PREVALENCE OF ANAEMIA AND ITS ASSOCIATED FACTORS AMONG PATIENTS WITH CHRONIC KIDNEY DISEASE AT MNAZI MMOJA AND TASAKHTAA HOSPITALS, ZANZIBAR

Fadhila Maulidi, BScN

MSc (Nursing Nephrology) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2024

Muhimbili University of Health and Allied Sciences

Department of Clinical Nursing

PREVALENCE OF ANAEMIA AND ITS ASSOCIATED FACTORS AMONG PATIENTS WITH CHRONIC KIDNEY DISEASE AT MNAZI MMOJA AND TASAKHTAA HOSPITAL, ZANZIBAR

By

Fadhila Maulidi

A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree of Master of Science (Nursing Nephrology) of

Muhimbili University of Health and Allied Sciences
October, 2024

CERTIFICATION

The undersigned certifies that they have read and recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; **"Prevalence of anaemia and its associated factors among patients with chronic kidney disease at Mnazi Mmoja and Tasakhtaa Hospital, Zanzibar",** in (partial) fulfilment of the requirements for the degree of Master Science (Nursing Nephrology) of Muhimbili University of Health and Allied Sciences.

_____

Prof. Francis Furia

Main supervisor

_____

Date

_____

Mr. Gift Lukumay

Co-supervisor

_____

Date

DECLARATION AND COPYRIGHT

I, **Fadhila Maulidi,** hereby declare that this **dissertation** is wholly original with no intention of being submitted to another university for consideration for a degree of this kind or any other.

Signature……. **Date**……...

This dissertation is protected by copyright under the 1999 Copyright Act, Berne Convection, and other national and international intellectual property laws. With the exception of brief excerpts used in fair dealing, research or private study, critical scholarly review, or disclosure with acknowledgment, it may not be produced in whole or in part by any means without the express written consent of the Directorate of Postgraduate Studies, acting on behalf of the author and Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENT

I would like to express my special thanks to my academic supervisors, Prof. Francis Furia, from the Department of Pediatrics and Child Health, at the School of Clinical Medicine and my Co-supervisor Gift Lukumay for their interest, encouragement, and guidance from the start of this research work to the completion and production of this dissertation.

Also, special thanks go to all members of the academic and non-academic staff at the school of nursing for their support in completing my study. Appreciation is made to all students in my class for their cooperation in every task done in the class. Without them, it would not be easy to accomplish the study.

Special thanks go to the Executive Director of Muhimbili National Hospital and the Director of the Nursing and Renal Unit in Charge for facilitating my study and for giving me support during data collection.

I take this chance to express my heartfelt appreciation to my family for their support, prayers, and encouragement. Lastly but not least, my special thanks go to my best friend Laidi Msisiri for her guidance, encouragement and support that she has given me throughout my studies and my research work process.

DEDICATION

I dedicate this work to my beloved children **Abdul-Fattah, Ashfyna, and Ashnyfat** for their endurance throughout my study.

ABSTRACT

Background: Anaemia from chronic kidney disease contributes to greater morbidity, mortality, and quality of life. Chronic kidney disease, a worldwide health burden, has huge economic consequences for healthcare systems and sufferers' families. To the best of my knowledge, no study has been done on the prevalence, clinical characteristics, and associated factors of anaemia among chronic kidney disease patients in Zanzibar.

Objective: This study is intended to estimate the prevalence of anaemia and its associated factors among patients with chronic kidney disease at two selected hospitals in Zanzibar.

Methods: A descriptive cross-sectional study design was conducted in two hospital settings among non-dialysis CKD patients (18 years of age and older), from stages 1 to 5. Convenience recruitment was conducted among 195 patients with CKD who attended the outpatient renal clinic, including those admitted to the wards at two selected hospitals in Zanzibar. In data collection, a Swahili-translated questionnaire was used to obtain socio-demographic data, and a checklist was used to obtain important past medical records and laboratory parameters. The data were initially recorded in Excel and then imported into SPSS version 26 for analysis. Descriptive analysis summarized baseline characteristics, with continuous variables summarized by mean and standard deviation and categorical variables presented as frequencies, percentages, and charts. Pearson’s chi-square test or Fisher's exact test were used to find the associations between sociodemographic and clinical factors among anaemic and non-anaemic CKD patients. To find the independent factors associated with anaemia in people with chronic renal disease, both univariate and multivariate modified poissons regression analyses were utilized. At a value of p below 0.05, all significance levels were established.

Results: A total of 195 participants were included to estimate the prevalence of anaemia among chronic kidney disease patients. The mean age of all participants was 55.8 ± 13.1 years. The prevalence of anaemia was 91.3% [95% CI (86.5-94.5)], and anaemia increased as kidney function declined. After adjusting for other confounders: **Mode of payment**, whereby patients

treated in the hospital free of charge (APR = 1.14, 95% CI: 1.01–1.29, p = 0.033) were 1.14 times more likely to develop anemia compared to those with health insurance coverage. Additionally, in **educational level**, compared to patients with college or university education, those with primary education or no schooling (APR = 1.29, 95% CI: 1.05–1.57, p = 0.015) were 1.29 times more likely to develop anemia and those with secondary education (APR = 1.23, 95% CI: 1.003–1.51, p = 0.047) were 1.23 times more likely to develop anemia.

Keywords: Anaemia, chronic kidney disease, prevalence, Zanzibar.

Conclusion: This study discovered that the majority of CKD participants were anaemic, confirming that anaemia is a common comorbidity among CKD patients in our environment. Anaemia was common at all stages of chronic renal disease and exacerbated by a steady reduction in kidney function. Patients who received free hospital care were more likely to acquire anaemia than those who had health insurance.

Recommendations: Healthcare institutions should lead improvements in several areas of CKD care, particularly early detection and treatment, and should implement periodic screening and intervention programs to prevent anemia among CKD patients. Policymakers and government support should develop anaemia preventive policies relevant to the country’s context, and measures to increase health insurance coverage should be implemented to improve the quality of care, particularly in hospitals that provide free CKD services.

TABLE OF CONTENT

CERTIFICATION i
DECLARATION AND COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
ABSTRACT v
TABLE OF CONTENT vii
LIST OF TABLES x
LIST OF FIGURE x
ABBREVIATIONS xi
DEFINITION OF THE TERMS xii
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Problem Statement 3
1.3 The Conceptual Framework 4
1.4 Rationale 6
1.5 Research Questions 6
1.5.1 Broad research question 6
1.5.2 Specific Research Questions 6
1.6 Research Objectives 7
1.6.1 Broad Objective 7
1.6.2 The specific objectives 7
CHAPTER TWO 8
2.0 LITERATURE REVIEW 8
2.1 Prevalence of anemia in CKD 8
2.2 Factors associated with anemia in CKD patients 9
2.2.1 Sociodemographic factors 9

2.2.2 Clinical Characteristics 10
CHAPTER THREE 13
3.0 METHODOLOGY 13
3.1 Study design 13
3.2 Study setting 13
3.3 Study population 14
3.4 Sample size calculation 14
3.5 Selection criteria 15
3.5.1 Inclusion criteria 15
3.5.2 Exclusion criteria 15
3.6 Variables 15
3.6.1 Dependent variable 15
3.6.2 Independent variables 15
3.6.3 Sampling Technique 16
3.6.4 Data Collection Tool 16
3.6.5 Pre-Testing of the Tool 16
3.7 Data collection procedures 17
3.8 Data management 17
3.9 Data analysis 17
3.10 Ethical Consideration 18
3.12 Dissemination plan 18
CHAPTER FOUR 19
4.0 RESULTS 19
4.1 Sociodemographic Characteristics of Study Participants 19
4.2 Clinical characteristics of the patients 21
4.3 Prevalence of anaemia among CKD patients 22
4.5 Relationship between sociodemographic factors, clinical characteristics, and anaemia 23
4.6 Factors Associated with Anaemia among CKD Patients 25

CHAPTER FIVE 27
5.0 DISCUSSION 27
5.1 Strengths and limitations 30
CHAPTER SIX 32
6.0 CONCLUSION AND RECOMMENDATIONS 32
6.1 Conclusion 32
6.2 Recommendations 32
REFERENCES 33
APPENDICES 39
Appendix I: Consent form 39
Appendix II: Fomu ya kuomba Ridhaa 41
Appendix III: Questionnaire 43
Appendix IV: Questionnaire- Swahili Version 47
Appendix V: Approval for ethical 50
Appendix VI: Introduction Letter 53
Appendix VII: Digital Receipt 55
Appendix VIII: Plagiarism Report 56

LIST OF TABLES

Table 1: Sociodemographic Characteristics of CKD Patients 20

Table 2: Clinical Characteristics of CKD Patients 21

Table 3: Laboratory profile and prevalence of anaemia in CKD patients 22

Table 4: Relationship between socio-demographic, clinical characteristics and anaemia 24

Table 5: Univariable and multivariable analysis of the factors associated with anemia 26

LIST OF FIGURE

Figure 1: Conceptual framework.....5

ABBREVIATIONS

AKI	Acute Kidney Injury
ART	Artificial Renal Therapy
CKD	Chronic kidney disease
DM	Diabetic Mellitus
EPO	Erythropoietin
ESRD	End-Stage Renal Disease
GFR	Glomerular Filtration Rate
HB	Haemoglobin
HD	Haemodialysis
HIV	Human Immunodeficiency Virus
HTN	Hypertension
ISN	International Society of Nephrology
KDIGO	Kidney Disease: Improving Global Outcome
LMICs	Lower- and Middle-Income Countries
MHD	Maintenance Haemodialysis
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University, of Health and Allied Sciences
RBC	Red Blood Cells
RRT	Renal Replacement Therapy
RPEC	Research for Publication Ethical Committee

DEFINITION OF THE TERMS

Chronic kidney injury: Is the steady worsening of renal structural or functional problems over a period exceeding three months, as demonstrated by damage to the kidneys with or without reducing GFR (1).

Anemia: The National Anaemia Strategy Council and the WHO define anaemia as a serum haemoglobin level of 12 g/dl in females and 13 g/dl in males at the age of 18 (2).

GFR: Calibrated serum creatinine and estimation algorithms like the Cockcroft-Gault formula (normalized for BSA) may estimate: 140 years of age x kg of weight x (0.86 for female) x 1, 73/72 x creatinine levels (mg per deciliter) x the BSA (m2) (3).

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Chronic kidney disease causes global anemia and highly costs healthcare systems. KDIGO has defined anaemia in CKD as a hemoglobin level of 13.0 g/dl for men and 12.0 g/dl for non-pregnant females (4). Regardless of the cause, chronic renal disease is defined as kidney damage or reduced kidney function that lasts for three months. Serum creatinine readings are used to compute a GFR, which indicates reduced kidney function. Imaging, biopsies, or clinical indicators such as elevated albuminuria (the ACR > 30 mg/gram; 3.4 mg/mMol) are typically used to detect kidney damage (5). Studies show that as GFR decreases, the risk of anemia increases, particularly when GFR drops below 60 mL/min/1.73 m^2. When GFR falls below 30 mL/min/1.73 m^2, anemia becomes more pronounced. Treatments like iron supplementation and erythropoiesis-stimulating agents (ESAs) have been effective in improving anemia in CKD patients (9).

In 2017, the prevalence of CKD was 9.1% worldwide, affecting around 700 million people, since 1990, the prevalence of CKD has increased by 29.3% (6). In sub-Saharan Africa, about 10% of the population is affected by CKD (7), while in Tanzania, estimates range from 7% to 10% (8). Research from sub-Saharan Africa indicates that the prevalence of anemia in CKD patients is around 59.15%, (7) with similar findings in Addis Ababa, Ethiopia, reporting a prevalence of 53.5% (10). In Tanzania, previous studies have shown varying anemia prevalence rates, with one study from Dodoma reporting 31.4% (11) and another from Dar es Salaam reporting 69% (12). These wide-ranging results suggest that further research is needed to better understand the true prevalence of anemia among CKD patients in Tanzania. The study in Dar es Salaam also identified inadequate erythropoietin (EPO) production and iron deficiency as the main causes of anemia in CKD patients (12).

Poor nutritional status plays a critical role in the development of anemia. Malnutrition, common in CKD patients due to dietary restrictions, reduced appetite, and metabolic changes, can lead to deficiencies in essential nutrients such as iron, vitamin B12, and folate. These nutrients are necessary for red blood cell production, and their deficiency can contribute to the worsening of anemia. Women, in particular, are at higher risk of anemia due to hormonal factors like menstruation and pregnancy, which can lead to blood loss and iron deficiency (13). Elderly patients with chronic kidney disease (CKD) often experience inflammation, nutritional deficiencies, and cardiovascular comorbidities, which can impair iron absorption and lower hemoglobin (Hb) levels due to reduced erythropoiesis with age (14). Other social factors, such as limited access to healthcare, low educational levels, and lack of support from partners, can also delay the diagnosis and treatment of anemia in CKD patients (10). Lifestyle factors such as smoking and alcohol use can further exacerbate anemia by impairing iron absorption and red blood cell production (12) .

As CKD progresses, several factors including inflammation, functional iron deficiency and reduced erythropoietin production leading to reduced red blood cell production and a higher likelihood of anemia, (15). Diabetes and high blood pressure, common causes of CKD, can worsen anemia. For example, diabetes-related inflammation can impair EPO production (16), and prolonged high blood pressure can damage the kidneys, further reducing their function (10). To my knowledge, no study has been conducted on the prevalence, clinical characteristics, and factors associated with anaemia among chronic kidney disease patients in Zanzibar. Therefore, the cross-sectional research aimed to examine the prevalence of anaemia and its associated factors in CKD patients at selected hospitals in Zanzibar

1.2 Problem Statement

Anemia is a significant complication of chronic kidney disease (CKD), adversely affecting patients' quality of life and contributing to increased mortality rates (17) . In CKD patients, anemia can result in symptoms such as fatigue, shortness of breath, and decreased physical functioning, while also raising the risk of cardiovascular complications and accelerating the progression to end-stage renal disease (ESRD) (18). Studies estimate the prevalence of anemia in CKD patients to be approximately 69% in Dar es Salaam (12) and 59.15% across Sub-Saharan Africa (7).

The Kidney Disease: Improving Global Outcomes (KDIGO) organization has developed comprehensive guidelines to address anemia in CKD patients. These guidelines focus on early detection, regular monitoring, and appropriate treatment using therapies such as erythropoiesis-stimulating agents (ESAs) and iron supplementation. They also provide recommendations for managing iron deficiency, minimizing blood transfusions, and optimizing hemoglobin levels to improve patient outcomes. KDIGO's evidence-based approach aims to standardize care, reduce complications, and enhance the quality of life for CKD patients globally (19).

Despite the global recognition of anemia's impact on CKD patients, there is limited data on prevalence of anaemia and its associated factors specific to Zanzibar. Regional factors such as healthcare access, nutrition, and socioeconomic status may influence the manifestation and progression of anemia differently in Zanzibar compared to other regions. These challenges can hinder the effectiveness of treatment, leading to suboptimal outcomes and a continued high burden of anemia. Investigating these factors is crucial to identifying unique patterns of anemia in CKD patients in this setting. Therefore, this study aims to determine the prevalence of anaemia and its associated factors among CKD patients at selected hospitals in Zanzibar.

1.3 The Conceptual Framework

The conceptual structure shows a relationship between independent and dependent variables. Determining the prevalence and related variables helps determine the extent of the problem, so efforts will be implemented to minimize anaemia and risk factors in CKD patients.

Sociodemographic characteristics: Older age causes inflammation and comorbidities that hinder iron absorption and RBD production. Hormonal variations in gender such as menstruation, pregnancy, and childbirth cause women to lose blood, which lowers their iron levels. Marital status may contribute to social support, access to healthcare, psychological health, and better treatment adherence, which can help CKD patients manage their anaemia. A higher level of education can improve healthcare awareness and practices, which can help manage anaemia. Residency or geographical location can influence access to health care, the quality and accessibility of medical services, and the timely diagnosis, treatment, and management of anaemia. Employment status factors like work-related stress, work flexibility, treatment adherence, and health insurance coverage are essential for controlling anaemia in CKD patients. Higher-income people can easily access health care and a nutritional diet, which can easily manage anemia in CKD patients.

Behavioral factors such as smoking and the use of alcohol: Overconsumption of alcohol and smoking can result in poor eating practices, malnutrition, interference with the body's ability to absorb and use iron, poor clinical adherence, and the risk of developing other comorbidities.

Clinical characteristics: Comorbidities such as diabetes, hypertension, heart disease, hepatitis, cancer, and other clinical conditions like uremia lead to chronic inflammation, reduced absorption, and increased iron loss in the urine, impairing the production of erythropoietin, which can lead to anaemia.

Independent variables

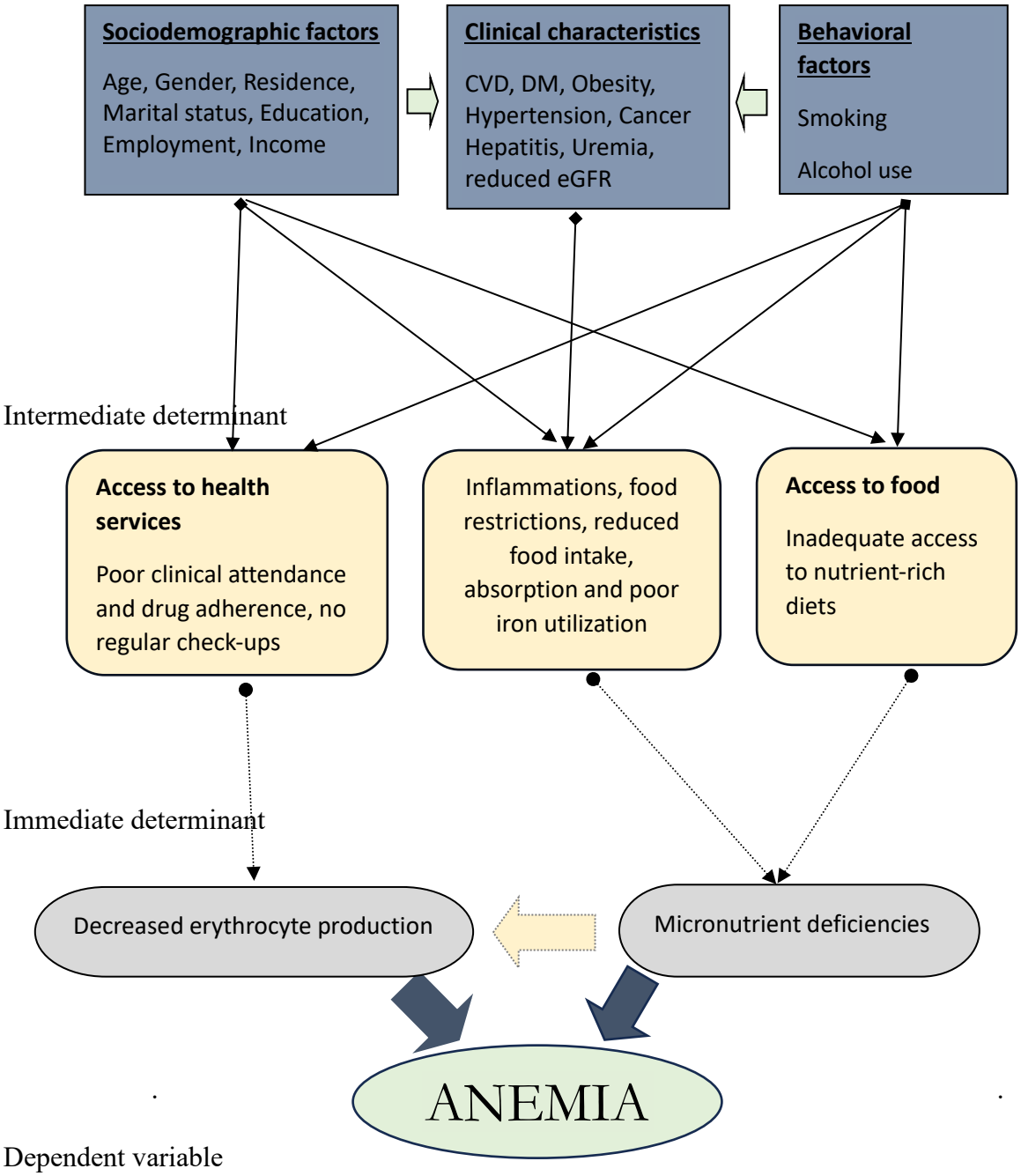


Figure 1: Conceptual framework

1.4 Rationale

Anemia is a common and serious complication of chronic kidney disease (CKD), significantly affecting patient outcomes. This study seeks to address the prevalence of anaemia and its associated factors contributing to anemia among CKD patients in Zanzibar. The findings of this study has discovered that, anemia is a prevalent and severe complication of chronic kidney disease (CKD). The findings also indicate that factors such as low socioeconomic status, limited access to healthcare, and poor nutritional status are the contributors to anemia in this population. Despite existing treatment guidelines, there may be gaps in addressing the specific causes and manifestations of anemia in CKD patients within the local context. Therefore, understanding these local patterns is essential for developing more targeted interventions. The insights from this research will form the basis for creating evidence-based strategies that aim to prevent and better manage anemia among CKD patients in Zanzibar. Ultimately, these strategies will enhance patient care and inform healthcare policies, leading to improved resource allocation and better overall management of CKD in this region.

1.5 Research Questions

1.5.1 Broad research question

What is the prevalence, clinical characteristics, and factors associated with anaemia among patients with CKD at selected hospitals in Zanzibar?

1.5.2 Specific Research Questions

1. What is the prevalence of anaemia among patients with CKD at selected hospitals in Zanzibar?
2. What are the factors associated with anaemia among patients with CKD at selected hospitals in Zanzibar?

1.6 Research Objectives

1.6.1 Broad Objective

To determine the prevalence, clinical characteristics, and factors associated with anaemia among patients with CKD at selected hospitals in Zanzibar.

1.6.2 The specific objectives

1. To determine the prevalence of anaemia among patients with CKD at selected hospitals in Zanzibar.
2. To determine factors associated with anaemia among patients with CKD at selected hospitals in Zanzibar**.**

CHAPTER TWO

2.0 LITERATURE REVIEW

When kidneys are damaged, the estimated eGFR declines, and impaired EPO production, the hormone that signals the bone marrow to make RBC, results in less RBC production, and a low level of hemoglobin, hence anaemia (20). Other common causes of anaemia are shortened red blood cell half-lives and a deficiency in functional iron(21) (22), iron deficiency due to poor appetite and decreased food intake (23), and nutritional deficits, especially folate and vitamin B12, due to anorexia (21).

The most common symptoms of anaemia include paleness, lethargy, dyspnea, dizziness, headaches, and depression(21). Anemia in CKD patients is a major predictor of cardiovascular events and is associated with prolonged hospitalization, transfusion needs, transition outcomes to ESRD, poor HR-QoL, increased morbidity, and mortality (11).

ESAs boost haemoglobin and cure anaemia by inducing EPO production. Iron supplements boost immunological, cognitive, and physical function (21). Hemoglobin normalization in patients with chronic kidney disease is not advised due to ESA dosage safety concerns, even if it decreases the negative consequences of anaemia on morbidity and improves quality of life. Cardiovascular outcomes may be improved by a physiologically normal or supraphysiological Hb level. The targeted hemoglobin level in patients with CKD is 10-11.5 g/dl and should not exceed level 13g/dl (24). Iron supplements boost immunological, cognitive, and physical function (25).

2.1 Prevalence of anemia in CKD

The estimated worldwide prevalence of CKD is 11% for stage 3–5 patients and 13% for stage 1–5 patients (26). The study done in developed countries shows the prevalence as follows: In Korea, 45.0% (27), Turkey 55.9% (28), Malaysia 60.3% (29), Spain 58.5% (30), China 51.5% (31), and the USA 15.4% (32).

In 25 sub-Saharan Africa, studies done among 5042 participants showed the anaemia prevalence of 59.15% among CKD patients (7). The Muhimbili National Hospital research in Tanzania found that 69% of CKD patients had anaemia (12). However, anaemia prevalence among CKD patients in Zanzibar is unknown.

2.2 Factors associated with anemia in CKD patients

2.2.1 Sociodemographic factors

Elderly patients with chronic renal disease experience inflammatory, nutritional, and cardiovascular comorbidities that might impair iron absorption (14). Hb falls with age owing to erythropoiesis; hence, older individuals may have a lower ideal Hb goal (33). According to a study done in the US, anaemia prevalence is significantly higher, about 52%, in older patients compared to younger patients (28%); it increased from 22.4 percent in younger stage 3 non-dialysis-CKD patients to 53.9 percent in stage 5 and from 43.9 percent in older Medicare stage 3 patients to 72.8 percent in stage 5 (34).

Likewise, hormonal variations are one of the contributing factors. Menstruation, pregnancy, and childbirth cause women to lose blood, which lowers their iron levels and raises their risk of anaemia. A study done in Sab Saharan has shown that the female sex is significantly related to anaemia, whereby the risk of anaemia is twice as high in women as in men (13) whereby the findings are the same as the study done in Addis Ababa (35), and that was done in the US (28).

Patients who live in rural areas may be less likely to receive health care due to distance or lack of access. Rural residents may experience anaemia due to the simultaneous presence of helminthic infestations, gastrointestinal blood loss, or nutritional deficiencies. Anaemia is significantly more common in rural residents, according to a systematic review study conducted in Africa, whereby, compared to urban dwellers CKD patients, rural residents had three times the likelihood of being anaemic (36).

Patients who are married or live with their partners may receive social support, access to healthcare, and better treatment adherence, which may be important in managing CKD and its aftereffects, including anaemia, but it is not necessarily that all get support because some of them are being restricted by their partners from seeking health care. A study in Addis Ababa found that married CKD patients had a greater rate of anaemia (76.3%) than non-married ones (10).

Alcohol overconsumption and smoking can result in poor eating practices, malnutrition, and reduced levels of vital nutrients like iron, folate, and vitamins B12 and B6. Nutrient deficiency in CKD patients can lead to anaemia, and worsen anaemia by interfering with the body's ability to absorb and use iron, which can interfere with erythropoiesis and reduce the bone marrow's capacity to generate RBC. The study done among patients with CKD in Addis Ababa, Ethiopia, documented that anaemia affects around 12% of smokers, 13% of ex-smokers, approximately 50% of former drinkers, and 14.5% of those who are current drinkers (10).

Greater knowledge of preventive healthcare practices, access to resources, and health awareness are frequently correlated with higher education. Lower-educated individuals may have less access to healthcare information, which could delay the diagnosis and treatment of CKD and accelerate the development of anaemia. Tanzanian research at Muhimbili National Hospital indicated that higher education protected patients with CKD against anaemia (12).

2.2.2 Clinical Characteristics

Since the prevalence of anaemia increases as a patient approaches the end stage of renal disease, delaying the advancement of chronic kidney disease (CKD) is crucial to avoid anaemia. In patients with a more advanced stage of CKD, erythropoiesis decrease, functional iron insufficiency, inflammatory response, and erythropoietin deficiency may all contribute to the gradual loss of kidney function, which could account for this observation (15). About 15.4% (4.8 million persons) in the NHANES analysis had CKD anaemia, and among CKD patients at stages 3, 4, and 5, the prevalence of anaemia was 17.4%, 50.3%, and 53.4%, respectively (37).

Similarly, a Sub-Saharan African study revealed that anemia was five times more common in individuals with stage 4-5 CKD than in those with stage 1-3 (7).

A high blood sugar level and other inflammatory conditions, like being overweight, are the root causes of diabetes, an inflammatory illness. Diabetes patients experience increased inflammation as a result, which causes an EPO deficiency (16). Anaemia prevalence rates in CKD patients with diabetes were found to be 22% and 15% overall in research from the UK (38) and USA (39) respectively, with rates varying from 5% and 8% in Stage 1 to 46% and 53% in Stage 5. According to an Addis Ababa study, individuals with diabetes mellitus had a twofold increased risk of anaemia compared to those without the disease (10).

Prolonged high levels of blood pressure harm the kidneys' fragile blood vessels, impairing their ability to function properly. As CKD progresses, erythropoietin production may be reduced, leading to anaemia. The study done in Addis Ababa shows that patients with HTN were threefold more likely to develop anaemia than patients with non-hypertensives.

As CKD progresses over time, the kidney’s ability to produce erythropoietin diminishes. This reduction leads to decreased RBC production, which can result in anaemia; therefore, the longer the patient experiences CKD, the higher the likelihood of developing anaemia. The study done in Addis Ababa indicated that more than half (54.0%) had chronic kidney disease of less than one year's duration (10).

Malnutrition, defined as protein-energy waste, is a sign of severe kidney disease. In CKD, particularly in the advanced stages, patients might experience malnutrition and muscle wasting, leading to a lower BMI. Malnutrition can contribute to anemia due to inadequate intake of essential nutrients like iron, folate, and vitamin B12, which are crucial for RBC production. The results showed that Korean patients without obesity-related body habits were five to seven times more likely to develop anaemia than those with obesity-related body habits.

This study provides clinical relevance since the high incidence of anaemia in individuals with chronic renal illness should be frequently tested, and information about potential risk factors for anaemia should be provided. Furthermore, recognizing risk factors that are linked with anaemia in individuals with CKD may aid medical professionals in providing clinical care.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

Analytical cross-sectional study. The methodology was chosen because it allowed investigators to evaluate the prevalence of anaemia and its associated factors among patients with CKD at selected hospitals in Zanzibar. The design allows for a comprehensive snapshot of the population, providing valuable insights to inform management and intervention strategies.

3.2 Study setting

The study was conducted at Tasakhtaa and Mnazi Mmoja Hospitals. Both two hospitals are located in Vuga district, southern Zanzibar. They provide renal services for inpatients and outpatients and renal replacement therapy (haemodialysis). The Tasakhtaa hospital is a multi-specialty private hospital with a capacity of 130 beds. Mnazi Mmoja Hospital is the referral and teaching hospital that receives patients from all three regions of Unguja and other patients from Pemba Island. At Tasakhtaa Hospital, the investigation was undertaken on CKD patients who were admitted to the medical ward and those who were attending the internal medicine clinic. The Tasakhtaa clinic is done weekly from Monday to Friday, and approximately 10 non-dialysis CKD patients attend per week. The clinic has two physicians, one medical officer, and one nurse. At Mnazi Mmoja Referral Hospital, the investigation was undertaken on non-dialysis CKD patients who attended the renal clinic, which is done once per week (on Wednesday), with approximately 25 patients on the same day and those who were admitted to the medical ward. The renal clinic at Mnazi Mmoja Hospital has one physician, two medical officers, and one nurse. Two hospitals were intentionally chosen to be the research places among the public and

private hospitals. These medical facilities offer services to patients of varied socioeconomic backgrounds.

3.3 Study population

The study involved non-dialysis CKD patients (age 18 years and above) from stages 1 to 5 who were attending outpatient renal clinics for follow-up purposes throughout data collection and those who were admitted to wards at two selected hospitals. The trial population included all CKD patients who met the KDIGO criteria, regardless of their main aetiology. The study involved participants in all stages of CKD; this is because CKD patients in any stage can develop anaemia at any time due to different factors such as diabetes, hypertension, poor nutrition, decreased appetite and food intake, old age, and other sociodemographic factors.

3.4 Sample size calculation

$$n = \frac{Z^2 P (100-P)}{d^2}$$

To calculate the prevalence of anaemia among CKD patients, the above formula was used: n = sample size, Z = statistical level of confidence (95%), d = precision (about 5%), and P = prevalence.

In a prior study conducted in Cameroon among CKD patients, the total frequency of anaemia was 86.7% (40).

$$n = \frac{(1.96)^2 \times 86.7 \times (100-86.7)}{5^2}$$

$$n = 3.842 \times \frac{86.7 \times 13.3}{25}$$

$$n = 177$$

Considering the sample size was reduced to a 10% rate of refusal to respond,

Adding 10% of 177 = (10%*177) = 195

n = 195

The sample size was 195

We used finite population correction for proportion to calculate sample size. We assumed a population proportion of 0.5 (confidence interval 95%) with a margin of error (precision) of 5%. We also assumed the population of CKD patients in both two hospital to be about 210, given that there were 150 CKD patients at Mnazi Mmoja Referral Hospital and 60 at Tasakhtaa Private Hospital. Therefore, we estimated that the sample size should be 195 of participants.

3.5 Selection criteria

3.5.1 Inclusion criteria

- CKD patients aged 18 years and older
- Mentally stable
- Able to speak Swahili

3.5.2 Exclusion criteria

- Critically ill patients who can’t speak
- Pregnant women

3.6 Variables

3.6.1 Dependent variable

The study's dependent variable was anemia. It was measured with data obtained from medical records; the data were recent and recorded within three months of collecting the data. My operational definition of anaemia was defined as hemoglobin levels < 12 g/dl for females and 13 g/dl for males in study participants aged ≥18 years with non-dialysis-CKD patients.

3.6.2 Independent variables

The independent variables were factors increasing the occurrence of anaemia in CKD patients. These determinants included:

- Sociodemographic factors such as age, gender, marital status, occupation, place of residence, education level, monthly income, access to food, and behavioral factors such as taking alcohol and smoking.
- Clinical characteristics such as the presence of co-morbidities such as diabetes, hypertension, hepatitis, HIV/AIDS, glomerulonephritis, obstructive uropathy, cancer, infections, duration and stage of CKD.

3.6.3 Sampling Technique

Convenience sampling were used whereby participants were selected based on their availability and willingness to take part in the study until the needed sample size was reached.

3.6.4 Data Collection Tool

- A structured questionnaire was used to obtain social demographic data and some of clinical information. The questionnaires consisted of fixed-response questions, which allowed for standardized data collection and statistical analysis.
- A checklist used to obtain clinical characteristics and laboratory parameters from medical records was utilized in the collection of data.

The instrument was adapted from a prior study conducted at the Hospital of Gondar University in northwestern Ethiopia (35). The questionnaire tool was created in English and translated into Swahili, which was the language spoken by most of the study participants**.**

3.6.5 Pre-Testing of the Tool

The pre-test of the data collection tool was conducted with 15 non-dialysis CKD patients, 5 patients at Tasakhtaa Private Hospital, and 10 patients at Mnazi Mmoja Referral Hospital. The aim was to ensure that the questionnaire was clear, understandable, and effectively captured the intended information before the main data collection phase.

3.7 Data collection procedures

- Participants who met the inclusion criteria and whose with completed medical records were recruited until the desired sample size of 195 was attained.
- Sociodemographic data were obtained from an interviewer-structured questionnaire, and clinical data were acquired retrospectively from medical records and then charted into a checklist.
- Participants were classified as anemic based on a hemoglobin level of <13 g/dL in men and <12 g/dL in women. Mild anemia was defined as Hb (11–11.9 g/dL (females), 11–12.9 g/dL (males), moderate as Hb of 8–10.9 g/dL, and severe anemia as Hb of <8 g/dL.
- The serum creatinine was used to estimate GFR using the chronic kidney disease epidemiology collaboration (CKD-EPI) equation: stage 1, eGFR >90 mL/min; stage 2, eGFR 60–89 mL/min; stage 3a, eGFR 45–59 mL/min; stage 3b, eGFR 30–44 mL/min; stage IV, eGFR 15–29 mL/min; and stage V, eGFR <15 mL/min.

3.8 Data management

The questionnaires were collected on the same day to maintain data management. The information gathered was then entered into SPSS software, and the computer was password-protected so that only the researcher could access it. A backup was stored on a flash disc. The investigator ensured that all data storage devices remained private and only available to the research team. After the study was over, all copies were destroyed.

3.9 Data analysis

The data were initially recorded in Excel and subsequently imported into SPSS version 26 for analysis. Descriptive analysis characterized and summarized baseline characteristics, with continuous variables summarized by mean and standard deviation, and categorical variables presented as frequencies, percentages, and illustrated through charts. The prevalence of anemia among CKD patients and its distribution were estimated across clinical characteristics. Associations between sociodemographic and clinical characteristics among anemic and non-

anemic patients were assessed using Pearson's chi-square test or Fisher's exact test (used when the expected cells were less than 5). Variables with a significance level of ≤0.2 were selected for inclusion in the modified Poisson regression model. All independent variables (such as sex, occupation, education level, income, mode of payment, and CKD stage) with p-values ≤ 0.05 and those with p-values ≤ 0.2 in univariate regression analysis were included in the multivariate analysis to control for potential confounding factors. Statistical significance in the multivariate analysis was defined as an adjusted prevalence ratio (APR) with a 95% confidence interval (CI) and a p-value ≤ 0.05, indicating variables significantly associated with anemia in CKD patients.

3.10 Ethical Consideration

Permission to perform this study was sought from the Institutional Review Board of the Muhimbili University of Health and Allied Sciences with Ref. No. DA.282/298/01.C/2133 and Zanzibar Health Research Institute with Ref. No. ZAHREC/02/ST/APR/2024/81. The permission to carry out the research was sought from the executive director and the chief of the internal medicine department at two selected hospitals in Zanzibar. Before data collection began, participants were provided with written consent. In addition, respondents were informed of the study's goal and their ability to withdraw from the interviews. Anonymity, which uses codes instead of names to ensure confidentiality and privacy, was used. Furthermore, participants were assured that the recorded information would never be shared with third parties if they didn't permit it, and their identities would not be disclosed.

3.12 Dissemination plan

Study findings will be disseminated to the MUHAS Research and Publication Committee, Muhimbili National Hospital, and MUHAS library for student review. Also, the results will be published in national and international journals for a wide range of scholars to broaden the body of knowledge.

CHAPTER FOUR

4.0 RESULTS

4.1 Sociodemographic Characteristics of Study Participants

The study included 195 participants, with 84 (43.1%) of the participants in the age group of 40–64 years old. The mean age of all participants was 55.8 ± 13.1 years. More than half of the participants, 102 (52.3%) were male, with the majority being married 141 (72.3%), and 126 (64.6%) living with their partners. About 70 (35.9%) had secondary education, 90 (46.2%) were self-employed, and 137 (70.3%) had a small average monthly income. Approximately three-quarters of the participants 142 (72.8%) were urban dwellers, and 151 (77.4%) were receiving hospital treatment free of charge. (**Table 1**).

Table 1: Sociodemographic Characteristics of CKD Patients (N=195)

Variables	Frequency	Percent (%)
Age group (years)		
18 – 39	23	11.8
40 – 64	121	62.1
65 and above	51	26.1
Sex		
Male	102	52.3
Female	93	47.7
Marital status		
Single	54	27.7
Married	141	72.3
Whom you live with		
Alone	8	4.1
Partner	126	64.6
Other family members	61	31.3
Educational status		
Never attended school	41	21.0
Primary education	56	28.7
Secondary education	70	35.9
Colleges and universities	28	14.4
Occupation status		
Employed	26	13.3
Self-employment	90	46.2
Non employed	79	40.5
Average monthly income		
Small amount (0-419,500 TZS)	137	70.3
Average (420000-884,100 TZS)	42	21.5
Large amount (884,100 TZS and above)	16	8.2
Residence area		
Urban	142	72.8
Rural areas	53	27.2
Mode of payment for hospital bill		
Health insurance coverage	44	22.6
Free of charge	151	77.4

4.2 Clinical characteristics of the patients

Out of 195 participants, 89 (45.6%) were diagnosed with CKD within a year, 83 (42.6%) were in CKD stage 5. Almost half (47.7%) of the patients had underlying comorbidities, with hypertension (50.6%) being the most common. Among the participants, four (19%) were smokers and three (12.8%) were alcohol users. More than half (68.2%) of the participants with documented anemia received hematinics (folate, folic acid). **(Table 2)**

Table 2: Clinical Characteristics of CKD Patients (N=195)

Variable	Frequency	Percent (%)
Duration of CKD		
<1 year	89	45.6
1-2 years	48	24.6
2 years and above	58	29.7
Stage of CKD		
Stages 1 &2	7	3.6
Stage 3	54	27.6
Stage 4	51	26.2
Stage 5	83	42.6
Presence of other comorbidity		
Yes	93	47.7
No	102	52.3
Underlying comorbidities		
Hypertension	47	50.6
Diabetes Mellitus	35	37.6
Others	11	11.8
Smoking		
Smokers	37	19
Non smokers	158	81.0
Alcohol use		
Alcoholic users	25	12.8
Non alcoholic	170	87.2
Type of treatment		
Hematinic (Folic acid)/ blood transfusion	133	68.2
None	62	31.8
Symptoms of anaemia at the time of recruitment		
Yes	97	49.7
No	98	50.3

Others include: *HIV/AIDS, Glomerulonephritis, Obstructive uropathy*

4.3 Prevalence of anaemia among CKD patients

Based on laboratory findings, the overall prevalence of anaemia among participants was 178 (91.3%) [95% CI (86.5-94.5)], with varying degrees of severity: 38 (19.5%) had mild anaemia [95% CI (14.5-25.6)], 118 (60.5%) had moderate anaemia [95% CI (53.5-67)], and 22 (11.3%) had severe anaemia [95% CI 7.6-16.5)]. The mean haemoglobin (Hb) concentration was 10.03 ± 1.759 g/dl, ranging from 6.2 to 14 g/dl. Among the patients, 78 (43.8%) were below the normal range for mean cell volume (MCV), 103 (57.8%) for mean cell haemoglobin (MCH), and 72 (40.4%) for mean cell haemoglobin concentration (MCHC). **(Table 3)**

Table 3: Laboratory profile and prevalence of anaemia in CKD patients (N=195)

Variable	Frequency (n)	Percent (%)
Anaemia status		
Anemic	178	91.3
Not anemic	17	8.7
Severity of anemia (n = 178)		
Mild	38	21.3
Moderate	118	66.3
Severe	22	12.4
MCV (fl)		
Normal range (80 – 100)	100	56.2
Below reference range (< 80)	78	43.8
MCH (n = pg)		
Normal range (27 – 32)	75	42
Below reference range (< 27)	103	57.8
MCHC (g/dl)		
Normal range (32 – 36)	106	59.6
Below reference range (< 32)	72	40.4

Mild *- (Hb level 11–12.9 g/dL)* ***Moderate -*** *(Hb level 8–10.9 g/Dl)* ***Severe-*** *(Hb level <8 g/dL)*

Not anemic*-(Hb level 11–12.9 g/dL) in male and (Hb level 11–11.9 g/dL) in female*

4.5 Relationship between sociodemographic factors, clinical characteristics, and anaemia

Study findings below depicted that there was a significant association between anaemia and independent variables like sex, occupation, level of education, average monthly income, mode of payment for hospital bills, and stages of CKD ($p = 0.043$, 0.001, <0.001, 0.012, 0.001, and <0.001), respectively, as their p-values were less than 0.05. **Whereby:**

Females appeared to have a higher prevalence of anemia 89 (95.7%) compared to males; those who never attended school had a significantly higher prevalence of anaemia 41 (100%), non-employed individuals had a significantly higher prevalence of anemia 77 (97.5%) compared to employed and self-employed individuals; those with a larger income had a lower prevalence of anemia 11 (68.8%); and those with health insurance coverage had a lower prevalence of anemia 34 (77.27%). Stage 4 and Stage 5 CKD patients had a significantly higher prevalence of anemia at 50 (98.04%) and 83 (100%), respectively. The prevalence of anemia was proportional to CKD stages: stage 1 and 2, 3, 4, and 5 CKD had 71.43%, 74.07%, 98.04%, and 100%, respectively.

Other factors like age, marital status, residence area, duration of CKD, alcohol use, smoking, and presence of other comorbidities were not statistically significantly associated with anemia ($p = 0.127$, 0.408, 0.568, 0.809, 0.251, 0.634, and 0.618), respectively, as their p-values were greater than 0.05. **(Table 4).**

Table 4: Relationship between socio-demographic, clinical characteristics and anaemia n= 195

Variables	Anemia status		Total	P value
	Present n (%)	Absent n (%)		
Age group (years)				
18 - 39	20(86.96)	3(13.04)	23	0.127*
40 - 64	114(94.21)	7(5.79)	121	
65 and above	44(86.27)	7(13.73)	51	
Sex				
Male	89(87.25)	13(12.75)	102	**0.043***
Female	89(95.70)	4(4.30)	93	
Marital status				
Single	51(94.44)	3(5.56)	54	0.408*
Married	127(90.05)	14(3.93)	144	
Whom you live with				
Alone	7(87.50)	1(12.50)	8	0.339*
Partner	58(95.08)	3(4.92)	61	
Other family members	113(89.68)	13(10.32)	126	
Educational status				
Never attended school	41(100)	0(0.00)	41	**<0.001***
Primary education	53(94.64)	3(5.36)	56	
Secondary education	65(92.86)	5(7.14)	70	
Colleges and universities	19(67.86)	9(36.14)	28	
Occupation status				
Employed	19(73.08)	7(26.92)	26	**0.001***
Self-employment	82(91.11)	8(8.89)	90	
Non employed	77(97.47)	2(2.53)	79	
Average monthly income				
Small amount (0-419,500 TZS)	128(93.43)	9(6.57)	137	**0.012***
Average (420000-884,100 TZS)	39(92.86)	3(7.14)	42	
Large amount (884,100 TZS and above)	11(68.75)	5(31.25)	16	
Residence area				
Urban	128(90.14)	14(9.86)	142	0.568*
Rural areas	50(94.34)	3(5.66)	153	

Mode of payment for hospital bill				
Health insurance coverage	34(77.27)	10(22.73)	44	**0.001***
Free of charge	144(95.36)	7(4.64)	151	
Duration of CKD				
<1 year	81(91.01)	8(8.99)	89	0.809*
1-2 years	43(89.58)	5(10.42)	88	
2 years and above	54(93.10)	4(6.90)	58	
Stage of CKD				
Stage 1 &2	5(71.43)	2(28.57)	7	**<0.001***
Stage 3	40(74.07)	14(25.93)	54	
Stage 4 **Age group (years)**	50(98.04)	1(1.96)	51	
Stage 5	83(100)	0(0.00)	83	
Presence of other comorbidity				
Yes	95(92.23)	8(7.77)	103	0.618
No	83(90.22)	9(9.78)	92	
Smoking				
Smokers	33(94.0)	4(6.0)	37	0.634*
Non smokers	145(91.8)	13(8.3)	158	
Alcohol use				
Alcohol users	23(81.1)	2(18.9)	25	0.251*
Non users	155(91.2)	15(8.8)	170	

4.6 Factors Associated with Anaemia among CKD Patients

We used a modified Poisson regression model to identify factors associated with anemia among CKD patients. In the univariate modified Poisson regression analysis, sex, level of education, occupation, average monthly income, and mode of payment for hospital bills were associated with anemia, as their p-value were <0.05. Multivariable modified Poisson regression analysis was carried out to determine the independent predictors of anemia among CKD patients by taking anemia as the outcome variable and including those variables with significant association obtained in the univariate analysis and those with p-value < 0.2. After adjusting for potential confounders, it was found that patients treated in a hospital free of charge (APR = 1.14, 95% CI: 1.01–1.29, p = 0.033) were 1.14 times more likely to develop anaemia compared to those

with health insurance coverage. Additionally, due to small sample sizes, participants who never attended school and those with only a primary level of education were combined. This group (APR = 1.29, 95% CI: 1.05–1.57, p = 0.015) was 1.29 times more likely to develop anaemia compared to participants with a college or university education. Similarly, participants with a secondary level of education (APR = 1.23, 95% CI: 1.003–1.51, p = 0.047) were 1.23 times more likely to develop anaemia compared to those with higher education. **(See Table 5).**

Table 5: Univariable and multivariable analysis of the factors associated with anaemia, N=195

		Univariable analysis			Multivariable analysis		
Variable	**Category**	**cPR**	**95% CI**	**p – value**	**aPR**	**95% CI**	**p – value**
Age (years)	≥ 65	0.99	0.82 – 1.20	0.936			
	40 – 64	1.08	0.92 – 1.28	0.339			
	18 – 39	Ref					
Sex	Female	1.10	1.01 – 1.20	0.035	1.00	0.91 – 1.10	0.962
	Male	Ref					
Education	No to primary	1.43	1.10 – 1.85	0.007	1.29	1.05 – 1.57	**0.015**
	Secondary	1.37	1.05 – 1.78	0.019	1.23	1.003 – 1.51	**0.047**
	College	Ref					
Occupation	Non-employed	1.33	1.05 – 1.69	0.017	1.12	0.90 – 1.39	0.312
	Self-employed	1.25	0.98 – 1.59	0.074	1.02	0.83 – 1.26	0.862
	Employed	Ref					
Average monthly income (Tsh/=)	0 – 419,500	1.36	0.97 – 1.90	0.071	1.05	0.74 – 1.48	0.789
	420,000 – 884,100	1.35	0.96 – 1.90	0.084	1.17	0.85 – 1.63	0.334
	≥ 884, 100						
Mode of payment	Free of charge	1.23	1.05 – 1.45	0.012	1.14	1.01 – 1.29	**0.033**
	Health insurance	Ref					
CKD stages	Stage 5	3.00	0.61 – 14.86	0.178	3.06	0.64 – 14.71	0.163
	Stage 4	2.94	0.59 – 14.58	0.187	2.95	0.61 – 14.19	0.177
	Stage 3	2.22	0.45 – 11.10	0.330	2.43	0.50 – 11.71	0.269
	Stage 2	3.00	0.61 – 14.86	0.178	3.39	0.70 – 16.37	0.129
	Stage 1	Ref					

Key: cPR: Prevalence Ratio, aPR: adjusted Prevalence Ratio, Ref: Reference Category

CHAPTER FIVE

5.0 DISCUSSION

This study was conducted to determine the magnitude of anaemia and its associated factors among patients with CKD in two hospitals in Zanzibar. A high burden of anaemia was noted with more than 90% of participants affected, and several factors were noted to influence occurrence of anaemia including sex, occupation, education, income, residence area, mode of payment, comorbidities, and CKD stage. The discussion is organized according to the study objectives.

Prevalence of anemia

The overall prevalence of anemia among CKD patients in this study was 91.3%. This is notably higher than findings from previous studies, including 31.4% in Dodoma, Tanzania (11), 53.5% in Addis Ababa, Ethiopia (10), 43.18% in South Africa (41), 45.0% in Korea (42), and 53.6% in Nepal (43). The variation in prevalence across these studies may be due to differences in study populations (10)(35) (41), methodologies (42), and participant inclusion and exclusion criteria. For instance, other studies employed cohort designs and included patients with specific serum creatinine levels and those stable for a certain period, which may explain the lower prevalence rates (43).

Findings from this study found that normochromic-normocytic (41.5%) and hypochromic-microcytic (40%) are the most common morphologic features of anaemia. These data are similar to the study that was done in South Africa (44). The main pathophysiological factor of anaemia in chronic kidney disease (CKD) is reduced erythropoietin secretion, which is explained by normochromic-normocytic anaemia. Conversely, hypochromic-microcytic anemia is primarily caused by iron deficiency, especially from decreased iron intake or iron loss, but it can also be explained by specific factors such as hemoglobinopathies, infectious diseases, and nutritional deficiencies (45). Thus, in addition to routine CKD care, nutritional support should be more frequently indicated among CKD patients to reduce the prevalence of these two morphologic features of anaemia among CKD patients.

Factors associated with anaemia among CKD patients

Clinical Characteristics

Many studies have shown an association between CKD stage and the prevalence and severity of anaemia (37) (10) (2). Similarly, the present investigation discovered a significant positive correlation ($P < 0.001$) between the CKD stage and the prevalence of anaemia. Furthermore, the prevalence of anaemia increased as the severity of CKD increased, rising from 33.3% at stage 1 to 100% at stage 5. These findings are not entirely new; a similar NHANES survey done in the United States indicated an increase in anaemia prevalence from 8.4% at stage 1 to 53.4% at stage 5 (32). A recent Korean cohort likewise showed a similar pattern, with a prevalence of 10% at stage 1 and 96.5% at stage 5 (42). Furthermore, these findings align with information gathered from several investigations in Ethiopia (35), the USA (37), and London (46). It has been proven that as GFR declines, hemoglobin levels fall, and the incidence and prevalence of anaemia rise. Additionally, declining eGFR is linked to progressive CKD, which can have negative clinical effects and result in low erythropoietin levels of metabolic products, hence renal failure (17). Therefore, identifying CKD patients at high risk for anaemia and monitoring haemoglobin levels should be done more regularly based on CKD stage. In contrast, a study conducted in South Africa revealed that the incidence of anemias did not rise linearly with the number of stages of CKD; rather, it increased with stages 1 and 5 of CKD, with the lowest prevalence occurring in stages 2 and 3 (41). This suggests that as kidney disease progresses from stage 2 to stage 3, there may have been some unidentified warning signs that led to the initial improvement in haemoglobin levels. Later, as the disease progresses from stage 4 to stage 5, haemoglobin concentrations eventually drop (41). Regular monitoring of hemoglobin levels and early identification of high-risk CKD patients are crucial for optimizing patient management and improving outcomes as the condition worsens.

In contrast to developed countries where early detection and management of CKD are prioritised (47), in this study, slightly less than half of patients (42.6%) were diagnosed when their CKD had progressed to stage 5. Patients' late arrangements for renal medical checkups may have been caused by several factors, including a lack of routine CKD screening programmes, late

recognition, inadequate follow-up care for CKD risk factors like diabetes and hypertension, and a preference for alternative treatments that increase the risk of CKD (48). Addressing these factors is critical to improving outcomes for CKD patients in developing nations. Efforts should focus on enhancing public awareness, structured screening, healthcare infrastructure strengthening, and evidence-based therapies, aiming to mitigate progression, reduce complications, and enhance quality of life.

Overall, the management of anaemia patients in this study was inadequate. Two-thirds (66.7%) of the patients received oral iron therapy, 3.1% had blood transfusions, and none received ESA due to limited availability. These findings contradict the data from the Gondar research, which revealed that iron therapy was provided to around 55% of anaemia patients, blood transfusions to 14% of patients, and ESA to 55.3% of patients (35). Moreover, clinical research has demonstrated that treating anaemia with hematinics and ESA enhances the quality of life, heart health, and physical activity. It may also slow down the course and morbidity of kidney disease (19). The availability and affordability of ESA and other essential treatments must be prioritized to optimize patient outcomes and mitigate the progression and complications of kidney disease.

Sociodemographic factors

Based on the sex of the participants, more than half (57.9%) of those who had anaemia were female. Similarly, Fishbone et al. found that in the National Health and Nutrition Examination Survey [1988–1994] and 1999–2004 surveys), adult women with CKD stages 3–5 had greater rates of anemia (69.9%–72.8%) than males (57.8%–58.8%) (28). This might be explained quite simply by premenopausal women’s blood loss that occurs during menstruation and pregnancy, along with inadequate nutritional intake. These findings underline the importance of targeted nutritional interventions and reproductive health considerations in the management and prevention of anemia among at-risk populations, particularly women with chronic health conditions like CKD. On the other hand, the research conducted in Malaysia showed the frequency of anaemia in the male population to be substantially greater (34.28%) than in the female population (19.28%) (49). This disparity underscores the need for region-specific studies and interventions tailored to local health dynamics and risk factors influencing anemia

prevalence among both genders.

Compared to patients with a college or university level of education, those who had never attended school or had only a primary level of education (APR = 1.29, 95% CI: 1.05–1.57, p = 0.015) were 1.29 times more likely to develop anemia. Similarly, patients with a secondary level of education (APR = 1.23, 95% CI: 1.003–1.51, p = 0.047) were 1.23 times more likely to develop anemia. The findings are in agreement with the results of an earlier study that was done at a tertiary hospital in Johannesburg, South Africa (41). This is because patients with higher levels of education typically have better health literacy and problem-solving skills, enabling them to understand their condition and the importance of medications such as erythropoiesis-stimulating agents (ESAs) and iron supplements. They are also more likely to adhere to treatment plans and dietary recommendations. Additionally, individuals with higher education levels may have stronger social networks and better advocacy skills, which enable them to seek and receive appropriate medical care. In contrast, those with lower levels of education may lack this access and support.

Moreover, the results found that patients who had access to free medical services were 1.14 times more likely to develop anaemia than patients with health insurance coverage (APR 1.14, 95% CI: 1.01–1.29, p = 0.033). Expanding health insurance coverage can lead to better healthcare access and potentially lower risks for anemia among CKD patients hence improve their health outcomes. However, our findings contradicted a study conducted in South Africa, which found that CKD patients with access to free medical services were less likely to develop anaemia. This is because South Africa has a more established healthcare system, and the quality of care may be higher compared to our research area (50).

5.1 Strengths and limitations

Strengths of the study

This study has discovered the high prevalence of anaemia among patients with CKD. This unique picture provided by this study can assist hospital management, medical professionals, nurses, and other stakeholders in the healthcare system in enhancing the current guidelines and

strategies for drawing greater attention to anaemia in CKD patients.

The limitations of the study

Firstly, findings cannot be generalized as the study involved only two tertiary hospitals and used a convenience sampling technique, lead to potential biases.

Second, serum iron, TSAT, ferritin level, vitamin B12, and folate were not assessed for our subjects. However, these tests could have provided further information about their iron and nutritional status of anaemia.

Third, there was the loss of some information, especially laboratory investigations especially in hospitals that were not using electric databases.

Despite these limitations, this study has contributed to the existing evidence on the prevalence, clinical characteristics, and factors associated with anaemia across CKD stages in non-dialysis CKD patients.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study revealed that anemia is a prevalent comorbidity among patients with chronic kidney disease (CKD) in Zanzibar. Anaemia was common at all stages of chronic renal disease and exacerbated by a steady reduction in kidney function. Patients with lower levels of education and who received free hospital care were more likely to acquire anaemia than those who had health insurance.

6.2 Recommendations

1. Healthcare institutions should lead improvements in several areas of CKD care, particularly early detection and treatment, and should implement periodic screening and intervention programs to prevent anemia among CKD patients.
2. Policymakers and government support should develop anaemia preventive policies relevant to the country's context, measures to increase health insurance coverage and improving access to essential treatments such as ESAs should be implemented to improve the quality of care, particularly in hospitals that provide free CKD services.
3. Health care providers and institutions should develop targeted educational programs for CKD patients to aim to improve health literacy about CKD, the importance of iron nutrition and supplements, and general disease management.
4. Higher learning and Research institutions should conduct more research with a strong study design and larger sample sizes, including important laboratory results such as serum iron, TSAT, ferritin levels, vitamin B12, and folate, to provide more solid data on different types of anaemia in CKD and enhance targeted treatment strategies.
5. Healthcare Institutions in collaborating with IT departments should implement an electronic database to enhance the accurate storage and accessibility of patient information that can be used in secondary research.

REFERENCES

1. Lameire NH, Levin A, Kellum JA, Cheung M, Jadoul M, Winkelmayer WC, et al. Harmonizing acute and chronic kidney disease definition and classification: report of a Kidney Disease: Improving Global Outcomes (KDIGO) Consensus Conference. Kidney Int. 2021;100(3):516–26.

2. Palaka E, Grandy S, Van Haalen H, McEwan P, Darlington O. The Impact of CKD Anaemia on Patients: Incidence, Risk Factors, and Clinical Outcomes - A Systematic Literature Review. Int J Nephrol. 2020;2020.

3. Cemin R, Foco L, Zoccali C, De Caterina R. Should we continue assessing glomerular filtration rate with the cockroft–gault formula in noac-treated patients? The magnitude of the problem. J Clin Med. 2020;9(6):1–13.

4. International K. KDIGO 2022 Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease. Kidney Int. 2022;102(5):S1–127.

5. Wilson S, Mone P, Jankauskas SS, Gambardella J, Santulli G. Chronic kidney disease: Definition, updated epidemiology, staging, and mechanisms of increased cardiovascular risk. J Clin Hypertens. 2021;23(4):831–4.

6. Stauffer ME, Fan T. Prevalence of anemia in chronic kidney disease in the United States. PLoS One. 2014;9(1):2–5.

7. Mammo M, Id T, Wondie A, Terefe TF, Tarekegn TT, Gebreeyesus FA, et al. Anemia and its predictors among chronic kidney disease patients in Sub-Saharan African countries : A systematic review and. 2023;1–17.

8. Ploth DW, Mbwambo JK, Fonner VA, Horowitz B, Zager P, Schrader R, et al. Prevalence of CKD, Diabetes, and Hypertension in Rural Tanzania. Kidney Int Reports. 2018;3(4):905–15.

9. Vecchio L Del, Minutolo R. ESA , Iron Therapy and New Drugs : Are There New

Perspectives in the Treatment of Anaemia ? 2021;

10. Disease R. Prevalence of Anemia and Its Associated Factors Among Chronic Kidney Disease Patients Attending Selected Public Hospitals of Addis Ababa , Ethiopia : Institutional-Based Cross-Sectional Study. 2021;67–75.

11. Meremo AJ, Mwashambwa MY, Masalu MB, Kapinga J, Tagalile R, Ngilangwa DP, et al. Prevalence and predictors of anaemia among patients presenting with kidney diseases at the university of Dodoma hospital in central Tanzania. Tanzan J Health Res. 2017;19(3):1–7.

12. Ruggajo P, May S, Jonathan I, Mngumi J, Fredrick F, Chillo P, et al. Anaemia in Patients on Haemodialysis Therapy in Dar es Salaam , Tanzania. 2019;5(4):1–6.

13. Wouters HJCM, van der Klauw MM, de Witte T, Stauder R, Swinkels DW, Wolffenbuttel BHR, et al. Association of anemia with health-related quality of life and survival: A large population-based cohort study. Haematologica. 2019;104(3):468–76.

14. Hanna RM, Streja E, Kalantar-Zadeh K. Burden of Anemia in Chronic Kidney Disease: Beyond Erythropoietin. Adv Ther. 2021;38(1):52–75.

15. Jha VK, Shashibhushan. Clinical Profile of Chronic Kidney Disease Patients in a Tertiary Care Hospital - An Observational Study. SM J Nephrol Kidney Dis. 2018;2(2):1016.

16. Tsai SF, Tarng DC. Anemia in patients of diabetic kidney disease. J Chinese Med Assoc. 2019;82(10):752–5.

17. Portolés J, Martín L, Broseta JJ, Cases A. Anemia in Chronic Kidney Disease: From Pathophysiology and Current Treatments, to Future Agents. Front Med. 2021;8(March):1–14.

18. Saritas T, Floege J. Cardiovascular disease in patients with chronic kidney disease. Herz [Internet]. 2020 Apr 14;45(2):122–8. Available from: http://link.springer.com/10.1007/s00059-019-04884-0

19. Rovin BH, Adler SG, Barratt J, Bridoux F, Burdge KA, Chan TM, et al. KDIGO 2021 Clinical Practice Guideline for the Management of Glomerular Diseases. Kidney Int. 2021;100(4):S1–276.

20. Ogata M, Fujii H, Sumi H, Ushimaru S, Fujishima R, Tominaga N. Renal anemia with a relatively normal renal function in vasculitis-induced acute tubulointerstitial damage. Ren Fail [Internet]. 2023;45(1). Available from: https://doi.org/10.1080/0886022X.2023.2173490

21. Guzzo I, Atkinson MA. Anemia in Chronic Kidney Disease. In: Pediatric Nephrology [Internet]. Cham: Springer International Publishing; 2022. p. 1779–94. Available from: https://link.springer.com/10.1007/978-3-030-52719-8_130

22. Guzzo I, Atkinson MA. Anemia in Chronic Kidney Disease. Pediatr Nephrol Eighth Ed. 2022;66(Suppl 1):1779–94.

23. Yin P, Wu Q, Shou L, Dong X. Risk factors for anemia in patients with chronic kidney disease: A protocol for systematic review and meta-analysis. Med (United States). 2021;100(40):E27371.

24. Chuengsaman P, Narenpitak S, Sritippayawan S. Efficacy and safety of recombinant human erythropoietin (Hema-Plus®) for management of anemia in Thai patients on peritoneal dialysis. World J Nephrol. 2021;10(6):109–21.

25. Pasini E, Corsetti G, Romano C, Aquilani R, Scarabelli T, Chen-Scarabelli C, et al. Management of anaemia of chronic disease: Beyond iron-only supplementation. Nutrients. 2021;13(1):1–10.

26. Cockwell P, Fisher LA. The global burden of chronic kidney disease. Lancet [Internet]. 2020;395(10225):662–4. Available from: http://dx.doi.org/10.1016/S0140-6736(19)32977-0

27. Ryu SR, Park SK, Jung JY, Kim YH, Oh YK, Yoo TH, et al. The prevalence and management of anemia in chronic kidney disease patients: Result from the KoreaN

Cohort Study for Outcomes in Patients With Chronic Kidney Disease (KNOWCKD). J Korean Med Sci. 2017;32(2):249–56.

28. Alagoz S, Dincer MT, Eren N, Bakir A, Pekpak M, Trabulus S, et al. Prevalence of anemia in predialysis chronic kidney disease: Is the study center a significant factor? PLoS One. 2020;15(4):1–9.

29. CHUN LEONG L. POS-237 Prevalence and risk factors of anemia among non-dialysis chronic kidney disease patients: a single-centre, cross-sectional study from Malaysia. Kidney Int Reports. 2022;7(2):S104.

30. Cases A, Egocheaga MI, Tranche S, Pallarés V, Ojeda R, Górriz JL, et al. Anemia en la enfermedad renal crónica: protocolo de estudio, manejo y derivación a Nefrología. Semergen. 2018;44(1):37–41.

31. Farrington DK, Sang Y, Grams ME, Ballew SH, Dunning S, Stempniewicz N, et al. Anemia Prevalence, Type, and Associated Risks in a Cohort of 5.0 Million Insured Patients in the United States by Level of Kidney Function. Am J Kidney Dis [Internet]. 2023;81(2):201-209.e1. Available from: https://doi.org/10.1053/j.ajkd.2022.07.014

32. Stats F. Chronic kidney disease in the united states, 2021. Adv Surg Med Spec. 2023;(March 2020):167–82.

33. Kuragano T, Mizusaki K, Kimura T, Nakanishi T. Anemia Management Considering the Pathophysiology of Elderly Chronic Kidney Disease Patients. Contrib Nephrol. 2019;198:135–43.

34. St Peter WL, Guo H, Kabadi S, Gilbertson DT, Peng Y, Pendergraft T, et al. Prevalence, treatment patterns, and healthcare resource utilization in Medicare and commercially insured non-dialysis-dependent chronic kidney disease patients with and without anemia in the United States. BMC Nephrol. 2018;19(1):1–11.

35. Disease R, Adera H, Hailu W, Adane A, Tadesse A. Prevalence Of Anemia And Its Associated Factors Among Chronic Kidney Disease Patients At University Of Gondar

Hospital , Northwest Ethiopia : A Hospital-Based Cross Sectional Study. 2019;219–28.

36. Abd Elhafeez S, Bolignano D, D'Arrigo G, Dounousi E, Tripepi G, Zoccali C. Prevalence and burden of chronic kidney disease among the general population and high-risk groups in Africa: A systematic review. BMJ Open. 2018;8(1).

37. Kovesdy CP, Davis JR, Duling I, Little DJ. Prevalence of anaemia in adults with chronic kidney disease in a representative sample of the United States population: analysis of the 1999–2018 National Health and Nutrition Examination Survey. Clin Kidney J. 2023;16(2):303–11.

38. Kalra PA, Bhandari S, Spyridon M, Davison R, Lawman S, Mikhail A, et al. NIMO-CKD-UK: a real-world, observational study of iron isomaltoside in patients with iron deficiency anaemia and chronic kidney disease. BMC Nephrol. 2020;21(1):1–10.

39. Farrington DK, Sang Y, Grams ME, Ballew SH, Dunning S, Stempniewicz N, et al. Anemia Prevalence, Type, and Associated Risks in a Cohort of 5.0 Million Insured Patients in the United States by Level of Kidney Function. Am J Kidney Dis. 2023;81(2):201-209.e1.

40. Kaze FF, Kowo MP, Wagou IN, Maimouna M, Menye HD, Fouda E, et al. Hematological Disorders during Chronic Kidney Disease Stages 3 to 5 Non-Dialysed in Cameroon. Open J Nephrol. 2020;10(2):61–72.

41. Nalado AM, Mahlangu JN, Waziri B, Duarte R, Paget G, Olorunfemi G, et al. Ethnic prevalence of anemia and predictors of anemia among chronic kidney disease patients at a tertiary hospital in Johannesburg, South Africa. Int J Nephrol Renovasc Dis. 2019;12:19–32.

42. Kim H, Koh J, Park SK, Oh KH, Kim YH, Kim Y, et al. Baseline characteristics of the autosomal-dominant polycystic kidney disease sub-cohort of the KoreaN cohort study for outcomes in patients with chronic kidney disease. Nephrology. 2019;24(4):422–9.

43. Adhikary LP, Sah SK. Prevalence of Anemia and its Association with Kidney Function

in Pre- Dialysis CKD Patients in Nepal: A Cross-Sectional Study. Intern Med Open Access. 2018;08(05):8–11.

44. George C, Matsha TE, Erasmus RT, Kengne AP. Haematological profile of chronic kidney disease in a mixed-ancestry South African population: A cross-sectional study. BMJ Open. 2018;8(11).

45. Mikhail A, Brown C, Williams JA, Mathrani V, Shrivastava R, Evans J, et al. Renal association clinical practice guideline on Anaemia of Chronic Kidney Disease. BMC Nephrol. 2017;18(1):1–29.

46. Delanerolle G, Forbes A, van Vlymen J, Gallagher H, Cole N, Hassan S, et al. Step-Wise Management of Anemia in Patients With Chronic Kidney Disease in Primary Care: Qualitative Study. J Prim Care Community Heal. 2023;14.

47. Nathan R. Hill1*, Samuel T. Fatoba1, Jason L. Oke1, Jennifer A. Hirst1, Christopher A. O'Callaghan2, Daniel S. Lasserson1 FDRH. global prevalence of ckd. Indian J Med Sci. 2013;67(5):103–16.

48. Kaze AD, Ilori T, Jaar BG, Echouffo-Tcheugui JB. Burden of chronic kidney disease on the African continent: A systematic review and meta-analysis. BMC Nephrol. 2018;19(1):1–11.

49. Salman M, Khan AH, Adnan AS, Sulaiman SAS, Hussain K, Shehzadi N, et al. Prevalence and management of anemia in pre-dialysis Malaysian patients: A hospital-based study. Rev Assoc Med Bras. 2016;62(8):742–7.

50. Nalado AM, Mahlangu JN, Waziri B, Paget G, Olorunfemi G, Naicker S, et al. Ethnic prevalence of anemia and predictors of anemia among chronic kidney disease patients at a tertiary hospital in Johannesburg , South Africa Ethnic prevalence of anemia and predictors of anemia among chronic kidney disease patients at a tertiary hospi. 2019;

APPENDICES

Appendix I: Consent form

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED HEALTH SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS

PARTICIPATION OF THE RESEARCH STUDY CONSENT FORM

HI! My name is **Fadhila Maulidi**, a Muhimbili University of Health and Allied Sciences Master of Nephrology Nursing student. I am currently researching the **prevalence of anemia and its associated factors among CKD patients at Mnazi Mmoja and Tasakhtaa Hospital, Zanzibar.**

The research aims

The research aims to determine the prevalence of anemia and its associated factors among CKD patients at Mnazi Mmoja and Tasakhtaa Hospital, Zanzibar.

The findings will be valuable in improving anemia screening, diagnosis, and management as part of CKD care. If you agree to share in the study, you'll be asked questions and respond to them.

Confidentiality

Codes will protect the acquired data; no names will be needed. The questionnaire data will be entered into the computer by using your identification number, and names and other identifying information will not be used if the study findings are published or presented at a scientific conference.

Benefits

If you agree to participate in the study, I request that you assist in gathering data so that the health government and other shareholders can find the finest method to deliver health preservation and reduce the burden of anemia in CKD patients**.**

Risks

Your participation in this research is unlikely to cause harm to you.

Alternatives and withdrawal rights

This research is optional, and you may opt-out at any time. No penalty is imposed for study refusal.

Who should you contact? If you have a question about this study, ask the principal researcher.

FADHILA MAULIDI

P.O. Box 65000, Dares Salaam. Tel. 0623155928

For inquiries concerning your participant rights, contact Prof. Bruno F. Sunguya, MUHAS Senate Research and Publications Committee Chair, P.O. Box 65001, Dar es Salaam.

Tel: +255 222152489.

The participant disagrees...

I..... My questions were solved after reading this. I consent to this research.

Sign for who is participating.....date.....

Sign of investigator/assistant.....Date.....

Appendix II: Fomu ya kuomba Ridhaa

Habari yako, Mimi, ni Fadhila Maulidi, mwanafunzi ninayefanya utafiti wa lengo la kuchunguza kuenea kwa upungufu wa damu, viambatanishi na visababishi vyake kwa wagonjwa wanaoumwa ugonjwa sugu wa figo katika Chuo kikuu cha afya kilichopo-Muhimbili.

Lengo la utafiti

Utafiti huu una lengo la kujua ukubwa wa tatizo la upungufu wa damu, viambatanishi na visababishi vyake kwa wagonjwa sugu wa figo.

Majibu ya utafiti yatakuza uboreshaji wa huduma za kupungukiwa damu katika hatua za awali za ugonjwa. Nakuomba kukubali ushiriki. Kama utakubali kushiriki, katika tafiti hii nitakuuliza baadhi ya maswali unayeweza kujibu kwa kadiri utavyoelewa ili kuweza kukusanya taarifa muhimu ila kuweza kufanikisha malengo yaliyopangwa.

Kukubali kushiriki

Ukikubali kushiriki katika huu utafitii utaombwa kujibu maswali. Ntakusomea maswali kwa usahihi halafu utayajibu.

Uhifadhi

Taarifa utazotupatia zitatumika kwa lengo ya utafiti huu tu na zitatunzwa kwa Usiri. Jina lako halitatumika bali utatambulishwa na namba katika kitambulisho chako. Taarifa zitazopatikana katika dodoso hili zitaingizwa katika computa na hataruhusiwa mtu mwingine kutumia taarifa zako bali sisi wafanya tafiti tu ndio tuna uwezo wa kutumia dodoso hizo.

Faida za ushiriki katika utafiti

Faida ya ushiriki ni kwamba, taarifa utazotupatia zitawezesha kugundua ukubwa wa tatizo la upungufu wa damu kwa wagonjwa sugu wa figo na visababishi hivyo kuweza kuweka mikakati thabiti kuzuia ili kuweza kupanguza vifo ndani ya ichi na duniani kote.

Madhara ya Utafiti

Utafiti huu hauna madhara yeyote kwa mshiriki

Haki ya kujitoa

Mshiriki ana haki ya kujitoa muda wowote atapojiskia kutoka na hakuna sheria itayomzuia au kumuhukumu kwa kujitoa kwake katika ushiriki hata kama mwanzoni alikubali kushiriki.

Kama utakuwa na maswali juu ya kushiriki kwako katika huu utafiti unaweza kuwasiliana na mratibu wa utafiti, **Fadhila Maulidi**

S.L.P 65000, Dar es Salaam, Namba ya simu: 0623155928

Maswali kuhusiana na mambo ambayo unataka kujua kuhusu kushiriki katika utafiti huu utawasiliana na Mwenyekiti wa kamati katika utafiti wa chuo: S.L.P 65001, Dar es Salaam Simu na: +255 222152489.

Unaridhia kujiunga katika huu utafiti?

Siridhii……

Jina langu……. nimeelewa yaliyoandikwa katika dodoso hili. Maswali niliyouliza yametolewa ufafanuzi, naridhia kushiriki katika huu utafiti.

Saini ya anaeshiriki ……

Sahihi ya anaefanya utafiti…… Tarehe…….....

Appendix III: Questionnaire

PREVALENCE OF ANAEMIA AND ITS ASSOCIATED FACTORS AMONG PATIENTS WITH CKD ATTENDING AT MNAZI MMOJA AND TASAKHTAA HOSPITAL, ZANZIBAR

PART A. SOCIODEMOGRAPHIC DATA

Serial NO.....Interview date

Patient ID……Contact……

PART A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Age of participants……
2. Sex
   a. Male
   b. Female

3. Marital status
   a. Single/ /Separated/divorced/Widowed
   b. Married

4. Who do you live with?
   a. Alone

   b. Partner

   c. other family members

5. Education level
   a. Never attended school
   b. Primary education
   c. Secondary education
   d. Education at colleges and universities

6. Occupation
    a) Employed
    b) Self employed
    c) Non employed

7. Average monthly income
    a) Small amount (0-419,500 TZS)
    b) Average (420000-884,100 TZS)
    c) Large amount (884,100 TZS and above)

8. Residence area
    a) Urban
    b) Rural areas

9. Mode of payment for hospital bill
    a) Health insurance coverage
    b) Free of charge

PART C: CLINICAL CHARACTERISTICS

10. For how long have you been suffering/diagnosed with CKD
    a) Less than 1 year
    b) One to two years
    c) Above 2 years
11. Stage of CKD at first time of diagnosis …….
12. Presence of comorbidity
    a) Yes
    b) No

13. Mention a comorbidity you have.
    a) Diabetes Mellitus
    b) Hypertension
    c) HIV/AIDS
    d) Glomerulonephritis
    e) Obstructive uropathy
    f) Polycystic kidney disease
    g) Hepatitis
    h) Others……...
14. Smoking
    a) Smoker
    b) Non smoker
    c) Never
15. Alcohol use
    a) Alcohol user
    b) Non alcohol

PREVALENCE OF ANEMIA (CHECKLIST)

CKD DIAGNOSIS AND STAGES

1. CKD diagnostic criteria: eGFR <60 ml/min/1.73m2 at research time.
Date……serum creatinine……. eGFR levels……...stage…….

2. CKD duration since admission…. ……...months

3. Hemoglobin level in g/dl at time of doing research……

4. Symptoms of anemia at the time of recruitment
   a) Yes
   b) No

5. RBC Indices: MCV, ……. … MCH, …….... ... MCHC.……

6. Ferritin level……ug/L

7. Saturation. Of Transferrin ……%

8. Serum B12 level……Serum Folate level in blood……

9. Erythropoietin level……. mIU/mL

10. Reticulocyte count ……

11. Treatment status for anemia
    a) Yes
    b) No

12. Current anemia treatment
    a) Blood transfusion, if yes latest date received
    b) Hematinic (Fessolate, Folic acid)
    c) ESA supplements
    d) Iron sucrose

Appendix IV: Questionnaire- Swahili Version

A. MAELEZO YA BINAFSI

1. Miaka ya mhojiwa .....

2. Jinsia ya mhojiwa
   a) Kiume
   b) Kike

3. Hali ya ndoa
   a) Sajaolewa/ Mtalakiwa/ Mjane
   b) Nina ndoa

4. Unaishi na nani?
   a) Peke yangu
   b) Na mwenza wangu
   c) Washiriki wengine wa familia

5. Kiwango cha juu cha elimu
   a) Sijui kusoma/Msingi
   b) Sekondari
   c) Vyuo vya kati/chuo kikuu

6. Shughuli inayokupatia kipato kwa ajili ya kujikimu
   a) Mtumishi
   b) Shughuli binafsi
   c) Sina kazi

7. Kipato chako kwa mwezi
   a) Kidogo (SH 0-419,500 za Tz)
   b) Wastani (SH 420,000-884,100 za Tz)
   c) Kikubwa (SH 884,100 na zaidi)

8. Makazi
   a) Mjini
   b) Shamba

9. Unalipaje bili ya hospitali
   a) Natumia bima
   b) Natibiwa bure

SEHUMU YA TATU: SIFA ZA KLINIC

10. Ni kwa muda gani umegundulika na ugonjwa wa figo
   a) Chini ya mwaka mmoja
   b) Mwaka 1 hadi 2
   c) Zaidi ya miaka 2

11. Uligundulika kuwa na ugonjwa sugu wa figo ulipofikia hatua ipi? ……

12. Una magonjwa sugu mengine yanayoambatana na ugonjwa wa figo?
   a) Ndio
   b) Hapana

13. Kama jibu ni ndio, yataje
   a) Kisukari
   b) Presha kubwa ya damu
   c) Ugonjwa wa ukimwi

d) Shinikizo la damu kwenye mishipa ya figo

e) Kizuizi cha mkojo

f) Ugonjwa wa figo wa vipele vingi

g) Ugonjwa wa homa ya ini

h) Mengineyo

14. Uvutaji wa sigara

a) Navuta

c) Sijawahi kuvuta sigara

15.Unywaji wa pombe

a) Nakunywa

c) Sijawahi kunywa pombe

Appendix V: Approval for ethical

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

Ref. No.DA.282/298/01.C/2133 Date: 02/04/2024

MUHAS-REC-04-2024-2133

FADHILA MAULIDI SALIMU
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: PREVALENCE OF ANEMIA, CLINICAL CHARACTERISTICS, AND ITS ASSOCIATED FACTORS AMONG CKD PATIENTS AT MNAZI MMOJA AND TASAKHTAA HOSPITAL, ZANZIBAR

Reference is made to the above heading,

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 02/04/2024
EXPIRATION DATE OF APPROVAL: 02/04/2025

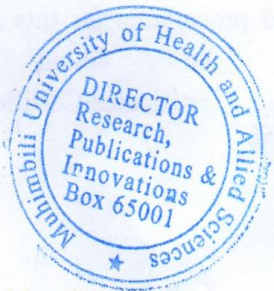
STUDY DESCRIPTION:
Purpose:

The purpose of this descriptive, cross-sectional study is to determine the prevalence of anemia, clinical characteristics and its associated factors among CKD patients at chosen hospitals in Zanzibar.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014554.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain Data Transfer Agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain Material Transfer Agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Apply for and obtain permission to publish the results from National Institute for Medical Research. The application should be before submitting to a publisher and not concurrently through the email publications@nimr.or.tz.
9. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
10. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
11. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.



Dr. Nahya Salim Masoud,

Chairperson, MUHAS Research and Ethics Committee

REVOLUTIONARY GOVERNMENT OF ZANZIBAR

Ministry of Health,
P. O. Box 236,
Street: Mnazi Mmoja - Zanzibar
Tel: +255-24-2231684
Email: info@mohz.go.tz
Website: www.mohz.go.tz

Zanzibar Health Research Institute,
87 Barabara ya Binguni
P. O. Box 236
Website: www.zahri.go.tz
Postcode: 72208, Binguni
Street: Binguni – Zanzibar
Tel: +255(0) 776 264 880
Email: zahrec@zahri.go.tz

Ref: NO. ZAHREC/02/ST/APR/2024/81 15th April, 2024

Fadhila Maulid,
Student Researcher,
MUHAS.

RE: ETHICAL CLEARANCE FOR CONDUCTING HEALTH RESEARCH IN ZANZIBAR

This is to certify that the research protocol titled **"Prevalence of Anemia, Clinical Characteristics, And Its Associated Factors among Patients with Chronic Kidney Disease at Mnazi Mmoja and Tasakhtaa Hospital, Zanzibar."** was received and reviewed on the 11th of March, 2024.

We would like to inform you that your proposal has been "**Approved**" for implementation.

Sites of Research: Mnazi Mmoja and Tasakhtaa Hospital.

The Principal Investigator has to:

i. Submit your progress report and a final report upon completion of Research.
ii. Seek permission for Publication of results from ZAHREC.
iii. Submit Copies of the final Publications to ZAHREC.
iv. Seek approval for any changes made to the approved protocol prior to their implementation

Any researcher who deviates or fails to comply with these conditions shall be guilty of an offense and shall be liable. **Six months: 15/04/2024 - 14/10/2024**

Thanks in advance.

ZANZIBAR HEALTH RESEARCH INSTITUTE * P.O. Box 236, ZANZIBAR *
23 APR 2024

Bernard P. Mfuta,
ACTING CHAIR- HRCC,
ZANZIBAR HEALTH RESEARCH INSTITUTE,
BINGUNI,
ZANZIBAR.

Amour S. Mohamed,
DIRECTOR GENERAL,
MINISTRY OF HEALTH,
ZANZIBAR.

Appendix VI: Introduction Letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.457/2022 04th April, 2024

The Clinical Director,
Ampola Tasakhtaa Hospital,
P.O. Box 1116,
ZANZIBAR

Re: INTRODUCTION LETTER OF FADHILA MAULID SALIMU

The bearer of this letter is Fadhila Maulid Salimu (HD/MUH/T.457/2022), a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MSc. Nursing Nephrology.

As part of her studies she intends to do a study titled: **"Prevalence of Anemia, Clinical characteristics and its Associated Factors Among CKD Patients at Mnazi Mmoja and Tasakhtaa Hospital, Zanzibar."**

The research has been approved by the Chairman of University Senate.

Kindly provide her the necessary assistance to facilitate the conduct of her research.

We thank you for your cooperation.

Mr. Sebe Mohamed
For: DIRECTOR, POSTGRADUATE STUDIES

c.c. Fadhila Maulid Salimu

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015, Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.457/2022 04th April, 2024

The Medical Officer In-Charge,
Mnazi Mmoja Hospital,
P.O. Box 672,
ZANZIBAR

Re: INTRODUCTION LETTER OF FADHILA MAULID SALIMU

The bearer of this letter is Fadhila Maulid Salimu (HD/MUH/T.457/2022), a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MSc. Nursing Nephrology.

As part of her studies she intends to do a study titled: **"Prevalence of Anemia, Clinical characteristics and its Associated Factors Among CKD Patients at Mnazi Mmoja and Tasakhtaa Hospital, Zanzibar."**

The research has been approved by the Chairman of University Senate.

Kindly provide her the necessary assistance to facilitate the conduct of her research.

We thank you for your cooperation.

Mr. Sebe Mohamed
For: DIRECTOR, POSTGRADUATE STUDIES

c.c. Fadhila Maulid Salimu

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix VII: Digital Receipt

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Fadhila SALUM
Assignment title:	dissertations
Submission title:	PREVALENCE, CLINICAL CHARACTERISTICS, AND FACTORS AS...
File name:	iated_factors_among_CKD_patients_in_Zanzibar_2_Currently_...
File size:	579.52K
Page count:	66
Word count:	12,300
Character count:	69,406
Submission date:	09-Jul-2024 01:37PM (UTC+0300)
Submission ID:	2308937110



Copyright 2024 Turnitin. All rights reserved.

Appendix VIII: Plagiarism Report

PREVALENCE, CLINICAL CHARACTERISTICS, AND FACTORS ASSOCIATED WITH ANAEMIA AMONG PATIENTS WITH CHRONIC KIDNEY DISEASE AT MNAZI MMOJA AND TASAKHTAA HOSPITAL, ZANZIBAR

ORIGINALITY REPORT

25%	23%	13%	12%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Muhimbili University of Health and Allied Sciences Student Paper	5%
2	dspace.muhas.ac.tz:8080 Internet Source	2%
3	www.dovepress.com Internet Source	1%
4	www.ncbi.nlm.nih.gov Internet Source	1%
5	wiredspace.wits.ac.za Internet Source	1%
6	journals.lww.com Internet Source	1%
7	www.researchsquare.com Internet Source	1%
8	ihi.eprints.org Internet Source	1%