength and joy you provided me throughout this journey.

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ABBREVIATIONS AND ACRONYMS

CO	**Cardiac Output**
HF	Heart Failure
HFpEF	Heart Failure with preserved ejection fraction
HFrEF	Heart failure with reduced ejection fraction
JVP	Jugular Venous Pressure
NT-proBNP	N-terminal pro-B-type natriuretic peptide
NYHA	New York Heart Association
RAAS	Renin- Angiotensin Aldosterone System
RV	Right Ventricular
SNS	Sympathetic Nervous System
T3	Triiodothyronine
T4	Thyroxine
TSH	Thyroid-Stimulating Hormone

OPERATIONAL DEFINITION

HEART FAILURE: Heart failure (HF) is characterized by the heart's inability to pump blood effectively, leading to inadequate tissue perfusion[1].

Thyroid function derangement (dysfunction)- a range of clinical conditions that affect the thyroid gland's ability to produce hormones, leading to various metabolic and physiological disturbances. It encompasses both hypothyroidism (insufficient hormone production) and hyperthyroidism (excess hormone production), which can significantly impact overall health, including reproductive and metabolic functions[2].

Hyperthyroidism – is defined as an overactive thyroid, whereby there is low TSH (0.4mu/L<) and high free T3 (>25pmol/L) and T4 (>7.8pmol/L)[3].

Hypothyroidism is defined as an underactive thyroid, whereby there is high TSH (>4mU/L), and a low free T3(3.5pmol/L<) and free T4 (9pmol/L<)[3].

ABSTRACT

Background: Thyroid dysfunction complicates the management of heart failure (HF), contributing to treatment refractoriness, increased medication burden, and poor outcomes. Early detection in asymptomatic patients is posited as a strategy to improve prognosis.

Objective: This study aimed to determine the pattern of thyroid function derangement among adults with HF in Dar es Salaam.

Methods: A facility-based cross-sectional study was conducted. Thyroid status (hypothyroidism, hyperthyroidism) was defined using standard hormone level thresholds (TSH, fT3, fT4). Data analysis was performed using STATA 17, with a p-value <0.05 considered significant.

Results: Among 359 HF patients, 20.1% had thyroid dysfunction. Hypothyroidism (13.7%) was significantly more prevalent than hyperthyroidism (6.4%), with subclinical hypothyroidism (11.7%) being the most common pattern ($p<0.001$). Thyroid derangement was significantly associated with the global type of HF, a higher NYHA class, a lower ejection fraction, and a history of hospitalization.

Conclusion & Recommendation: The prevalence of thyroid dysfunction, particularly subclinical hypothyroidism, is high in this HF population and is linked to worse clinical severity. Routine screening with thyroid function tests (TSH, fT3, fT4) is recommended for all HF patients, including asymptomatic individuals, to enable early intervention.

CHAPTER ONE

1.0 INTRODUCTION AND BACKGROUND INFORMATION

Thyroid dysfunction has a significant impact on cardiac function and is recognized as a risk factor for the development of heart failure. Thyroid function derangement is a range of clinical conditions that affect the thyroid gland's function. It is a common health condition that can significantly impact cardiovascular health[4].

Recent studies have increasingly underscored the association between thyroid dysfunction and heart failure (HF), implying a complicated interaction between these two conditions[5]. Both hyperthyroidism and hypothyroidism can lead to various cardiac complications, impacting parameters such as heart rate, contractility, and vascular resistance. Thyroid hormones exert direct effects on myocardial and vascular endothelial cells, influencing cardiac output and contractility[6].

Hypothyroidism can lead to decreased cardiac contractility and increased vascular resistance, potentially resulting in heart rhythm disturbances[7]. Subclinical thyroid dysfunction, while often overlooked, can also impact cardiovascular health, with studies showing no significant correlation with coronary heart disease in certain populations[8].This study aims to determine the burden of thyroid function derangement among heart failure patients.

1.1 DEFINITION OF HEART FAILURE

Heart failure (HF) is characterized by the heart's inability to pump blood effectively, leading to inadequate tissue perfusion[1]. It is primarily categorized into two types based

on ejection fraction: Heart Failure with Reduced Ejection Fraction (HFrEF) and Heart Failure with Preserved Ejection Fraction(HFpEF)[9].

Heart failure with reduced ejection fraction (HFrEF) occurs when the heart cannot adeq uately pump blood to the body's tissues when the cardiac filling pressure is normal[10]. Heart failure with preserved ejection fraction (HFpEF) is a clinical condition that involves typical heart failure symptoms and signs, together with a left ventricular ejection fraction of 50% or more. Heart failure is often linked to various underlying causes, including coronary artery disease, hypertension, and cardiomyopathy, with symptoms such as shortness of breath and fatigue[9].

Left Heart Failure is described by decreased left ventricular output and increased left atrial and pulmonary venous pressure. Systolic dysfunction occurs when the heart muscle is weakened and cannot contract strongly enough. Diastolic dysfunction, on the other hand, happens when the heart muscle becomes stiff and does not relax properly, making it difficult for the ventricle to fill. Additionally, there may be a combination of both types, complicating diagnosis and treatment. As a result, patients may experience symptoms such as shortness of breath, fatigue, and fluid retention, which can significantly affect their quality of life[11].

Right ventricular failure is defined as reduced right ventricular output and increased right atrial and systemic venous pressure. Common causes include chronic lung disease, pulmonary embolism, and pulmonary valvular stenosis. "Cor pulmonale" specifically describes right heart failure resulting from chronic lung diseases. It is defined by signs and symptoms resulting from right ventricular dysfunction. The primary signs of

RV failure include edema, fatigue, and breathlessness due to elevated systemic venous pressure and reduced cardiac output, leading to sodium and water retention[11].

Biventricular heart failure occurs when both sides of the heart are affected, often due to conditions like dilated cardiomyopathy or coronary heart disease. It can also develop when left heart disease leads to elevated left atrial pressure, resulting in pulmonary hypertension and affecting right heart function[11].

1.1.2 EPIDEMIOLOGY OF HEART FAILURE

Heart failure (HF) is a significant global health issue, affecting approximately 64 million people worldwide, with its prevalence on the rise[12]. The incidence of HF varies between 1 to 9 cases per 1000 person-years, and it is estimated that 1-2% of the adult population suffers from this condition[12]. In 2021, there were 56.5 million prevalent cases globally, with a higher prevalence in males than females[13]. The economic burden of HF is substantial, with costs exceeding $346 billion globally[14]. Hospitalization for HF and related conditions significantly contributes to healthcare expenditures. Key factors contributing to HF include ischemic heart disease, hypertension, and diabetes, with modifiable risk factors accounting for nearly 89% of new cases[12]. Global prevalence Ranges from 0.7% to 1.3% in individuals under 55 years, increasing to 4.7% to 13.3% in those aged 65 and older[12]. Etiological Differences have shown that Ischemic heart disease is prevalent in high-income regions, while hypertensive heart disease dominates in lower-income areas[15]. Younger populations are more affected in lower-income countries than older populations in wealthier regions[16]. HF accounts for 1-2% of all hospital admissions, with a significant proportion of elderly patients[12]. One-year mor-

tality is approximately 10.7%, escalating to 40.3% within five years[12]. Despite advancements in treatment, the burden of HF remains high, particularly in aging populations, highlighting the need for improved management strategies tailored to regional characteristics[12].

In 2019, the age-standardized prevalence rate of HF in Asia was 722.45 per 100,000 persons, amounting to approximately 31.89 million cases. China reported the highest prevalence, followed by Kuwait and Jordan, indicating regional disparities in HF burden[17]. Hypertensive heart disease is the leading cause of HF in Asia, followed by ischemic and rheumatic heart diseases[17].

In East Africa, heart failure prevalence ranges from 0.3% to 7.7%. Common causes include hypertensive heart disease, dilated cardiomyopathy, and rheumatic heart disease, with significant impacts on morbidity and mortality among young and middle-aged adults[18]. Heart failure accounts for approximately 13% of all deaths in Sub-Saharan Africa, with a notable prevalence among younger populations compared to high-income regions[16]. In Niger, a study reported that 41.54% of cardiovascular patients were admitted for heart failure, with a mean age of 56.7 years[19].

Heart failure in Tanzania predominantly affects younger patients, with a mean age of 55 years. The main etiologies include hypertension (45%), cardiomyopathy (28%), and rheumatic heart disease (12%), reflecting a shift towards patterns seen in developed countries[20].

1.1.3 PATHOPHYSIOLOGY OF HEART FAILURE

Heart failure can be defined as the failure of the heart to pump enough blood to meet the body's demands. Starling's law states that ventricular contraction is increased when the ventricle is stretched before contraction. Preload is the blood volume in the heart chamber before contraction while afterload is the resistance the heart must overcome to pump blood out of the chamber after contraction. Preload, afterload, and myocardial contractility which are the components of Starling's Law are affected in this condition and therefore cardiac output is reduced. The most common cause of heart failure is ventricular dysfunction and this may be due to systolic dysfunction or diastolic dysfunction which is common in diseases such as left ventricular hypertrophy. These dysfunctions are commonly seen in conjunction with one another, particularly in patients with coronary artery disease. SNS and the RAAS are activated to increase the cardiac output due to decreased cardiac output. These systems are usually beneficial to the heart but when overactive they exacerbate the heart failure situation by increasing preload and afterload thus sustaining a cycle. RAAS activation leads to vasoconstriction and water and sodium retention with the help of angiotensin II as the main hormone involved. SNS stimulation initially may be beneficial but later leads to detrimental effects including cell death and enlargement. Sodium and water retention are also enhanced by other hormones such as aldosterone, endothelin-1, and even vasopressin. Natriuretic peptides are released to antagonize fluid retention, but this mechanism also becomes ineffective in heart failure. High pressure in the left and right atria results in pulmonary and peripheral edema, which is worsened by renal perfusion problems. In myocardial infarction as the cause of heart failure, contractility of the heart decreases, and this com-

bined SNS and RAAS activation can lead to a worsening of ventricular function and thus worsening of heart failure[11].

1.1.4 CLINICAL FEATURES OF HEART FAILURE

Acute left heart failure typically presents with sudden dyspnea at rest, which can progress to respiratory distress and failure. A precipitating factor, such as an acute myocardial infarction, may be evident in the patient's history. Patients often appear agitated, pale, and clammy, with cool extremities and a rapid pulse; bradycardia may also occur, worsening the situation. Blood pressure is usually elevated due to sympathetic activation, though it may be normal or low in cardiogenic shock. Jugular venous pressure is often elevated, particularly with fluid overload. In acute heart failure, the heart's apex remains normal because there isn't enough time for dilation. A "gallop" rhythm, indicated by a third heart sound, may be noted, and a new systolic murmur can suggest mitral regurgitation or ventricular septal rupture. Chest examination may reveal crepitations in the lungs if pulmonary edema is present, along with possible expiratory wheezing. Patients with acute-on-chronic heart failure may show additional chronic heart failure signs[11].

Patients with chronic heart failure often experience a relapsing and remitting course, marked by stable periods and episodes of decompensation that may require hospitalization. The clinical presentation depends on the underlying heart disease, the specific type of heart failure, and changes in the SNS and RAAS. Low cardiac output can lead to fatigue, reduced exercise tolerance, cool extremities, and hypotension. Blood flow is diverted from skeletal muscles to prioritize perfusion to vital organs, contributing to

weakness. Poor renal perfusion can cause decreased urine output (oliguria) and elevated blood urea nitrogen levels (uremia). In left heart failure, pulmonary edema results in dyspnea and inspiratory crackles, while right heart failure is associated with elevated JVP, hepatic congestion, and peripheral edema. In ambulatory patients, swelling typically affects the lower extremities, whereas in bed-bound patients, it tends to accumulate around the thighs and sacrum. Ascites or pleural effusion may also occur. Chronic heart failure can often lead to significant weight loss, known as cardiac cachexia. This condition is caused by a combination of factors, including loss of appetite (anorexia), impaired nutrient absorption due to gastrointestinal congestion, reduced blood flow to tissues resulting from low cardiac output, and muscle wasting from inactivity[11].

1.1.5 CLASSIFICATION OF HEART FAILURE

Heart failure classification is crucial for diagnosing and managing patients effectively. The New York Heart Association classification is widely used. It divides patients into four classes based on their physical activity limitations and symptoms[21] as shown in the table below.

Table I showing the New York Heart Association Classification of Heart Failure[21]

CLASS I (MILD)	No limitation on physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, or dyspnea (shortness of breath)
Class II (mild)	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, or dyspnea
Class III (moderate)	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, or dyspnea
Class IV (severe)	Unable to carry out any physical activity without discomfort. Symptoms of cardiac insufficiency at rest. If any physical activity is undertaken, discomfort is increased

Despite its widespread use, the NYHA classification has limitations in discriminating between varying degrees of heart failure severity[21].

1.1.6 DIAGNOSIS OF HEART FAILURE

Diagnosing heart failure (HF) requires careful consideration of clinical symptoms, diagnostic tests, and the patient's medical history[22].Timely and accurate diagnosis is crucial for effective management and improved patient outcomes[22].Common symptoms include shortness of breath (99%), fatigue, and leg edema (40%)[22].Patients often present with additional signs such as basal crepitations (95%), orthopnea (70%), and paroxysmal nocturnal dyspnea (49%)[22].The demographic profile typically shows a higher prevalence in males and older adults, particularly those aged 51-70 years[22].Transthoracic echocardiography is considered the "gold standard" for assessing heart structure and function, providing critical information for diagnosis[23]. Natriuretic peptide testing can help identify preclinical cardiac dysfunction and differentiate HF from other conditions[24].

The Framingham criteria is a tool used in diagnosing heart failure, including signs and symptoms assessed by a physician panel[25]. It is highly sensitive (92%) and moderately specific (79%) for diagnosing heart failure, making it particularly useful for ruling out heart failure[26]. Diagnosis of heart failure is made when two major criteria or one major and two minor criteria is met.

Table II shows the Framingham diagnostic criteria for heart failure [26]

MAJOR CRITERIA	**MINOR CRITERIA**
Acute pulmonary edema	Ankle edema
Cardiomegaly	Dyspnea on exertion
Hepatojugular reflux	Hepatomegaly
Neck vein distension	Nocturnal cough
Paroxysmal nocturnal dyspnea	Pleural effusion
Rales	Tachycardia (>120 beats per minute)
Third heart sound (gallop)	

Advanced imaging techniques, including magnetic resonance imaging and computed tomography, are also utilized for comprehensive evaluation [23]. The overlap of symptoms with other conditions, such as chronic obstructive pulmonary disease (COPD), complicates the diagnosis[23].

1.1.7 TREATMENT OF HEART FAILURE

Acute heart failure accompanied by pulmonary edema is a medical emergency that demands prompt intervention. The patient should be placed in a cardiac position and kept at rest, with continuous monitoring of vitals. Intravenous opiates can be helpful for patients in distress, but they must be administered cautiously, as they can potentially cause respiratory depression and exacerbate hypoxemia and hypercapnia. Patients are also given nitrates such as intravenous glycerine trinitrate and are decongested using loop diuretics[11].

The management of chronic heart failure focuses on improving cardiac function by enhancing the heart's contractility and coordinating the myocardium. This involves optimizing preload, reducing afterload, and controlling heart rate and rhythm. These goals can be achieved through various methods, including medications, implantable device therapy, coronary revascularization, and, in severe cases, the use of mechanical assist devices or cardiac transplantation. The foundational therapies include angiotensin-converting enzyme inhibitors (ACE-I), angiotensin receptor-neprilysin inhibitors (ARNI), beta-blockers, and mineralocorticoid receptor antagonists (MRA). Recently, sodium-glucose co-transporter 2 (SGLT2) inhibitors have shown efficacy in both HFrEF and HFpEF, enhancing outcomes. Effective treatment requires a team approach, including patient education, lifestyle modifications, and exercise training. Empowering patients through education on self-monitoring and adherence to treatment plans is crucial for improving outcomes[11].

1.1.8 DEFINITION OF THYROID FUNCTION DERANGEMENT

Thyroid function derangement (dysfunction) involves a range of conditions affecting the thyroid gland function, which plays a crucial role in regulating metabolism and hormonal balance. The prevalence of these diseases, including hyperthyroidism, hypothyroidism, thyroiditis, and thyroid cancer, is on the rise, necessitating a deeper understanding of their pathophysiology and treatment options. Hyperthyroidism, often caused by Graves' disease, is characterized by excessive thyroid hormone production due to autoantibodies. Hypothyroidism commonly results from Hashimoto's thyroiditis, where the immune system attacks thyroid tissue[27].

1.1.9 EPIDEMIOLOGY OF THYROID FUNCTION DERANGEMENT

The global epidemiology of thyroid dysfunction reveals significant variations influenced by factors such as iodine availability, autoimmune diseases, and demographic characteristics[28]. The prevalence of thyroid disorders is notably high, with iodine deficiency being the primary cause in many regions, while autoimmune conditions dominate in iodine-sufficient areas[28]. Iodine deficiency is the most common cause of thyroid disorders globally, leading to conditions like goiter and hypothyroidism[28,29]. In iodine-replete regions, Hashimoto's disease is prevalent, accounting for the majority of hypothyroidism cases[29]. Studies indicate a mean incidence of hypothyroidism in women at 3.5/1000 survivors/year, with lower rates in men[28]. Thyroid disorders are more common in females, with a male-female ratio of 2.2:1 observed in Nigeria[30].

The risk of developing hypothyroidism increases with age, while hyperthyroidism shows no significant age correlation[28].

1.1.10 THYROID FUNCTION DERANGEMENTS IN HEART FAILURE

Thyroid function derangement significantly impacts heart failure, influencing both prognosis and treatment strategies[31]. Thyroid dysfunction, including conditions like subclinical hypothyroidism and thyrotoxicosis, has been linked to adverse cardiovascular outcomes[31]. Subclinical Hypothyroidism (SH) is associated with increased cardiovascular mortality in heart failure patients, particularly those with reduced ejection fraction. A study found that SH independently predicted cardiovascular death, highlighting the need for routine thyroid function tests in heart failure management[32]. Thyroid hormones, particularly triiodothyronine (T3), are crucial for the survival of cardiomyocytes.

Low T3 levels correlate with higher levels of biomarkers indicating heart failure severity, suggesting that thyroid dysfunction exacerbates heart failure progression[33]. Thyrotoxicosis can lead to increased cardiac output and arrhythmias, contributing to heart failure. Approximately 1% of patients with thyrotoxicosis develop thyrotoxic cardiomyopathy, a reversible condition that can improve with appropriate treatment[34,35]. Effective management of thyrotoxicosis includes beta-blockers to control heart rate and antithyroid medications to normalize hormone levels, which can alleviate heart failure symptoms[35].

1.1.11 EPIDEMIOLOGY OF THYROID FUNCTION DERANGEMENT AMONG PATIENTS WITH HEART FAILURE

The epidemiology of thyroid function derangements among patients with heart failure reveals a significant interplay between thyroid dysfunction and cardiovascular health[36]. Thyroid hormones are crucial for cardiac performance, and both overt and subclinical thyroid dysfunctions are linked to increased heart failure risk[36]. Thyroid dysfunction is prevalent among heart failure patients, with studies indicating that it can be a modifiable risk factor for heart failure[36]. In a cohort study conducted by Rahman et al. of 3650 heart failure patients, a significant portion exhibited co-morbid conditions, including thyroid dysfunction[22]. Thyroid hormones influence cardiovascular parameters; for instance, higher free thyroxine (FT4) levels correlate with increased short-term mortality in acute heart failure patients[37]. Thyrotoxic heart failure, though rare (0.8% of cases), shows better survival rates post-treatment compared to non-thyrotoxic heart failure[38]. Thyroid dysfunction may exacerbate heart failure through inflammatory pathways, promoting cell death and worsening outcomes[33].

Studies indicate that globally approximately 22% to 27% of HF patients exhibit thyroid dysfunction, with subclinical hypothyroidism being the most prevalent form[39,40]. Patients with thyroid dysfunction have a higher risk of HF hospitalization and mortality, particularly those with overt hypothyroidism[39,40].

1.1.12 PATHOPHYSIOLOGY OF THYROID FUNCTION DERANGEMENTS IN HEART FAILURE PATIENTS

Thyroid hormone significantly regulates cardiac performance in addition to its metabolic and thermoregulatory functions. Extensive research has established a robust relationship between thyroid hormones and the cardiovascular system, with recent findings confirming notable changes in cardiac structure and function among patients with persistent subclinical thyroid dysfunction. Triiodothyronine (T3) is the biologically active form of thyroid hormone, primarily derived from converting thyroxine (T4) in peripheral tissues. Local T3 levels in the heart are controlled by deiodinases, making the heart particularly sensitive to T3 reductions. This is essential for maintaining cardiac morphology and function.T3 enhances cardiac output by affecting stroke volume and heart rate. In humans, two thyroid receptor genes give rise to four isoforms: TRα1, TRα2, TRβ1, and TRβ2, with TRα1 showing a high affinity for T3 and playing a key role in physiological regulation. T3 also regulates the transcription of crucial cardiac proteins, including SERCA2, αMHC, β1-adrenergic receptors, and others. Its non-genomic actions influence ion transport, mitochondrial function, and intracellular signaling pathways. Moreover, thyroid hormones promote angiogenesis in the adult heart, supporting arte-

riolar growth in healthy conditions and following myocardial infarction through pathways involving the integrin receptor (αvβ3) and key growth factors[41].

1.1.13 CLINICAL FEATURES OF THYROID FUNCTION DERANGEMENT IN HEART FAILURE

Clinical presentation of thyroid function derangement in heart failure depends on the type of thyroid dysfunction existing in a particular patient. Patients with hyperthyroidism may present with palpitations, tremors, weight loss despite normal appetite, dyspnea, fatigue, irritability and emotional lability, heat intolerance, lid retraction, and lid lag. In hypothyroidism, patients can present with weight gain, cold intolerance, fatigue, drowsiness, dry hair, dry skin, menorrhagia (in females), infertility, constipation, and hoarseness of voice[11].

1.1.14 DIAGNOSIS OF THYROID FUNCTION DERANGEMENT IN HEART FAILURE

Diagnosing thyroid function derangement in heart failure involves checking thyroid function tests, specifically TSH, free T3, and free T4 levels. Early identification is crucial, as hyperthyroidism can lead to reversible cardiomyopathy, necessitating treatment to restore normal thyroid function and improve cardiac health[41].

Table III showing normal range of T3, T4, and TSH levels[3]

Hormone	Normal Range	Unit
Free T3	3.5-7.8	pmol/L (picomoles per liter)
Free T4	9-25	pmol/L (picomoles per liter)
TSH	0.4-4.0	mU/L (milliunits per liter)

Table IV showing how to interpret thyroid function tests[11]

TSH	T4	T3	INTERPRETATION
Undetectable	Raised	Raised	Primary Hyperthyroidism
Undetectable or Low	Normal	Normal	Subclinical Hyperthyroidism
Elevated	Raised	Raised	Secondary Thyrotoxicosis
Normal	Low	Low	Secondary Hypothyroidism
High	Low	Low	Primary Hypothyroidism
Elevated	Normal	Normal	Subclinical Hypothyroidism

1.1.15 TREATMENT OF THYROID FUNCTION DERANGEMENT IN HEART FAILURE

The treatment of hypothyroidism in heart failure involves levothyroxine administration, which shows a dose-dependent positive effect on left ventricular ejection fraction and may reduce re-hospitalization rates. Thyroid hormone treatment, particularly T3, may improve cardiac function in heart failure patients by correcting low cardiac tissue thyroid hormone levels. Current evidence suggests this approach could enhance coronary blood flow and reverse maladaptive cardiac remodeling. In hyperthyroidism, the treatment of thyroid disease in heart failure primarily aims to normalize thyroid hormone levels using anti-thyroid drugs like Propylthiouracil (PTU) and Methimazole (MMI), alongside beta-blockers to manage cardiovascular symptoms and reduce the peripheral effects of elevated thyroid hormones[34].

1.2 PROBLEM STATEMENT

Thyroid hormones regulate myocardial contractility, influence heart rate, reduce systemic vascular resistance, and promote vasodilation. The normal range of thyroid hormone is 3.5-7.8pmol/l for free T3, 9-25pmol/L for free T4, and 0.4-4.0mU/L for TSH. Thyroid dysfunction encompasses a range of clinical conditions that affect the functioning of the thyroid gland. Thyroid dysfunction presents significant challenges in managing heart failure (HF) patients, as it can worsen cardiovascular function and complicate treatment. Amiodarone, for example, a drug used in treating arrhythmias in patients with heart failure, should not be given to hypothyroid patients, as it will worsen their hypothyroid state.

The global prevalence of thyroid function abnormalities ranges from 20% to 35%, in Africa from 29% to 36%, and in Kenya, around 36%[42–44]. Risks associated with thyroid dysfunction in Sub-Saharan Africa include the type of heart failure (HFrEF is more susceptible to hypothyroidism), previous hospitalizations, certain medications like amiodarone, and underlying autoimmune thyroid disease. Elevated TSH levels have been associated with increased mortality and hospitalization rates among HF patients[45]. There is no data on the prevalence of thyroid dysfunction in Tanzania.

There is a gap in knowledge on the magnitude and distribution of thyroid dysfunction among heart failure patients attending medical clinics in Dar es Salaam. It is not known which type of thyroid dysfunction prevails in this population and how it influences the severity of heart failure.

This study aims to address those gaps by determining the prevalence of thyroid dysfunction (hypothyroidism and hyperthyroidism), identifying associated risk factors based on socio-demographic and clinical characteristics, and the impact thyroid function derangement has on the severity of heart failure. The study findings will help improve the treatment of heart failure, reduce medication expenses and hospital stay, improve clinicians' approach in managing heart failure with thyroid function derangement, and improve morbidity and mortality.

1.3 STUDY RATIONALE

Thyroid function derangement in heart failure (HF) patients is a critical area of study due to its significant impact on prognosis and treatment outcomes[32]. Research indicates that thyroid hormones play a vital role in cardiovascular health, influencing clinical outcomes in HF patients[32]. Thyroid dysfunction, particularly subclinical hypothyroidism (SH), is associated with increased cardiovascular mortality in HF patients. SH independently could lead to more cardiovascular death, as has been shown by a study by De Luca in patients with reduced ejection fraction[32]. Thyroid hormones significantly affect N-terminal pro-B-type natriuretic peptide (NT-proBNP) levels, a key biomarker in HF. Elevated NT-proBNP levels correlate with thyroid dysfunction, indicating worse cardiac function[46]. Thyroid dysfunction in patients with heart failure makes treatment difficult, leading to refractoriness of HF[32]. Patients do not improve despite optimum treatment, leading to increased drug load and expenses. Findings from this study emphasize the significance of early detection of thyroid function derangement among asymptomatic adult patients diagnosed with heart failure. This will enable these patients to be managed early, hence improving treatment outcomes, reducing hospital stays, and reducing mortality.

1.4 RESEARCH QUESTIONS

1) What is the status of thyroid function (T3, T4, TSH) in heart failure patients attending medical clinics in Dar es Salaam?

2) How is thyroid function derangement (hypothyroidism/hyperthyroidism) distributed among heart failure patients attending medical clinics in Dar es Salaam by age and gender?

3) How do the risk factors (age, gender, education level, and obesity) correlate with levels of thyroid hormones (hypothyroidism/hyperthyroidism) among heart failure patients attending medical clinics in Dar es Salaam?

4) What is the status of thyroid dysfunction based on the severity of heart failure among heart failure patients attending medical clinics in Dar es Salaam?

1.5 OBJECTIVES

1.5.1 BROAD OBJECTIVE

To determine the pattern of thyroid function derangement among heart failure patients attending medical clinics in Dar es Salaam.

1.5.2 SPECIFIC OBJECTIVES

1. To determine the prevalence of thyroid function derangement (hyperthyroidism, hypothyroidism) among heart failure patients attending medical clinics in Dar es Salaam
2. To determine socio-demographic (age, gender) factors by thyroid function derangements (hypothyroidism, hyperthyroidism) among heart failure patients attending medical clinics in Dar es Salaam
3. To determine the socio-economic risk factors (education level, marital status, employment status) by thyroid function derangements (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam.
4. To determine the prevalence of thyroid dysfunction based on the severity of heart failure among heart failure patients attending medical clinics in Dar es Salaam.

CHAPTER TWO

2.0 LITERATURE REVIEW

Numerous studies have indicated a high prevalence of thyroid disorders among the heart failure population, which includes both subclinical and overt forms of thyroid dysfunction[47,48]. The global prevalence of thyroid dysfunction in heart failure patients appears to be significant, though exact figures vary across studies. The global prevalence of thyroid function abnormalities ranges from 20% to 35%, in Africa from 29% to 36%, and in Kenya, around 36%[42–44].

Importantly, thyroid dysfunction in heart failure patients is associated with poor prognosis. Subclinical hypothyroidism with TSH ≥7 mIU/L and isolated low T3 levels was found to be associated with an increased risk of adverse cardiovascular outcomes in heart failure patients[49]. In the Penn Heart failure study it was found that the average age was 57 years, 35% were female, and 71% were white. The majority exhibited heart failure symptoms of NYHA class II (45%) or III (32%), with systolic heart failure accounting for 85% and heart failure of non-ischemic origin for 71%. Comorbid conditions were chronic kidney disease (16%), hyperlipidemia (49%), diabetes mellitus (29%), and hypertension (62%). 74% were euthyroid overall, 5% had subclinical hypothyroidism, 5% had subclinical hyperthyroidism, 1% had overt hyperthyroidism, and less than 1% had overt hypothyroidism. Low T3 syndrome was present in 14%[49].

In a cross-sectional study conducted in Pakistan that aimed at determining the frequency of subclinical hypo and hyperthyroidism in patients presenting with congestive cardiac failure, it was found that subclinical hypothyroidism occurred in 20.88% and hyperthyroidism in 8.79% of congestive heart failure patients, highlighting the commonality of thyroid dysfunction in this population, with hypothyroidism being twice as prevalent as hyperthyroidism[50]. There were 91 cases of congestive heart failure in this study where 30 (32.97%) females and 61 (67.03%) males. Eleven (22.95%) males and eight (26.67%) females had hypothyroidism (p=0.41). Age, BMI, and length of HF did not differ significantly (p=0.14, 0.25, and 0.39, respectively). It was found in 3 (15%) DM cases and 16 (22.53%) non-diabetics (p=0.55)[50].

A cohort study conducted in Israel on the impact of thyroid-stimulating hormone (TSH) levels on clinical outcomes in heart failure patients found that increased TSH levels predict worse outcomes. Both high and low TSH levels correlate with increased mortality rates[45]. The study involved an analysis of 274 patients diagnosed with acute decompensated heart failure. It found that 21% of these patients presented with subclinical hypothyroidism, while 35% demonstrated signs of low-T3 syndrome[45]. Notably, subclinical hypothyroidism was identified as an independent predictor of adverse cardiovascular outcomes, thereby highlighting the critical role of thyroid function in the management and prognosis of heart failure[45]. 434 days was the median follow-up duration. During this time, the overall mortality rate was 13.2% (739/5599). Increased mortality was linked to both high and low TSH levels. Additionally, a higher event rate of death and hospitalizations related to heart attacks were linked to elevated TSH[45].

A retrospective cohort study conducted in Mogadishu, Somalia, from January 2019 to January 2021 revealed that 35.6% of heart failure patients exhibited some form of thyroid dysfunction, with subclinical hypothyroidism being the most common type. This finding emphasizes the importance of evaluating thyroid function in heart failure management[44].

A cross-sectional study conducted by Mfeukeu-Kuate et al. from Cameroon aimed to ascertain the burden type and associated factors of thyroid dysfunction in patients with heart failure. The study found that out of the 63 patients included in the study, 38 (60.3%) had thyroid dysfunction, with hypothyroidism being the most common type. This study also found that those patients with HFrEF were more likely to have hypothyroidism than those with preserved ejection fraction[51].

Muyodi BO et al. conducted a descriptive cross-sectional study in Kenya to determine the prevalence of thyroid dysfunction and its correlation with the severity of heart failure in ambulatory heart failure patients. The prevalence of thyroid dysfunction in heart failure patients was 36.8%, which was found more in women than men. The most prevalent subtypes were subclinical hypothyroidism (18.8%), euthyroid sick syndrome (9%), and primary hypothyroidism (6%). No significant association between thyroid dysfunction and the severity of heart failure was found[43].

Age is a significant risk factor, with older adults being more susceptible to thyroid dysfunction and its impact on heart failure. Studies have shown that subclinical thyroid dysfunction is common in older people and can influence the risk of heart failure[52]. The Cardiovascular Health Study, which focused on adults aged 65 and older, found that

subclinical hypothyroidism with TSH ≥10.0 mU/l was associated with a greater incidence of heart failure events[52]. An observational study conducted in India by Sasthanan et al. indicates that most patients with heart failure and subclinical hypothyroidism were aged 51-60 years, suggesting age is a significant demographic risk factor[53]. Gender also plays a role, with some studies indicating differences between men and women. In a study of thyroid cancer survivors, being male was associated with an increased risk of cardiovascular disease compared to females[54].

Body mass index (BMI) is another demographic factor linked to thyroid dysfunction and heart failure risk. Socioeconomic factors play a crucial role in the development and progression of thyroid dysfunction in HF patients.

A large UK-based study revealed significant disparities in HF risk factors based on socioeconomic status[55]. The most deprived populations showed higher annual increases in comorbidities, body mass index, and lower smoking reductions compared to the most well-off groups. This socioeconomic gap resulted in a 5-year difference in age at HF onset between the most deprived and most affluent populations. Additionally, ethnicity played a role, with South Asian and Black populations developing HF at younger ages and having different risk factor profiles compared to the white population[55]. Lower socioeconomic status is often associated with limited access to healthcare, leading to undiagnosed or untreated thyroid conditions, which can exacerbate heart failure risks[36]. Conditions such as obesity, hypertension, and dyslipidemia, prevalent in certain demographic groups, are linked to subclinical hypothyroidism, increasing HF risk[53]. Over-

weight or obese patients had an increased risk of cardiovascular disease compared to those with normal BMI[54].

In a study conducted in New York by Ascheim et al, of 132 ambulatory heart failure patients with left ventricular systolic dysfunction, 7% were found to have primary hypothyroidism, while 34% had a low T3 state, and the prevalence of abnormal thyroid function correlated with the severity of heart failure as measured by NYHA class[56]. Another large prospective study of 1365 heart failure patients found that more severe heart failure was associated with higher thyroid-stimulating hormone (TSH), higher free thyroxine (FT4), and lower total triiodothyronine (TT3) concentrations[49].

CHAPTER THREE

3.0 METHODOLOGY

3.1. Study design

A cross-sectional descriptive study among heart failure patients attending medical clinics in Dar es Salaam from 8th April – 9th June 2025.

3.2. Study Setting

The study was conducted in Dar es Salaam at medical clinics from selected hospitals.

Dar es Salaam is located at 6°48'South, 39°17' East on the eastern coast of East Africa[57]. It comprises five municipalities: Kinondoni, Ilala, Temeke, Ubungo, and Kigamboni. According to the 2022 census, the current population of Dar es Salaam is 5,383,728[58]. Dar es Salaam is essential for business, government, education, and trade.

3.3. Population

3.3.1 General population

All adult heart failure patients in Dar es Salaam

3.3.2. Target population

All adult heart failure patients attending medical clinics in Dar es Salaam.

3.3.3 Study population

Randomly recruited adult heart failure patients (based on Framingham criteria and previous echocardiography) attending Dar es Salaam's medical clinics who agreed to participate in the study.

3.4. Sample size estimation

From the Kish Leslie formula used in another cross-sectional study[62] $n = Z^2 p (1-p) / D^2$

Where

Z = 1.96, corresponding to 95% CI

D= margin of error (precision): for this study, taken as 0.05

p = expected proportion with characteristic of interest. For this study p value = 36.8% was obtained from a previous study.

$n = (1.96)^2 \times 0.368 \times (1 - 0.368) / (0.05)^2 = 357$

The estimated minimum sample size was **357**

Justification of formula

A similar study was done by Muyodi et.al in 2019-2020 in Kenya[43]; Thyroid hormone profile in ambulatory heart failure patients attending adult outpatient clinic at Kenyatta National Hospital, using the same formula. The study aimed to determine the prevalence of thyroid dysfunction and its correlation with the severity of heart failure in ambulatory heart failure patients attending adult outpatient clinics. Thus, using the same sample size formula ensured the validity of the results and minimized bias.

3.5 Sampling procedure:

This study employed a multistage cluster sampling technique to categorize Dar es Salaam medical clinics. Medical clinics were placed in multistage clusters according to their stage levels of clinics in national hospitals, zonal referral hospitals, regional referral hospitals, district hospitals, health centers, polyclinics, and dispensaries. One cluster, the National Hospital medical clinics, was randomly selected. The National Hospital medical clinics cluster included Muhimbili National Hospital, Mloganzila, and Jakaya

Kikwete Cardiac Institute. One medical clinic was picked from the selected cluster by simple random sampling, which was used for the study. Finally, 359 study participants were recruited using a consecutive sampling technique.

3.5.1 Inclusion criteria:

1) All adult heart failure patients (based on Framingham criteria and echocardiographic findings) attending medical clinics in Dar es Salaam who consent to participate in the study.

3.5.2 Exclusion Criteria

1) Patients who could communicate (Language barrier or mute heart failure patients)
2) Patients with documented treatment for thyroid dysfunction (hyperthyroidism-carbimazole, hypothyroidism- thyroxine)
3) Patients on thyroid-lowering drugs (Amiodarone, NSAIDS)

3.6 Data Collection

Data collection was comprised of socio-demographics (age, gender, marital status, education level, employment status) and clinical and laboratory variables.

The principal investigator and a trained research assistant collected data from study participants at the selected hospital.

Sociodemographic and clinical variables

As in a previous study, conducted by Mfeukeu-Kuate et al, which aimed to determine the Burden, Type, and Associated Factors of Thyroid Dysfunction in Patients with Heart

Failure in Mogadishu, the principal investigator and research assistant adopted the structured questionnaire for the collection of social demographic and Clinical variables[51].

Sociodemographic data included gender, age, marital status, level of education, and employment status.

For clinical data, heart failure data, history, and paraclinical data were requested.

Whereby in Heart failure data, patients information regarding the duration of heart failure diagnosis, etiology of heart failure (Hypertension, congenital heart disease, valve disease, ischemic heart disease, cardiomyopathy, and others), current clinical stage based on NYHA(where Class I have no limitations of physical activity, Class II- Mild Symptoms with normal physical activity, Class III- Marked limitation of physical activity, Class IV- Unable to carry out physical activity without symptoms of heart failure[22]), type of heart failure based on echocardiography, the number of hospitalizations for heart failure during the last twelve months, and the current medication the patient is on were sought from the patient's file. The patient was asked about a previous history of hyperthyroidism, hypothyroidism, diabetes, hypertension, chronic kidney disease, dyslipidemia, known or treated cancer, chronic hepatopathy, HIV, chronic alcoholism, smoking, and any other illnesses.

In paraclinical data, previous echocardiography results were sought to aim at the left ventricular systolic ejection fraction (%), and biological analysis on the TSH, T3, and T4 levels was done.

3.7 Data Collection Procedure

Weight and Height

A research assistant (a trained nurse) measured each participant's body weight using a Seca weighing scale GmbH & Co. KG, Germany) to the nearest 0.5 kg. Body weight was measured without shoes. Participants stood with feet close together, arms at their sides, and reading was taken. Height was measured using a height-measuring rod. Participants were asked to stand on the floor without shoes, parallel to the height measuring rod, and were asked to look directly forward while standing. Height was measured and recorded to the nearest 0.5cm.

Body Mass Index

Body Mass Index was calculated using a person's height and weight, using the formula: BMI = weight in kg/Height in m^2.

The BMI parameters used, per the 2022 WHO guideline, were as shown in the table.

Table V showing Body Mass Index parameters[59].

WEIGHT STATUS	**BODY MASS INDEX (BMI) Kg/ m^2**
Underweight	<18.5
Normal weight	18.5-24.9
Overweight	25.0-29.9
obese	≥30

Blood Pressure Measurements

One nurse was designated to oversee the measurement of blood pressure (BP) in participants. Each participant's BP was assessed using a Spengler aneroid sphygmomanometer (Spengler, France) at least twice, with a minimum interval of five minutes of rest between measurements. Participants were seated in a chair, in a relaxed position, with their backs supported and arms positioned at heart level to ensure accuracy in the readings.

Table VI showing Categories of BP Among Adults According to the 2017 ACC/AHA[60]

BP Category	**SBP, mm Hg**		**DBP, mm Hg**
Normal	<120	and	<80
Elevated	120–129	and	<80
Hypertension			
Stage 1	*130–139*	or	*80–89*
Stage 2	*≥140*	or	*≥90*

Laboratory variables

A venous blood sample was taken from study participants, and at least 2.5 mL of blood was drawn in a 5 mL syringe. Samples were transported refrigerated (2^0C to 8^0C) to a single center laboratory for measurement of TSH within 8 hours. The sample was analyzed as soon as it reached the Laboratory. Serum TSH, T3, and T4 were measured and reported by the laboratory technician, using Maglumi 2000 Chemiluminescence Immunoassay Analyzer(manufacturer: SNIBE, China; Shenzhen). A partici-

pant with a low TSH (0.4mu/L<) and high free T3 (>25pmol/L) and T4 (>7.8pmol/L) was defined as hyperthyroid.[3] A participant with a high TSH (>4mU/L) and a low free T3(3.5pmol/L<) and free T4 (9pmol/L<) was defined as hypothyroid.[3]

3.8 Data Analysis

Data was collected, entered, cleaned for errors, and analyzed by using STATA Version 17. Continuous variables were described using mean, median, and standard deviation. A comparison between continuous variables was made using a t-test. Categorical variables were expressed as numbers and percentages, and a comparison between categorical variables was made using the Chi-squared test. Results were expressed as odds ratio (OR) and adjusted odds ratio (aOR) with a corresponding 95% confidence interval (CI). A p-value less than 0.05 was considered statistically significant. A multivariate logistic regression analysis included variables that achieved a significant level of 0.2.

3.9 Dissemination of results

The research results and findings will be disseminated to the HKMU Library, the Ministry of Health, and the Cardiac Society of Tanzania through research reports and scientific conferences. A manuscript will be prepared and then submitted to one of the journals for publication.

CHAPTER FOUR

4.0 ETHICAL CONSIDERATION

Ethical approval for this study was obtained from the KU Institutional Research and Ethics Committee. Additionally, the Head of Research, Training, and Consultancy at Jakaya Kikwete Cardiac Institute was sought, and permission was granted to conduct the study.

Before data collection, this study's purpose, objectives, and procedures were well explained to the study participants. Voluntary informed consent forms were given to all participants to read and were signed. For participants unable to read and write, the consent forms were read to them, and a thumbprint was used as a signature alternative. The study did not cause any serious harm to the study participants. Participants were informed of slight pain during sample withdrawal, which resolved immediately after the procedure. Physical risks related to blood drawing were reduced through aseptic techniques, while psychological discomfort from participants was mitigated by creating a supportive, confidential environment. Confidentiality was maintained. Initials were used to preserve privacy. Collected data was stored confidentially in a manner that prevents unauthorized access. Data was only accessed by authorized personnel involved in this study. No participant was forced to be part of the study, and participants who wanted to discontinue were allowed to withdraw. The principal investigator took time to address and answer any questions raised by the research participants, ensuring that their inquiries were fully understood and thoughtfully responded to. Heart failure patients with thyroid function derangement were informed and referred for further management.

CHAPTER FIVE

5.0 RESULTS

5.1 The social demographics and clinical information of the study participants

A total of 378 (226 females and 152 males) HF patients, were recruited. A total of 359 participated in the study (Table 1) and 19 were excluded 07 did not consent and 12 were on thyroid altering medications. Most were female (60.2%) compared to males (39.8%). Older individuals comprised most of the patient age distribution. The 65–74 (29.8%) and 55–64 (27.0%) age groups had the highest proportions, in contrast to younger patients (18–34 years), who comprised only 4.2%. Most of the study participants had completed university(56.5%), were married (84.7%), and were employed (42.6%).

Most of the study participants were obese (49%) had Stage 2 and elevated systolic hypertension (32% and 31%), had left sided heart failure (92.5%), had preserved ejection fraction (87.2%), and had no history of hospitalization due to heart failure in the past twelve months and these findings were statistically significant with p-value of <0.001. The commonest etiology of heart failure was hypertension; however, it was not statistically significant.

Table 1: Social-demographic characteristics of heart failure patients in Dar es Salaam. (N=359)

Variables	Categories	n (%)
Sex	Female	216(60.2)
	Male	143(39.8)
Age group	18–34	15(4.2)
	35–44	32(8.9)
	45–54	47(13.1)
	55–64	97(27.0)
	65–74	107(29.8)
	75+	61(17.0)
Level of Education	Primary Education	66(18.4)
	Secondary School Completed	89(24.8)
	Diploma	1(0.3)
	University Completed	203(56.5)
Marital Status	Married	304(84.7)
	Unmarried	55(15.3)
Work Status	Employed	153(42.6)
	Non paid	144(40.1)
	Retired	61(17.0)
	Student	1(0.3)

Table 2: Clinical characteristics of heart failure patients attending medical clinics in Dar es Salaam N=359

Variables	Categories	n (%)	p-value
BMI Categories	Underweight	1(0.3)	<0.001
	Normal	51(14.2)	
	Overweight	131(36.5)	
	Obese	176(49.0)	
Systolic categories	Normal	57(15.9)	<0.001
	Elevated	112(31.2)	
	Hypertension Stage 1	77(21.5)	
	Hypertension Stage 2	113(31.5)	
Diastolic categories	Normal	237(66.0)	<0.001
	Hypertension Stage 1	75(20.9)	
	Hypertension Stage 2	47(13.1)	
Type of Heart Failure	Global	23(6.4)	<0.001
	Left-sided heart failure	332(92.5)	
	Right-sided heart failure	4(1.1)	
Etiology of Heart Failure	Cardiomyopathy	40(11.4)	<0.056
	Hypertension	289(80.5)	
	Ischemic heart Disease	22(6.13)	
	Valvular Heart Disease	8(2.23)	
Severity of Heart Failure (NYHA)	I	50(13.9)	<0.001
	II	192(53.5)	
	III	111(30.9)	
	IV	6(1.7)	
Severity of Heart Failure (Ejection Fraction)	Mildly reduced	18(5.0)	<0.001
	Preserved	313(87.2)	
	Reduced	28(7.8)	
Hospitalization history due to Heart failure	No hospitalization history	315(87.7)	<0.001
	History of hospitalization once or more	44(12.3)	

5.2 The prevalence of thyroid function derangement (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam

A substantial burden of thyroid dysfunction (20.1%) was found in this study (359 patients) in Dar es Salaam, with hypothyroidism (approximately 14%) being more common than hyperthyroidism (approx. 6%). The most prevalent thyroid disorder, according to a thorough analysis of thyroid status, was subclinical hypothyroidism (11.7%), which was followed by primary hyperthyroidism (2.2%) and secondary hyperthyroidism (3.3%). Secondary hypothyroidism (0.6%) was uncommon, whereas primary hypothyroidism (1.4%) and subclinical hyperthyroidism (0.8%) were less common.

Table 3: The prevalence of thyroid function derangement (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam

Variables	Categories	n (%)	P-value
Thyroid Function Derangement	Normal	287(79.9)	<0.001
	Hypothyroidism	49(13.7)	
	Hyperthyroidism	23(6.4)	
Thyroid function derangement subtypes	Primary Hypothyroidism	5 (1.4)	<0.001
	Primary Hyperthyroidism	8 (2.2)	
	Subclinical Hypothyroidism	42 (11.7)	
	Subclinical Hyperthyroidism	3 (0.8)	
	Secondary Hypothyroidism	2 (0.6)	
	Secondary Hyperthyroidism	12 (3.3)	

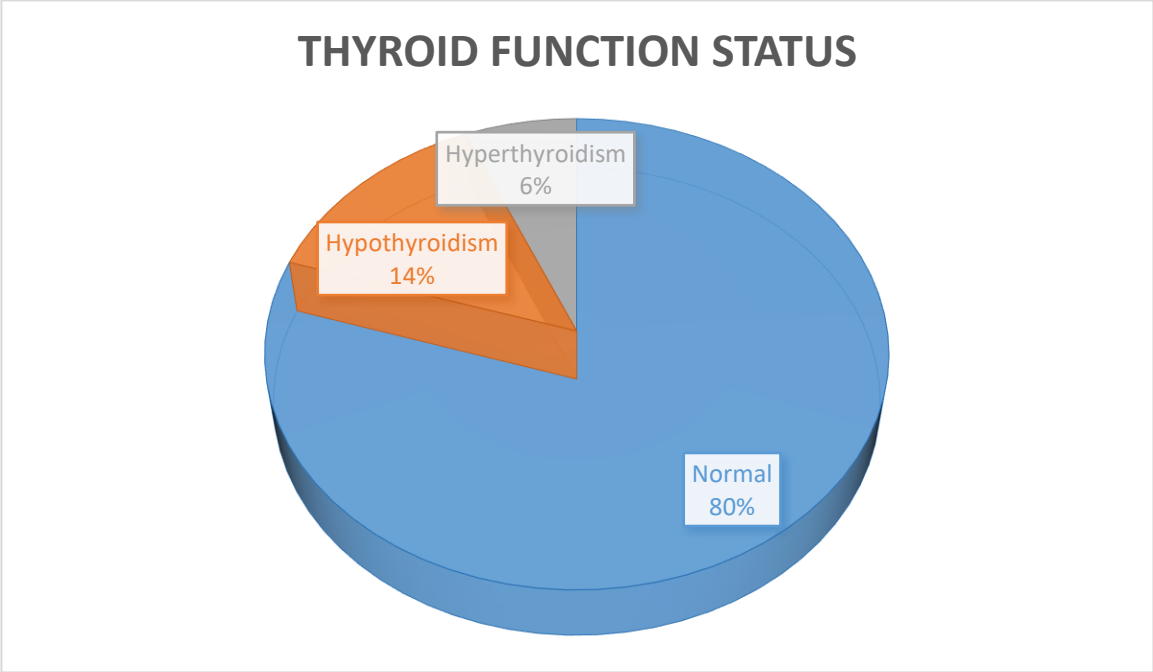

Figure 1: Prevalence of thyroid function derangement (TSH, T3, T4) among adult heart failure patients attending medical clinics in Dar es Salaam

5.3 Distribution of socio-demographic (age, gender) characteristics by thyroid function derangements (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam

A trend toward a higher prevalence of thyroid function derangement was observed among female participants compared to males, though this difference did not reach statistical significance (p=0.118). Similarly, patients with heart failure aged 65–74 years exhibited a greater likelihood of thyroid dysfunction relative to other age groups; however, this association was also not statistically significant (p=0.168).

Table 4: Distribution of socio-demographic (age, gender) characteristics by thyroid function derangements (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam (N = 359)

Variables	n(%)	Euthyroid (287)	Hypothyroid (49)	Hyperthyroid (23)	p-value
Gender					
Female	216 (60.2)	166 (57.8)	36 (73.5)	14 (60.9)	0.118
Male	143 (39.8)	121 (42.2)	13 (26.5)	9 (39.1)	
Age group					
18–34	15 (4.2)	13 (4.5)	0 (0.0)	2 (8.7)	0.168
35–44	32 (8.9)	28 (9.8)	2 (4.1)	2 (8.7)	
45–54	47 (13.1)	41 (14.3)	4 (8.2)	2 (8.7)	
55–64	97 (27.0)	81 (28.2)	13 (26.5)	3 (13.0)	
65–74	107 (29.8)	78 (27.2)	18 (36.7)	11 (47.8)	
75+	61 (17.0)	46 (16.0)	12 (24.5)	3 (13.0)	

5.4 The distribution of socio-economic and clinical factors by thyroid function derangements (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam. (N=359)

No statistically significant associations were observed between thyroid function derangement and education level (p=0.084), marital status (p=0.051), or work status (p=0.174). While minor variations in distribution were noted, none reached conventional thresholds of statistical significance.

Table 5: Distribution of socio-economic risk factors by thyroid function derangements (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam (N = 359)

Variables	**Thyroid function derangement**				
	Total	Euthyroid	Hypothyroid	Hyperthyroid	p-value
Level of Education					
Primary Education	66 (18.4)	52 (18.1)	9 (18.4)	5 (21.7)	0.084
Secondary School	89 (24.8)	66(23.0)	11 (22.5)	12 (52.2)	
Diploma	1 (0.3)	1 (0.4)	0 (0.0)	0 (0.0)	
University Completed	203 (56.6)	168 (58.5)	29 (59.2)	6 (26.1)	
Marital Status					
Married	304 (84.7)	247 (86.1)	36 (73.5)	21 (91.3)	0.051
Unmarried	55 (15.3)	40 (13.9)	13 (26.5)	2 (8.7)	
Work Status					
Employed	153 (42.6)	132 (46.0)	13 (26.5)	8 (34.8)	0.174
Non paid	144 (40.1)	106 (36.9)	28 (57.1)	10 (43.5)	
Retired	61 (17.0)	48 (16.7)	8 (16.3)	5 (21.7)	
Student	1 (0.3)	1 (0.4)	0 (0.0)	0 (0.0)	

Hypothyroid patients had a higher prevalence of obesity (57.1%), indicating a possible metabolic interaction, whereas blood pressure and BMI categories had no significant relationship with thyroid status. Significantly, a higher percentage of global heart failure (26.1% vs. 4.5% in euthyroid, *p*=0.002) and a higher probability of NYHA class III/IV symptoms (43.5% and 8.7%, respectively, *p*=0.079) were associated with hyperthyroidism. The detrimental impact of thyroid dysfunction on the progression of the disease was further demonstrated by the significant increases in heart failure hospitalization rates that were related to both hypo- and hyperthyroidism (22.5% and 26.1%, respectively, *p*=0.004).

Table 6: Distribution of clinical factors by thyroid function derangements (hypothyroidism, hyperthyroidism) among heart failure patients attending medical clinics in Dar es Salaam (N = 359)

Variables	**Thyroid function derangement**				
	Total	Euthyroid	Hypothyroid	Hyperthyroid	p-value
BMI Categories					
Underweight	1 (0.3)	0 (0.0)	1 (2.0)	0 (0.0)	0.158
Normal	51 (14.2)	40 (13.9)	6 (12.2)	5 (21.7)	
Overweight	131 (36.5)	109 (38.0)	14 (28.6)	8 (34.8)	
Obese	176 (49.0)	138 (48.1)	28 (57.1)	10 (43.5)	
Systolic BP category					
Normal	57 (15.9)	41 (14.3)	12 (24.5)	4 (17.4)	0.458
Elevated	112 (31.2)	89 (31.0)	17 (34.7)	6 (26.1)	
Htn stage 1	77 (21.5)	61 (21.3)	10 (20.4)	6 (26.1)	
Htn stage 2	113 (31.5)	96 (33.5)	10 (20.4)	7 (30.4)	
Diastolic BP category					
Normal	237 (66.0)	185 (64.5)	35 (71.4)	17 (73.9)	0.668
Htn stage 1	75 (20.9)	64 (22.3)	7 (14.3)	4 (17.4)	
Htn stage 2	47 (13.1)	38 (13.2)	7 (14.3)	2 (8.7)	
NYHA					
I	50 (13.9)	43 (15.0)	5 (10.2)	2 (8.7)	0.079
II	192 (53.5)	155 (54.0)	28 (57.1)	9 (39.1)	
III	111 (30.9)	85 (29.6)	16 (32.7)	10 (43.5)	
IV	6 (1.7)	4 (1.4)	0 (0.0)	2 (8.7)	
Type of Heart Failure					
Global	23 (6.4)	13 (4.5)	4 (8.2)	6 (26.1)	0.002
Left sided heart failure	332 (92.5)	271 (94.4)	44 (89.8)	17 (73.9)	
Right-sided heart failure	4 (1.1)	3 (1.1)	1 (2.0)	0 (0.0)	
Hospitalization HISTORY due to heart failure					
No	315(87.7)	260(90.6)	38(77.6)	17(73.9)	0.004
Yes	44(12.3)	27(9.4)	11(22.5)	6(26.1)	

Patients with more severe high blood pressure (stage 2 hypertension) appear less likely to develop hypothyroidism. On the other hand, hyperthyroidism is much less common in patients with typical left-sided heart failure compared to global heart failure cases. Patients who've been hospitalized for heart failure are over three times more likely to have hypothyroidism, suggesting that thyroid problems might go hand-in-hand with worse heart failure outcomes. Blood pressure and certain types of heart failure didn't show clear relationships with thyroid function derangement.

TABLE 7: Logistic regression of clinical risk factors diagnosed with thyroid function derangements (hypothyroidism, hyperthyroidism) among adult heart failure patients attending medical clinics in Dar es Salaam (n = 359)

Factor variables	**RRR**	***p-value***	**aRRR**	***p-value***
Hypothyroid				
Systolic bp categories				
Normal	Ref		Ref	
Elevated	0.65(0.29-1.49)	0.311	0.57(0.24-1.32)	0.189
Htn stage 1	0.56(0.22-1.42)	0.221	0.51(0.2-1.31)	0.161
Htn stage 2	0.36(0.14-0.89)	0.027	0.31(0.12-0.8)	0.016
Hyperthyroid				
Systolic bp categories				
Normal	Ref		Ref	
Elevated	0.69(0.18-2.58)	0.583	0.66(0.17-2.47)	0.532
Htn stage 1	1.01(0.27-	0.99	1.03(0.27-	0.963

	3.8)		3.92)	
Htn stage 2	0.75(0.21-2.69)	0.656	0.77(0.21-2.79)	0.688
Hypothyroid				
Diastolic bp categories				
Normal	Ref			
Htn stage 1	0.58(0.24-1.37)	0.212		
Htn stage 2	0.97(0.4-2.36)	0.953		
Hypothyroid				
Type of Heart Failure				
Global	ref		ref	
Left-sided Heart failure	0.53(0.16-1.69)	0.282	0.78(0.23-2.62)	0.685
Right-sided heart failure	1.08(0.09-13.53)	0.951	1.16(0.09-15.42)	0.913
Hyperthyroid				
Type of Heart Failure				
Global	ref			
Left-sided Heart failure	0.14(0.05-0.40)	<0.001	0.16(0.05-0.553)	0.002
Right-sided heart failure	3.75e-06(0)	0.977	1.03e-6(0)	
Hospitalization HISTO-RY due to heart failure				
No	Ref		2.51(0.82-7.64)	0.106
Yes	3.40(1.24-9.35)	0.018		

5.5 The prevalence of thyroid dysfunction based on the severity of heart failure among heart failure patients attending medical clinics in Dar es Salaam

A history of hospitalization due to heart failure was strongly linked to EF impairment ($p<0.001$). Those with a hospitalization history due to heart failure had an ejection fraction that was either mildly reduced (44.4%) or reduced EF (35.7%) compared to those with preserved EF (8.3%).

Table 8: The prevalence of thyroid function derangement based on the severity of heart failure (Ejection fraction)among heart failure patients attending medical clinics in Dar es Salaam (N=359)

		Ejection fraction			
	Total	**Mild reduced**	**Reduced**	**Preserved**	**p-values**
THYROID_STATUS					
EUTHYROID	287(79.9)	13(72.2)	17(60.7)	257(82.1)	0.052
HYPERTHYROID	49(15.1)	2(11.2)	6(21.5)	41(13.1)	
HYPOTHYROID	23(6.3)	3(16.7)	5(17.8)	15(4.8)	
HOSPITALIZATION HISTORY DUE TO HEART FAILURE					
NO	315(87.7)	10(55.6)	18(64.3)	287(91.7)	<0.001
YES	44(12.3)	8(44.4	10(35.7)	26(8.3)	

On the other hand, hospitalization history has a significant and discernible influence on NYHA. Those with a history of hospitalization had a higher NYHA class than those without a history of hospitalization, with a p-value of <0.001.

Table 9: The prevalence of thyroid dysfunction based on the severity of heart failure (NYHA) among heart failure patients attending medical clinics in Dar es Salaam(N=359)

	NYHA CLASS					
	Total	I	II	III	IV	p-values
Thyroid status						
Euthyroid	287(79.9)	43(86.0)	155(80.7)	85(76.6)	4(66.7)	0.114
Hyperthyroid	49(13.7)	5(10.0)	28(14.6)	16(14.4)	0(0.0)	
Hypothyroid	23(6.3)	2(4.0)	9(4.7)	10(9.0)	2(33.3)	
HOSPITALIZATION HISTORY						
NO	315(87.7)	49(98.0)	173(90.1)	91(82.0)	2(33.3)	<0.001
YES	44(12.3)	1(2.0)	19(9.9)	20(18.0)	4(66.7)	

CHAPTER SIX

6.0 DISCUSSION

This study determined the distribution of thyroid function derangement among adult heart failure patients attending medical clinics in Dar es Salaam. According to this study, 20.1% of heart failure patients in Dar es Salaam have thyroid function abnormalities, indicating a significant burden of thyroid dysfunction. Hypothyroidism (13.7%) is more common than hyperthyroidism (6.4%), especially subclinical hypothyroidism (11.7%), which aligns with data from similar populations in Sub-Saharan Africa.

Although the prevalence in this study is higher than the rates reported by Mohamud et al. in Mogadishu (15.2%)[44], it is remarkably consistent with data from Kenya's Kenyatta National Hospital (36.8%) and more general Sub-Saharan African studies[43,44,51]. This regional resemblance may imply that common environmental or genetic factors may influence East African populations' thyroid-HF pathophysiology.

Most of the heart failure patients in this study were found to have hypothyroidism (13.7%). In a study conducted in India, where the prevalence of thyroid dysfunction in heart failure patients was 28.6%, 22.2% had hypothyroidism[42]. Muyodi et al had similar findings, where among 36.8% with thyroid dysfunction, 24.8% had hypothyroidism[43].

the most common of hypothyroidism in this study was subclinical hypothyroidism, 11.7 %. The finding is in keeping with the study findings of Muyodi et al in Kenya, where subclinical hypothyroidism was the most common,18.8%[43]. In Mogadishu, similarly, subclinical hypothyroidism was also the most prevalent, 33.3%[44]. These findings have significant clinical implications. In Sub-Saharan African populations, thyroid dysfunction has been shown by Mfeukeu-Kuate et al to worsen heart failure symptoms and compli-

cate treatment[51]. Given the high prevalence of subclinical disorders that could otherwise go unnoticed, the study findings support the need for routine thyroid screening in HF clinics across the region. Similar trends observed in Mogadishu and Nairobi suggest that thyroid screening should be a regional priority in HF care guidelines[43,44].

In this study, the majority of study participants in the age group 65-75 had thyroid dysfunction, hyperthyroidism (47.8%), hypothyroidism (36.7%), although not statistically significant($p=0.118$). These findings are in keeping with findings from Mohamud et al in Mogadishu, who also found no significant relationship between age and thyroid function derangement ($p = 0.80$)[44].

The history of hospitalization due to heart failure in this study was strongly associated with a severe form of heart failure. The majority of study participants who had a history of hospitalization due to heart failure and thyroid dysfunction presented with mildly reduced and reduced ejection fraction (44.4, 35.7) and NYHA class IV ($p<0.001$). These findings were different from a study in Kenya by Muyodi et al in Kenya, where there was no association between the severity of heart failure based on NYHA class and thyroid function derangement[43].

CHAPTER SEVEN

7.0 CONCLUSION AND RECOMMENDATION CONCLUSION

Thyroid dysfunction is highly prevalent among heart failure patients attending medical clinics in Dar es Salaam, with hypothyroidism, particularly subclinical hypothyroidism, being the most frequently observed derangement. Individuals with global heart failure exhibit a significantly higher likelihood of concurrent thyroid dysfunction. Furthermore, thyroid dysfunction demonstrates a statistically significant association with adverse clinical outcomes, including advanced New York Heart Association (NYHA) functional class, reduced left ventricular ejection fraction (LVEF), and a history of hospitalization due to heart failure exacerbation.

RECOMMENDATIONS

This study's high rate of thyroid dysfunction (20.1%), especially subclinical hypothyroidism (11.7%), among heart failure patients, emphasizes the necessity of proper utilization of thyroid function (T3, T4, TSH) in all HF patients, regardless of symptom status, since overt symptoms are often absent. Future studies should focus on longitudinal designs, such as prospective cohort studies that track thyroid function and HF outcomes over time, as well as randomized controlled trials to evaluate whether thyroid hormone normalization improves cardiac parameters, to establish a causal relationship between thyroid dysfunction and HF progression.

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APPENDICES

APPENDIX I: CONSENT FORM (ENGLISH VERSION)

Title: THYROID FUNCTION DERANGEMENT AMONG HEART FAILURE ADULTS ATTENDING CARDIAC CLINICS IN DAR ES SALAAM

Principal Investigator: DR. CHRISTINE R. YONAZI,

CONTACT OF PI: 0713392485

1. Introduction

You are being invited to participate in a research study. This study aims to investigate the thyroid function among adult patients with heart failure, focusing on the thyroid hormones.

2. Purpose of the Study

The purpose of this study is to:

- Determine the burden of thyroid function derangements among adult patients with heart failure in Dar es Salaam.

3. Procedures

If you agree to participate, you will be asked to:

- Provide information about your medical history, demographics, social, and life-style through a questionnaire.

- Undergo a physical examination, including weight measurement, height, blood pressure measurement, and neck examination.
- Blood sample for laboratory tests will be taken for thyroid hormones analysis (free T3, T4, and TSH)

4. Risks and Discomforts

- There are minimal risks associated with participation in this study.
- You may experience minor discomfort from a venopuncture for blood sample collection.
- Your privacy and confidentiality will be maintained throughout the study.

5. Benefits

- Participation in this study helps us improve our understanding of the levels of thyroid hormones in patients with heart failure, enabling recommendations for early screening of thyroid function among heart failure attending cardiac clinics to enable early intervention and prevent further complications.

6. Alternatives

You are not obligated to participate in this study. You may choose to decline participation without any penalty.

7. Confidentiality

All information collected during this study will be kept confidential. Your name and other identifying information will not be associated with your research data.

8. Voluntary Participation

Your participation in this study is entirely voluntary. You have the right to withdraw from the study at any time without any penalty.

9. Questions

If you have any questions about this study, please do not hesitate to contact:

1. Principal Investigator: Dr. Christine Yonazi

Phone number: 0713-392485

P.O. Box 15618, Dar es Salaam, Tanzania

Email: yonazicr@gmail.com

2. Head of Department of Internal Medicine: Prof. Yassin Mgonda

Phone number: 0754-277-554

3. Secretary of KU-IREC: Prof. Columba Mbekenga

Phone number: 0784-645777

10. Consent

By signing below, you acknowledge that you have read and understood this information and agree to participate in this research study.

Participant Signature: _____Date: _____

Witness Signature: _____ Date: _____

Name of Investigator: Dr. Christine R. Yonazi **Date: _____**

APPENDIX II: FOMU YA IDHINI (TOLEO LA KISWAHILI)

MATATIZO YA UFANYAJI WA KAZI YA TEZI YA KOO KATI YA WATU WAZIMA WENYE UGONJWA WA KUFELI KWA MOYO WANAOHUDHURIA KLINIKI ZA MOYO DAR ES SALAAM

Mtafiti Mkuu: DKT. CHRISTINE R. YONAZI,

MAWASILIANO YA MTAFITI MKUU: 0713392485

1. Utangulizi Unakaribishwa kushiriki katika utafiti huu wa kisayansi. Utafiti huu unalenga kuchunguza kazi ya tezi koo (tiiroidi) miongoni mwa wagonjwa watu wazima wenye kufeli kwa moyo, kwa kuzingatia homoni za tiiroidi.

2. Madhumuni ya Utafiti Madhumuni ya utafiti huu ni:

    - Kubaini mzigo wa matatizo ya ufanyaji wa kazi ya tezi ya koo kwa watu wazima wenye ugonjwa wa kushindwa kwa moyo huko Dar es Salaam

3. Ikiwa utakubali kushiriki, utaombwa:

    - Kutoa taarifa kuhusu historia yako ya matibabu, maelezo ya kijamii na mtindo wa maisha kupitia dodoso.
    - Kufanyiwa uchunguzi wa mwili, ikijumuisha upimaji wa uzito, urefu, shin-ikizo la damu, na uchunguzi wa shingo.
    - Kutoa sampuli ya damu kwa ajili ya vipimo vya maabara vya homoni za tiiroidi (T3 huru, T4 huru, na TSH).

4. Hatari na Usumbufu

    - Kuna hatari ndogo zinazohusiana na ushiriki katika utafiti huu.
    - Unaweza kuhisi usumbufu mdogo wakati wa uchukuwaji wa damu kwa ajili ya vipimo.
    - Taarifa zako zitahifadhiwa kwa faragha na usiri wakati wote wa utafiti huu.

5. Manufaa

    - Ushiriki wako katika utafiti huu unaweza kusaidia kuboresha uelewa wetu wa viwango vya homoni za tiiroidi kwa wagonjwa wenye kushindwa kwa moyo na kuwezesha kupendekeza uchunguzi wa mapema wa ufanyaji kazi ya tezi ya koo ili kuwezesha kuingilia mapema na kuzuia matatizo zaidi.

6. Mbadala

    - Huna wajibu wa kushiriki katika utafiti huu.
    - Unaweza kuamua kutoshiriki bila kupata adhabu yoyote.

7. Usiri

    - Taarifa zote zitakazokusanywa katika utafiti huu zitahifadhiwa kwa usiri mkubwa.
    - Jina lako na taarifa nyingine za utambulisho hazitaunganishwa na data za utafiti.

8. Ushiriki wa Hiari

    - Ushiriki wako katika utafiti huu ni wa hiari kabisa.
    - Una haki ya kujiondoa wakati wowote bila madhara yoyote.

9. Maswali

Ikiwa una maswali yoyote kuhusu utafiti huu, tafadhali wasiliana na:

1. Mtafiti Mkuu: Dkt. Christine Yonazi

   Namba ya simu: 0713-392485 P.O. Box 15618, Dar es Salaam, Tanzania

   Barua pepe: yonazicr@gmail.com

2. Mkuu wa Idara ya Tiba ya Ndani: Prof. Yassin Mgonda

   Namba ya simu: 0754-277-554

3. Katibu wa KU-IREC: Prof. Columba Mbekenga

   Namba ya simu: 0784-645777

10. Ridhaa

    Kwa kusaini hapa chini, unathibitisha kuwa umesoma na kuelewa taarifa hizi na unakubali kushiriki katika utafiti huu.

Sahihi ya Mshiriki: _____ Tarehe: _____

Sahihi ya Shahidi: _____ Tarehe: _____

Jina la Mtafiti: Dr. Christine R. Yonazi Tarehe: _____

APPENDIX III: QUESTIONNAIRE (ENGLISH VERSION)

THYROID FUNCTION DERANGEMENTS AMONG ADULT HEART FAILURE PATIENTS ATTENDING MEDICAL CLINICS IN DAR ES SALAAM.

File Number:_____

Contact Phone Number: _____

STEP 1: DEMOGRAPHIC INFORMATION

(Please circle the number corresponding to the appropriate response.)

Sex:

[ ] 1. Male

[ ] 2. Female

AGE:_____

Highest Level of Education Completed:

[ ] 1. Primary school completed

[ ] 2. Secondary school completed

[ ] 3. Diploma completed

[ ] 4. University completed

Marital Status:

[ ] 1. Married

[ ] 2. Unmarried

Main Work Status over the past 12 months:

[ ] 1. Employed

[ ] 2. Non-paid

[ ] 3. Retired

[ ] 4. Student

STEP 2: MEDICAL HISTORY AND EXAMINATION

BP _____

WEIGHT_____ HEIGHT _____ BMI _____

How long have you been diagnosed with heart failure?

Etiology of Heart Failure:

1. Hypertension [ ]
2. Congenital heart disease [ ]
3. Valve disease [ ]
4. Ischemic heart disease [ ]
5. Cardiomyopathy [ ]
6. Other (please specify): _____

Current Clinical Stage according to NYHA:

_____

Type of Heart Failure (depending on the cavity):

1. Left heart failure [ ]
2. Right heart failure [ ]
3. Global heart failure [ ]

Number of Hospitalizations for Heart Failure in the Last 12 Months:

Current Medications (list all medications you are currently taking):

Have you been diagnosed with any of the following conditions? Please check all that apply:

Hyperthyroidism [ ]

Hypothyroidism [ ]

Diabetes [ ]

Hypertension [ ]

Chronic kidney disease [ ]

Dyslipidemia [ ]

Known or treated cancer [ ]

Chronic hepatopathy [ ]

HIV [ ]

Chronic alcoholism [ ]

Smoking [ ]

Do you have any other conditions not listed above?

Yes (please specify): _____

Echocardiography (Left ventricular systolic ejection fraction):

_____

Left ventricular function:

1. Preserved [ ]

2. Reduced [ ]

3. Mildly Reduced [ ]

STEP 3: PARACLINICAL DATA

Biological Analysis:

TSH level (uUI/ml): _____

fT4 level (pg/ml): _____

fT3 level (pg/ml): _____

APPENDEX IV: DODOSO (KISWAHILI)

Mabadiliko ya Ufanisi wa Tezi za Shingo Miongoni mwa Wagonjwa Watu Wazima wa Kufeli kwa Moyo wanaohudhuria Kliniki Jijini Dar es Salaam

Nambari ya Faili:_____

Nambari ya Simu ya Mawasiliano:

_____

HATUA YA 1: TAARIFA ZA KIDEMOGRAFIA

(Tafadhali zungusha namba inayolingana na jibu sahihi.)

Jinsia:

[ ] 1. Mwanaume

[ ] 2. Mwanamke

UMRI:_____

Kiwango cha Juu cha Elimu Ulichokamilisha:

[ ] 1. Hakuna elimu rasmi

[ ] 2. Chini ya shule ya msingi

[ ] 3. Shule ya msingi imekamilika

[ ] 4. Shule ya sekondari imekamilika

[ ] 5. Stashahada imekamilika

[ ] 6. Chuo Kikuu kimekamilika

Hali ya Ndoa:

[ ] 1. Hujawahi kuoa/kuolewa

[ ] 2. Umeoa/Kuolewa sasa

[ ] 3. Mmetengana

[ ] 4. Talaka

[ ] 5. Mjane

[ ] 6. Mnaishi pamoja bila ndoa rasmi

Hali kuu ya Kazi katika miezi 12 iliyopita:

[ ] 1. Mfanyakazi wa serikali

[ ] 2. Mfanyakazi wa sekta binafsi

[ ] 3. Anajiajiri

[ ] 4. Haipati malipo

HATUA YA 2: HISTORIA YA MATIBABU NA UCHUNGUZI

BP _____

UZITO_____ UREFU _____ BMI _____

Umegunduliwa kuwa na kushindwa kwa moyo kwa muda gani?

Sababu za Kufeli kwa Moyo:

1. Shinikizo la damu

2. Ugonjwa wa moyo wa kuzaliwa

3. Ugonjwa wa valvu za moyo

4. Ugonjwa wa moyo kukosa damu

5. Ugonjwa wa kutanuka kwa moyo (Cardiomyopathy)

6. Nyingine (tafadhali eleza): _____

Hatua ya Sasa ya Kliniki kulingana na NYHA:

Aina ya Kufeli kwa Moyo (kulingana na sehemu ya moyo):

1. Kufeli kwa moyo wa kushoto

2. Kufeli kwa moyo wa kulia

3. Kufeli kwa moyo kwa ujumla

Idadi ya Kulazwa Hospitalini kwa Sababu ya Kufeli kwa Moyo Katika Miezi 12 Iliyopita:

Dawa unazotumia Sasa (orodhesha dawa zote unazotumia kwa sasa):

Je, umewahi kugunduliwa na mojawapo ya hali zifuatazo? Tafadhali angalia zote zi-nazohusika:

Madini joto kuzidi [ ]

Madini joto kupungua [ ]

Kisukari [ ]

Shinikizo la damu [ ]

Ugonjwa sugu wa figo [ ]

Ugonjwa Wa Lehemu Kuzidi [ ]

Saratani inayojulikana au iliyotibiwa [ ]

Ugonjwa sugu wa ini [ ]

Virusi Vya Ukimwi [ ]

Ulevi sugu wa muda mrefu [ ]

Uvutaji sigara [ ]

Je, una hali nyingine yoyote ambayo haijatajwa hapo juu?

Ndio (tafadhali eleza): _____

Hapana

Echocardiografia (Asilimia ya utoaji wa damu ya ventrikali ya kushoto):

Utendaji kazi wa Ventrikali ya Kushoto:

1. Imehifadhiwa

2. Umepungua

HATUA YA TATU: TAARIFA ZA VIPIMO VYA MAABARA

Uchunguzi wa Kibiolojia:

Kiwango cha TSH (uUI/ml): _____

Kiwango cha fT4 (pg/ml): _____

Kiwango cha fT3 (pg/ml): _____

UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH

JAKAYA KIKWETE CARDIAC INSTITUTE (JKCI)

JAKAYA KIKWETE CARDIAC INSTITUTE

In reply please quote;
Ref No: AB.123/307/01L/60 08/04/2025

Dr. Christine R. Yonazi
HK/PG/IM/21/0012
Master of Medicine in Internal Medicine - KU

RE: PERMISSION TO CONDUCT RESEARCH AT JKCI

Reference is made to your letter requesting to do a research study entitled **"Thyroid Function Derangements Among Adult Heart Failure Patients Attending Medical Clinic in Dar es Salaam."** here at JKCI.

This letter serves as an official document that permits you to do the above-mentioned task as requested. However, the institution also requires you to have JKCI local co-supervisor

It is our sincere hope that you will adhere strictly to the rules and regulations governing good clinical practice. Your compliance with these standards will ensure the integrity and ethical conduct of your study.

Best Regards,

JAKAYA KIKWETE CARDIAC INSTITUTE
P. O. Box 65141
Dar-es-Salaam
JKCI

Dr. Pedro Pallangyo
Head of Research, Training and Consultancy.
CC: ALL DIRECTORATES & Head of Units

KAIRUKI UNIVERSITY (KU)

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

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

Ref. No. KU/IREC/27.10/552 **8 April, 2025**

Dr. Christine R. Yonazi,
Kairuki University,
70 Chwaku Street,
Mikocheni,
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: **Thyroid Function Derangements among Adult Heart Failure Patients Attending Medical Clinic in Dar es Salaam (Yonazi, C. R., 2025)** 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 **a 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. Frederick Kaijage

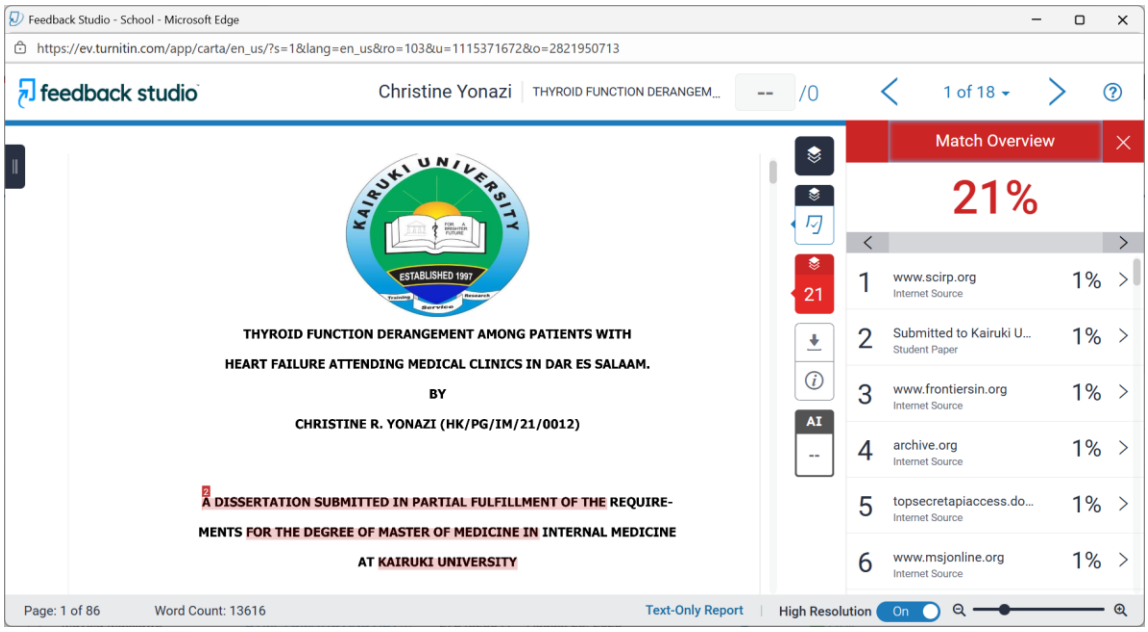
Signature:

SECRETARY

Name: Prof. Columba Mbekenga

Signature:

DIRECTOR POSTGRADUATE STUDIES AND RESEARCH INSTITUTE
KAIRUKI UNIVERSITY
P. O. Box 65300, DSM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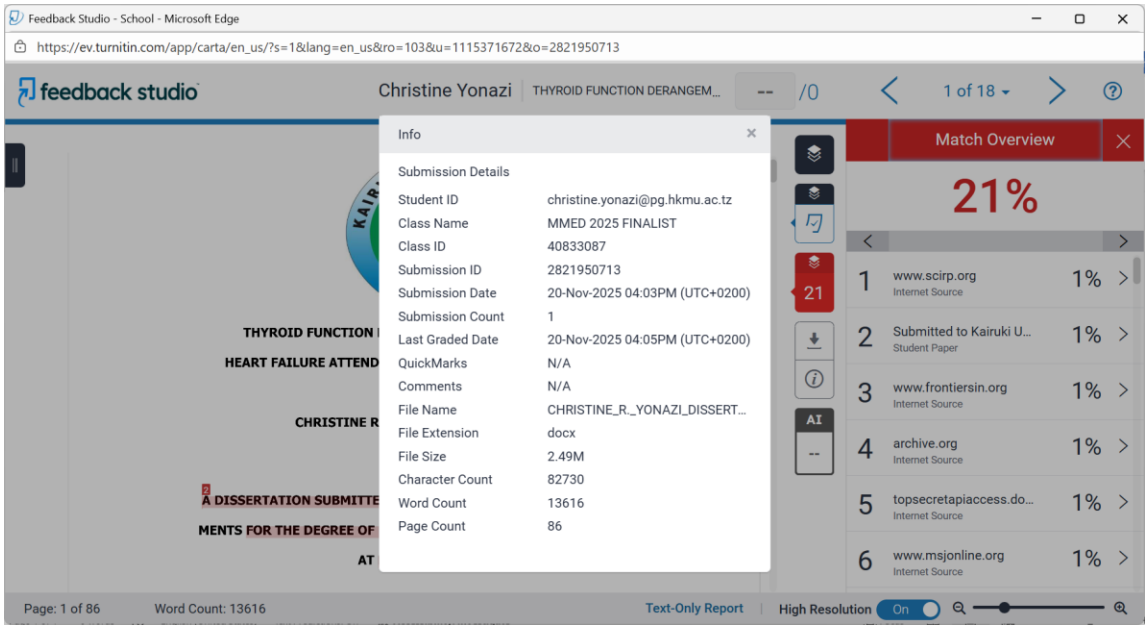
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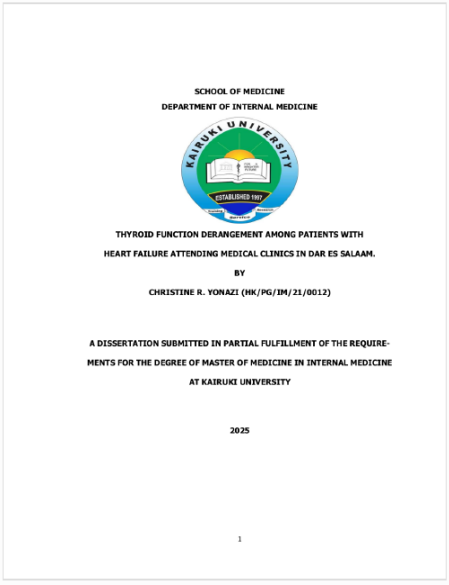

SCHOOL OF MEDICINE

DEPARTMENT OF INTERNAL MEDICINE

THYROID FUNCTION DERANGEMENT AMONG PATIENTS WITH HEART FAILURE ATTENDING MEDICAL CLINICS IN DAR ES SALAAM.

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN INTERNAL MEDICINE AT KAIRUKI UNIVERSITY

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