AFRICA UNIVERSITY

(A United Methodist-Related Institution)

THYROID DYSFUNCTION AMONGST PATIENTS ATTENDING CITIMED HOSPITAL IN 2024

BY

PAULINE CHIPAKO

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE BACHELOR OF MEDICAL LABORATORY SCIENCES HOUNOURS IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL RESOURCES.

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Abstract

Thyroid dysfunction is a significant global health concern that affects metabolic processes and overall well-being. This study sought to assess the prevalence of thyroid dysfunction and its association with socio-demographic factors among patients attending Citimed Hospital in Chitungwiza, Zimbabwe, in 2024. The research was conducted using a retrospective cross-sectional design, examining laboratory records of 90 patients who underwent thyroid function testing in 2024. A random sampling technique was employed to ensure representation across gender, age, and location. Data collection included thyroid hormone levels (TSH, fT3, fT4 and socio-demographic variables was analysed through descriptive and inferential statistics. The results revealed that thyroid dysfunction was more prevalent in females (56.7%) and predominantly affected individuals aged over 60 years. The most common thyroid disorder was hypothyroidism, accounting for 43.1% of the cases, followed by hyperthyroidism (10.3%). Factors contributing to thyroid dysfunction included advanced age, female gender and limited access to healthcare. Thyroid function test abnormalities were significantly associated with the presence of thyroid dysfunction, with notable variations in TSH and fT4 levels. The findings underscore the critical need for early detection and intervention, especially among high-risk groups such as the elderly and females. Based on the study, it is recommended that Citimed Hospital enhances screening, diagnostic capabilities, and public awareness campaigns to mitigate the burden of thyroid diseases. Furthermore, affordable diagnostic tools and community-based health education can improve access and early management. This study provides localized insight into thyroid health, serving as a basis for clinical practice improvements and future public health interventions aimed at managing endocrine disorders in resource-limited settings.

Keywords: Thyroid dysfunction, hypothyroidism, hyperthyroidism, Citimed Hospital, TSH, fT3, fT4, Zimbabwe, endocrine disorders, prevalence, socio-demographic factors.

Declaration

I PAULINE CHIPAKO hereby declare that this dissertation is my original work except where I have given credit to sources. The work has never been submitted, nor will it ever be submitted for a degree at any other institution.

Pauline Chipako	p. chipako	11/04/2025
Name of Student	**Signature**	**Date**
Mr G. Malunga		11/04/2025
Name of Supervisor	**Signature**	**Date**

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List of Acronyms

TFT- Thyroid Function Test

TSH - Thyroid Stimulating Hormone

fT3 - Free Thyroxine

fT4 - Free Triiodothyronine

TgAb - Thyroglobulin Antibody

TPOAb -Thyroid peroxidase Antibody

ATA - American Thyroid Association

NHANES - National Health and Nutrition Examination Survey

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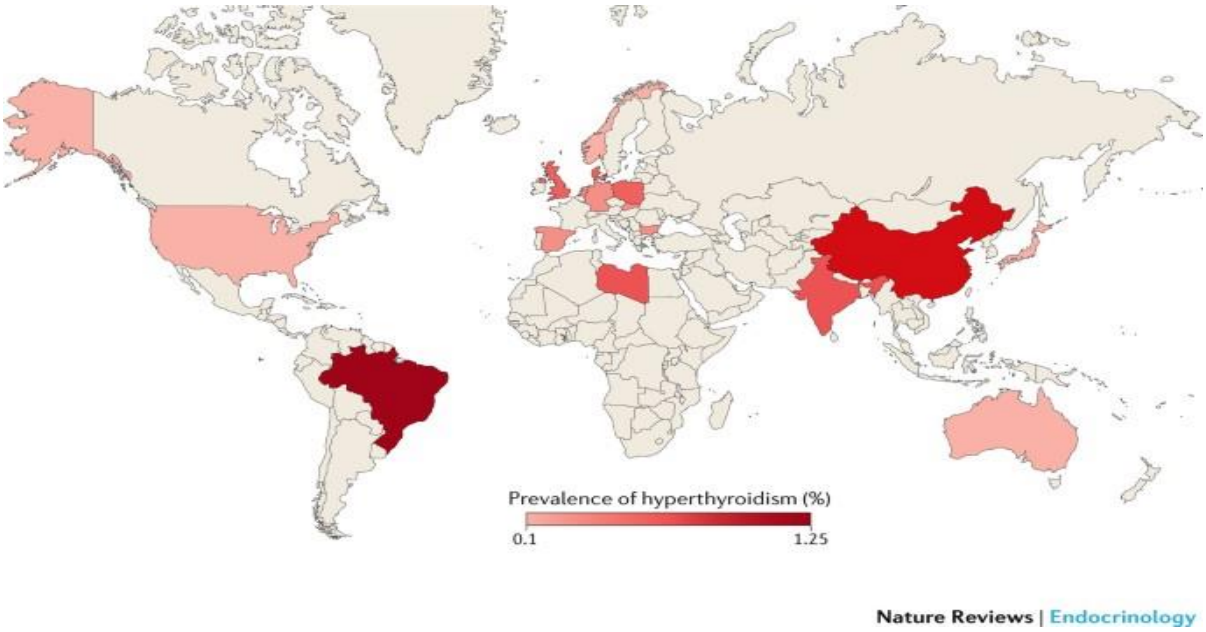
CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter provides a comprehensive introduction of thyroid dysfunction, which is the main focus of this research study. This chapter outlines the geographical location affected, background of the study, highlighting how the subject has been treated in previous literary works and its importance, and also the key objectives of this study. The study's limitations are discussed in order to comprehend the study boundaries. The detailed analysis provided in the next chapters is set up in this chapter.

1.2 Background of the Study

1.2.1 Global distribution of thyroid dysfunction



(source: Nature Reviews Endocrinology)

Fig 1: A map showing the global distribution of hyperthyroidism

An excessive amount of thyroid hormones is the hallmark of hyperthyroidism, a common thyroid condition. Its global distribution varies greatly because of environmental conditions, genetic predispositions, and iodine intake (Lee & Pearce, 2023). The image above shows a world map depicting the prevalence of hyperthyroidism by country. The color gradient indicates the percentage, ranging from 0.1% to 1.25%, with darker shades of red representing higher prevalence. Based on the map above, China and Brazil exhibit a high prevalence of hyperthyroidism. India, the UK, and parts of Scandinavia show moderate prevalence. The United States, Australia, and most of Africa have a lower prevalence, indicated by lighter shades. Most of Africa appears to have a low prevalence of hyperthyroidism, aligning with the lightest color on the gradient (around 0.1%). However, Libya shows slightly more prevalence than the rest of Africa. Much of South America (besides Brazil), Russia, and Southeast Asia appear to have a low prevalence, similar to the lightest shade on the map.

1.2.2 Thyroid Hormones

Thyroid is a small, butterfly-shaped gland located at the front of the neck under the skin. It's a part of the endocrine system which controls many of the body's important functions by producing and releasing thyroid hormones, like thyroxine (T4) and triiodothyronine (T3). The primary purpose of the thyroid is to regulate the metabolic rate, or the rate at which the body converts the food that is consumed into energy. Since all of the cells in the body require energy to function, a malfunctioning thyroid can have an effect on the entire body (Armstrong M, Asuka E, 2024).

Thyroid-stimulating hormone (TSH), free thyroxine (FT4), and free triiodothyronine (FT3) are among the thyroid hormones that TFTs assess in the blood. These tests aid in the diagnosis of

subclinical thyroid diseases, hyperthyroidism, hypothyroidism, and thyroid hypertrophy, among other thyroid dysfunctions (National Guideline Centre (UK), 2019).

Measurements of thyroxine (T4), triiodothyronine (T3), and thyroid-stimulating hormone (TSH) are the primary tests. Diagnosing diseases including hyperthyroidism, hypothyroidism, and other thyroid-related problems requires an understanding of these test results. TSH, (thyroid-stimulating hormone), is a hormone that the pituitary gland produces and it controls the thyroid's production of T4 and T3. TSH levels normally fall between 0.4 and 4.0 mIU/L. While low TSH values suggest hyperthyroidism, elevated levels frequently indicate hypothyroidism (Debra and Angelica, 2023). Thyroxine (T4), is the main hormone that the thyroid gland produces. There are two types of it, free T4 (the active form) and total T4 (bound to proteins). The typical range for total T4 levels is between 4.5 and 12.0 µg/dL. Below is a table showing the reference ranges of these three thyroid hormones.

Table 1: Reference ranges of thyroid hormones

THYROID HORMONE	**REFERENCE RANGE**
TSH	0.4 - 4.0 mU/L
fT3	3.6 – 6.0 pmol/L
fT4	8.0 – 18.0 pmol/L

1.2.3 Thyroid Dysfunction

In nations with adequate iodine, the prevalence of hyperthyroidism is estimated to be between 0.2% and 2.5% worldwide. About 0.2-1.4% of people have overt hyperthyroidism, which is characterized by low TSH and increased T3and/or free thyroxine. Any disorder with high thyroid

hormone levels, regardless of the underlying aetiology, is referred to as thyrotoxicosis (Reid & Wheeler, 2005). Hyperthyroidism, which results from excessive thyroid hormone production, inflammation-induced release of preformed hormones from the thyroid gland, excess T4 repletion, secret thyroid hormone ingestion, or struma ovaria can all cause thyrotoxicosis. A particular kind of ovarian dermoid tumour known as struma ovaria is primarily composed of thyroid tissue. Heart arrhythmias, congestive heart failure, osteoporosis, poor obstetric outcomes, and metabolic abnormalities like elevated resting energy expenditure and gluconeogenesis can all result from untreated hyperthyroidism (Kravets, 2016). Thyroid conditions are more prevalent, with 35–45% of people worldwide suffering from hypothyroidism (Chiovato et al., 2019). To avoid consequences, thyroid dysfunction must be diagnosed and treated as soon as possible (Armstrong M, Asuka E, 2024). There are several factors that affect how these tests should be interpreted, such as age, sex, and coexisting conditions. For example, TSH levels can be affected by various non-thyroidal disorders, which could result in a misdiagnosis if not carefully considered. Research indicates that the demographic characteristics of patients, such as age and sex, play a significant role in the prevalence of thyroid disorders. For example, studies have shown that women are more likely to experience thyroid dysfunction than men, particularly in middle to older age groups. Research has indicated that there are differences in the prevalence of thyroid dysfunction in various populations. 80% of the 69,575 specimens examined for thyroid function were euthyroid (had normal thyroid function), whereas the other twenty percent had aberrant results, according to a study done in Korea (Choi et al., 2022). Another study conducted in Nepal revealed that subclinical hypothyroidism was the most prevalent ailment among the 484 medical staff members in the radiotherapy department, accounting for 30.4% of the abnormal thyroid function.

1.2.4 Laboratory Measurement of Thyroid Hormones

Thyroid hormone tests in a laboratory are essential for both detecting and treating thyroid conditions. These tests assess the pituitary gland's control on thyroid function as well as the thyroid's hormone production levels. TSH is the main test used to evaluate thyroid function and acts as a "early warning system" for problems of the thyroid (Dunlap, 1990). It can be tested using the ELISA method. Principle of Enzyme-Linked Immunosorbent Assay (ELISA), is the idea of antigen-antibody interactions. The standard TSH ELISA involves coating a microtiter plate with a particular antibody that binds to the target hormone, such as TSH. TSH, if any, attaches itself to the antibody when the sample is added. The captured hormone then forms a "sandwich" with the addition of a second enzyme-linked antibody. When an enzyme substrate is introduced, the amount of TSH in the sample is measured by a change in colour. Commonly used for measuring TSH levels, it provides high sensitivity and specificity (Braverman & Cooper, 2012). The other method is Chemiluminescence Immunoassay (CIA) which the principle is the same as that of ELISA, however, CIA uses chemiluminescent labels rather than enzymes to capture the target hormone. The intensity of the light released by the reaction is measured and correlated with the concentration of hormones. Because of its sensitivity and quick results, it is frequently employed in contemporary laboratories to measure different thyroid hormones.

Fluorescence Polarization Immunoassay (FPIA) is another way used to test these thyroid hormones. The principle behind Fluorescence Polarization Immunoassay (FPIA) is that it quantifies the polarization of fluorescent light released by tagged antibodies attached to hormones in a sample. Quantification is possible since the degree of polarization varies according to whether the hormone is free or attached to an antibody. Thyroid hormones can be quickly tested in certain clinical contexts (Debra and Angelica, 2023).

There is also the High-Performance Liquid Chromatography (HPLC) and Liquid Chromatography-Mass Spectrometry (LC-MS). HPLC separates components in a mixture according to how they interact with a stationary phase and a mobile phase. In order to identify and measure hormones according to their mass-to-charge ratio, LC-MS combines this separation with mass spectrometry. Offers extremely precise thyroid hormone readings and is especially helpful for evaluating complicated cases or validating immunoassay results (Tony Brayer, 2022).

1.3 Problem Statement

Thyroid dysfunction is becoming more common in many communities, which is a serious public health concern. During my attachment at Citimed Hospital, patients seeking thyroid function tests were so many that it became a concern which needed research. A significant percentage of individuals have aberrant thyroid function, according to preliminary evaluations of these test results, which may have substantial implications for their general health and wellbeing.

Several important questions were brought up by the large number of aberrant results: What are the fundamental causes of the high rate of thyroid dysfunction among Citimed Hospital patients? Do demographic variables like age, gender, and lifestyle choices have an impact on these findings? In addition, how may early identification and management techniques be enhanced, and what are the possible health repercussions for individuals with thyroid dysfunction?

The purpose of this study is to investigate the frequency, demographic traits, and possible risk factors of thyroid dysfunction in patients who are treated at Citimed Hospital. This study aims to add to the body of knowledge already in existence and help medical professionals create focused screening and treatment plans for thyroid-related conditions by finding patterns and underlying causes.

1.4 Research Objectives

1.4.1 Broad Objectives

The research aimed to assess thyroid dysfunction among patients at Citimed Hospital in Chitungwiza Zimbabwe, in 2024.

1.4.2 Specific Objectives

1. To identify sociodemographic characteristics associated with thyroid dysfunction among patients attending Citimed Hospital in 2024.
2. To analyze the thyroid function test results of patients attending Citimed Hospital in 2024.
3. To determine the prevalence of thyroid disorders among the patient population at Citimed Hospital in 2024.

1.5 Research Questions

1. What was the sociodemographic characteristics that are associated with thyroid dysfunction among patients attending Citimed Hospital in 2024?
2. What was the analysis of the thyroid function test results of patients attending Citimed Hospital in 2024?
3. What was the prevalence of thyroid disorders among the patient population at Citimed Hospital in 2024?

1.6 Justification of the Study

Thyroid dysfunction is a major global health concern that affects a variety of patients' quality of life. It is imperative to look at the trends and incidence of thyroid dysfunction among patients at Citimed Hospital, as there aren't many studies on thyroid function testing conducted in Zimbabwe. Gaining insight into the thyroid health condition of those in this population can help to improve

patient outcomes, treatment plans, and diagnostic accuracy all of which can eventually improve Zimbabwe's healthcare system.

1.7 Study Limitation

This research does not include any other healthcare institutions in the area, it is limited to the patients who receive care at Citimed Hospital. This will limit the generalizability of the research findings to a wider demographic. The study will only analyze thyroid function test results and thyroid problem prevalence among the patient population at Citimed Hospital over a period of one year, limiting the generalizability of the findings to a broader demographic.

1.8 Study Delimitation

This study, only focuses on patients who attended Citimed Hospital during the period of January to December 2024, this means that the findings of this study are specific to this local health service provider. This means that there will be a clear picture and understanding of the challenges faced on thyroid functioning, then coming up with solutions related to that specific region and this means optimizing healthcare service at Citimed Hospital.

1.9 Summary

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CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter shows reviewed literature related to the analysis of thyroid dysfunction in patients. This review of the literature will examine the state of the art on thyroid function tests, emphasizing the complexity of thyroid conditions, the value of accurate diagnosis, and the difficulties encountered in clinical settings. With the goal of offering a thorough overview of the present status of thyroid diagnostics and its implications for patient care, this review synthesizes information from multiple investigations.

2.2 Conceptual Framework for thyroid dysfunction amongst patients

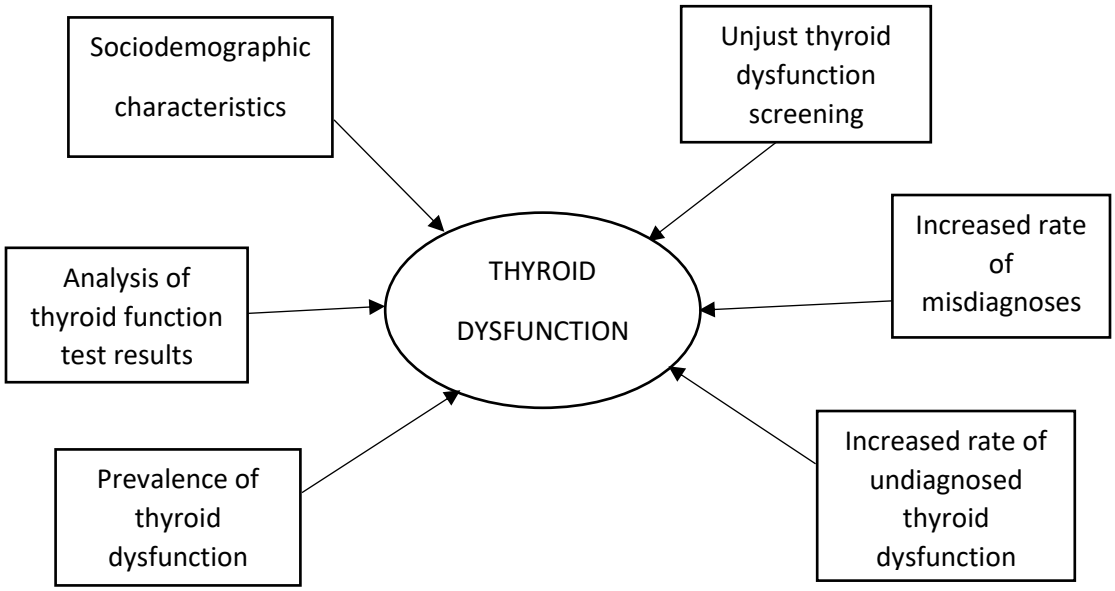

Fig 2: Conceptual framework for thyroid dysfunction among patients

This conceptual framework for thyroid dysfunction includes a number of interconnected elements that affect thyroid health, diagnostic procedures, and their outcomes. Age, gender, and

socioeconomic level are some of the factors that have a big influence on how common thyroid diseases are. It is easier to identify at-risk populations and put the patient population in context when these characteristics are understood. Determining the prevalence of thyroid is crucial for spotting patterns and guiding treatment procedures. Examining variances according to clinical and demographic parameters is part of this. The analysis and correct interpretation of thyroid function test results is vital in thyroid function diagnosis in order to minimize cases of misdiagnosis and undiagnosis and also lower needless medical costs.

2.3 Literature Review

2.3.1 Prevalence of Thyroid Dysfunction

A large percentage of the population suffers from thyroid dysfunction, which seems to be the most common endocrine condition. Goiter was a serious health issue in Europe prior to the introduction of the iodine fortification program. The prevalence of hypothyroidism appears to rise with increased iodine intake. Thyroid-stimulating hormone (TSH) levels are the most sensitive measure of thyroid function, and they are the primary basis for the diagnosis of thyroid dysfunction (Strikić Đula et al., 2022). As a result, TSH above and free thyroxine (fT4) within the reference range are considered subclinical hypothyroidism, whereas TSH above and fT4 below the reference range are considered clinical hypothyroidism. Similar to this, the inverse hormone pattern distinguishes between clinical and subclinical hyperthyroidism (TSH under and fT4 within the reference range) (TSH under and fT4 above the reference range) (Pn et al., 2018).

According to the American Thyroid Association (ATA), more than 12% of US citizens may experience a thyroid issue at some point in their lifetime, and 20 million Americans currently suffer from some type of thyroid disease ("General Information/Press Room," n.d.). The National Health and Nutrition Examination Survey (NHANES III) selected a reference US population of 13,344

participants without recognized thyroid disease by determining serum concentrations of TSH, T4, thyroglobulin antibodies (TgAb), and thyroid peroxidase antibodies (TPOAb). They found that hypothyroidism was present in 45.6% of the population (with a higher presence of subclinical than clinical hypothyroidism), while hyperthyroidism was present in 37.3% of the population (with the almost equal presence of subclinical and clinical hyperthyroidism) (Hollowell et al., 2002).

In 2014, the first meta-analysis of thyroid dysfunction epidemiology in European populations was carried out. According to the authors, the average score for undiagnosed thyroid dysfunction was 23.71%, which translates to 16.94% for undiagnosed hypothyroidism and 6.72% for undiagnosed hyperthyroidism. This analysis was done across seven research. Nine investigations evaluated the prevalence of thyroid dysfunction, both previously recognized and undiagnosed. The average score for hypothyroidism and hyperthyroidism was 46.82% and 12.75%, respectively (Garmendia Madariaga et al., 2014). The results of another meta-analysis conducted in 2019 with 20 studies, Chaker and Bianco (2017) revealed that the prevalence of undiagnosed overall (subclinical plus clinical) hypothyroidism in Europe was 46.7%, with 12.65% of undiagnosed clinical hypothyroidism and 14.11% prevalence of undiagnosed subclinical hypothyroidism.

Studies on the prevalence of hyperthyroidism and hypothyroidism in different populations are scarcer, particularly when it comes to cases that go undiagnosed. The participant selection process in these studies frequently has limitations. For instance, data on the frequency of both diagnosed and undiagnosed instances of thyroid dysfunction in Australia's elderly population reveal that there are nearly twice as many cases among this demographic as there are in Europe (Empson et al., 2007). Hypothyroidism is more common in women than in men, in people over 65, and in Eastern and Southern Europe compared to Northern and Western Europe (Chaker L, Bianco AC, 2017).

In Africa, hypothyroidism is a prevalent thyroid condition that is frequently linked to endemic goitre and iodine shortage. A study conducted in Zimbabwe revealed a high frequency of hypothyroidism, with raised TSH levels (above 5.0 mu/l) in 66 out of 188 participants and low total thyroxine (T4) levels below 60 nmol/l in 19 out of 36 subjects with elevated TSH levels (above 7.0 mu/l) (Ch & D, 1991). Depending on the region, endemic goitre prevalence in Zimbabwe varies from 1% to 90%. A research in two regions (Wedza and Chiweshe) of Zimbabwe where goitre is endemic discovered a severe iodine deficit (A. Ogbera & Kuku, 2011).

Graves' disease is the most commonly documented autoimmune thyroid disorder in Africa, but the overall prevalence remains unknown due to underdiagnosis and underreporting. According to a study conducted in Lagos, Nigeria, 42% of participants with thyrotoxicosis went on to develop heart failure; yet, a report from the Congo showed that the frequency of thyrotoxic heart disease was 12.6% (A. O. Ogbera & Kuku, 2011).

2.3.2 Sociodemographic characteristics associated with thyroid dysfunction

Numerous sociodemographic characteristics, such as age, sex, race/ethnicity, and socioeconomic status, have an impact on thyroid dysfunction, which includes both hyperthyroidism and hypothyroidism (Strikić Đula et al., 2022). Effective diagnosis and therapy depend on an understanding of these relationships.

There is now strong evidence that the normal condition of the thyroid varies throughout life as one ages. Age-related changes in thyroid hormone levels are notable, especially in TSH and FT3. On the other hand, FT3 levels often decline with aging, which may have an effect on metabolic functions and general health (Taylor et al., 2023). Research in Brazil showed that the risk of developing hypothyroidism rises with age, especially in women. For instance, the prevalence of

hypothyroidism is higher in older adults (65 years of age and older), with estimates as high as 25% in community-based populations, while the prevalence of hyperthyroidism is higher in younger adults, especially women between the ages of 20 and 44 (Olmos et al., 2015a). Thyroid function in the elderly has drawn more attention due to the correlation between thyroid health and longevity, cognitive function, disability, and risk of cardiovascular disease. The results of the first Whickham survey, which was released in 1977, indicated that while TSH levels in males did not change with age, they did rise significantly in females beyond the age of 45 (Aggarwal & Razvi, 2013). Serum TSH concentrations, as well as serum thyroid peroxidase (TPOAb) and thyroglobulin (TgAb) antibodies, rise with age in both men and women, according to the more extensive and current NHANESIII survey (Hollowell et al., 2002).

Research suggests that thyroid dysfunction is more common in women than in men. For example, women are substantially more likely to have hypothyroidism, particularly after menopause when thyroid diseases are more common (Meng et al., 2015). A study conducted in Brazil, for instance, found that women were more likely than males to receive treatment for hypothyroidism (97.3%) (Olmos RD, Aquino EM, 2015). Furthermore, research indicates that men are more likely than women to have untreated hypothyroidism, and men are frequently underdiagnosed and undertreated for the condition (Ettleson et al., 2021a).

Thyroid dysfunction is also significantly influenced by racial and cultural differences. Thyroid diseases are more common in some racial groups than others, according to research. For example, it has been discovered that non-Hispanic Black people are more likely than non-Hispanic White people to acquire hyperthyroidism (Brent, Leung, Ebrahim, 2019). Overt hypothyroidism was found to be more common in white women in Brazil (16.7%) than in brown (8.8%) and black (6.9%) women, suggesting that race had protective implications (Olmos et al., 2015b).

Thyroid disease diagnosis and treatment are greatly impacted by socioeconomic status (SES). Access to healthcare is frequently impeded for those with lower socioeconomic status, which increases the prevalence of untreated thyroid disorders. According to a study in the US, untreated hypothyroidism was linked to irregular access to healthcare (Ettleson et al., 2021b). Additionally, improved thyroid problem management and treatment adherence are favourably correlated with higher income and educational attainment levels (Helfand M et al., 2015).

Thyroid function can be greatly impacted by a history of autoimmune diseases, especially autoimmune thyroid illness. According to (Marouli, 2021), thyroid hormone production is dysregulated by illnesses including Graves' disease and Hashimoto's thyroiditis, which affect general health and call for close observation and treatment. Alterations in thyroid function can also be correlated with the existence of chronic diseases, such as cardiovascular disease or chronic renal disease. For example, decreased thyroid hormone levels are common in people with chronic kidney disease, which can make therapy and management more difficult (Taylor et al., 2023). Certain drugs can disrupt thyroid function via changing the body's metabolism of thyroid hormones or by directly modifying hormone levels. For instance, alterations in thyroid function tests have been linked to some antidepressants and antipsychotics, which may complicate the clinical picture for individuals with a history of mental illnesses (Steronborg, 2021).

In conclusion, the complex relationships between age, sex, and medical history and thyroid function underscore the need for tailored approaches to the diagnosis and treatment of thyroid-related conditions. Optimizing patient treatment and outcomes requires an understanding of these relationships.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology used to analyze thyroid function among patients attending Citimed hospital from January to December 2024. This study provides an overview of the methodological technique that was used to look into the research objectives and research questions that were set forth in previous chapters.

3.2 Research Design

A retrospective cross-sectional study design was utilized for collecting comprehensive data from patients during their routine health evaluations. This design was appropriate because it was effective in capturing a momentary picture of thyroid health and its association with various factors in a particular population (Citimed hospital) at a specific point in time (January to December 2024). The main purpose of this investigation was to assess the prevalence of thyroid dysfunction and identify factors associated with thyroid hormone level. The study made use of the existing current laboratory records from January to December 2024.

3.3 Study Site

This study was conducted at Citimed hospital, a well-established facility located in Chitungwiza. Citimed is renowned for providing an extensive array of medical services, one of which is endocrinology, which specializes in illness pertaining to hormone function such as thyroid disorders.

3.4 Study Population

The patient population that the hospital serves is varied, encompassing a diversity of demographics including age, gender, ethnicity and socioeconomic status. Due to this variability, thyroid function in various groups can be thoroughly examined.

3.5 Inclusion Criteria

In order to guarantee that the study includes adults who might present with thyroid issues, patients must be at least 18 years old. Patients who exhibit signs of thyroid malfunction, such as fatigue or weight changes or who have been referred for thyroid function tests. Patients who have undergone thyroid function tests at Citimed Hospital.

3.6 Exclusion Criteria

To maintain the study's attention on the intended objectives, individuals who had infections or acute diseases that might have an impact on thyroid hormone levels were eliminated. Breastfeeding mothers or pregnant women were excluded as pregnancy's hormonal changes can have a huge impact on thyroid function. To avoid discrepancies, patients who, during the last month had thyroid surgery or were undergoing treatment such as hormone replacement or radioactive iodine therapy for thyroid disorders were not be included. Patients below the age of 18 years were also excluded.

3.7 Sample Size

The formula to calculate the sample size (n) is as follows:

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

Where;

n = required sample size

z= the statistical parameter that depends on the confidence level

p= estimated prevalence of disease.

d= confidence interval expressed as a decimal

Assuming a confidence level of 95% (z = 1.96), an estimated prevalence of thyroid dysfunction of 6% (p = 0.06), and a desired margin of error of 5% (d = 0.05), the calculated sample size is 90 records.

3.8 Sampling Procedure

A random sampling technique was employed to ensure representation from various demographic groups where, all laboratory numbers were written onto a piece of paper and placed into a box. The box was shaken and papers were picked one by one until the sample size was reached. The research on thyroid function among patients who visit Citimed Hospital was meticulously set up to include a variety of demographic groups using a rigorous sampling process. By using a strong random sample approach, the study attempted to obtain a thorough picture of thyroid health in the patient group. The insights gained will be beneficial for both clinical practice and future research endeavors.

3.9 Data Collection Instrument

The thyroid function test results, past diagnoses, treatments, and any other relevant medical information was extracted from the medical records of patients who visited Citimed Hospital. This guaranteed that every participant had their data collected thoroughly. Comprehensive information on thyroid hormone levels, such as TSH, T3 and T4, as well as any other tests performed, such as

thyroid antibody tests, can be obtained by directly extracting data from thyroid function test reports.

3.10 Data Analysis

Several methodological steps were involved in the data analysis for the Citimed hospital study on thyroid function in patients. First step being cleaning the data for guaranteed accuracy and completeness. Demographic details and thyroid function test results, including TSH, free T4 and free T3 levels' means and standard deviations was compiled using descriptive statistics. Correlation analysis was used to investigate associations between demographic characteristics and thyroid outcomes, and comparative analyses was employed to evaluate variations between subgroups. The findings were analyzed in the context of the body of current literature, with limits mentioned and suggestions for further study offered. The results were then be combined into an extensive report with visual representations such as bar graphs and tables to help guide future research initiatives and clinical practices.

3.11 Ethical Considerations

Permission was requested firstly from the Africa University Research Ethics Council (AUREC) and then from Citimed hospital before the commencing of the research. The study strived to protect participant rights and welfare while providing important insights into thyroid health by giving these ethical criteria top priority.

3.12 Summary

This chapter three involved many aspects. The first section of the chapter clearly explained the study research design, followed by a description of the study site and study population. Following that, the sample size and sampling criteria, which was stratified sampling, were described. Data

collection methods and data analysis procedures were also presented. Finally, ethical issues brought this chapter to an end.

CHAPTER 4: DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter is for the results presentation, discussion and analysis of the study on thyroid dysfunction among patients at Citimed Hospital in Chitungwiza Zimbabwe, in 2024. However, in this chapter, socio-demographic characteristics associated with thyroid dysfunction among patients attending Citimed Hospital in 2024 were identified. The thyroid function test results of patients attending Citimed Hospital in 2024 was analyzed. The prevalence of thyroid disorders among the patient population at Citimed Hospital in 2024 was assessed. Lastly, the chapter summary was provided.

4.2 Socio-demographic characteristics of study participants

Table 2: Socio-demographics of the study population

Characteristics		**Frequency/N (%)**
Gender	Male	39 (43.3%)
	Female	51(56.7%)
Location	High density	40 (44.4%)
	Low density	30 (33.3%)
	Rural areas	20 (22.3%)

Table 2 shows the study population of the total of 90 patients assessed for thyroid dysfunction among patients at Citimed Hospital in Chitungwiza Zimbabwe, in 2024. The study population had 39 (43.3%) males and 51(56.7%) females. Making the most participating gender to be females.

The age group >60 had the most patients that participated with 26 constituting 28.9% of the study population. The majority of participants were from the high- density suburb with 44.4%, followed by the low- density suburbs (33.3%) and the least participants from rural areas with 22.3%.

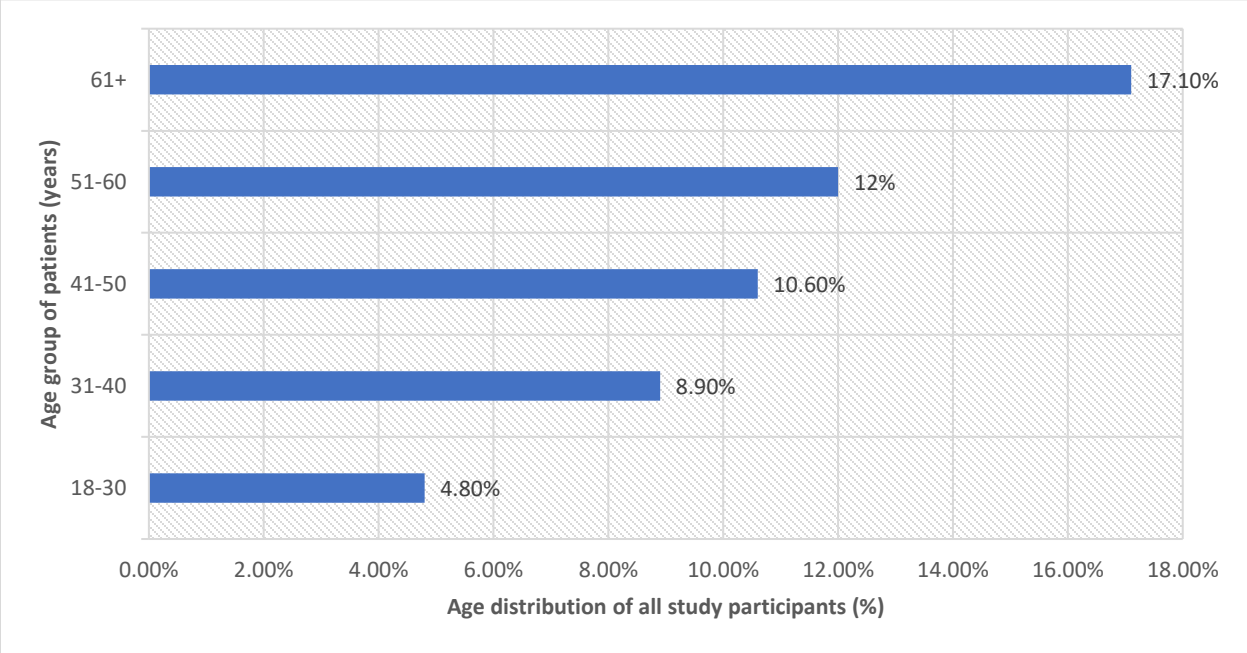

Figure 3: Age distribution of all study participants (%)

4.3 Thyroid function test results analysis of study participants

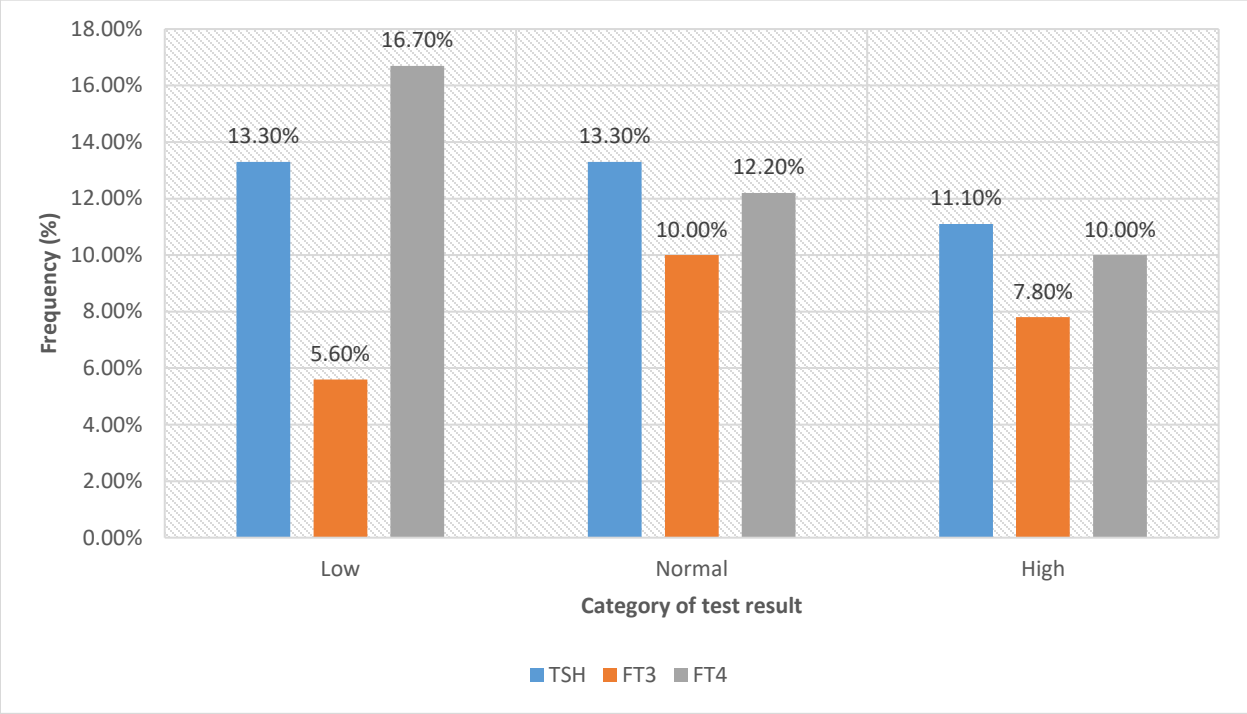

Figure 4: Analysis of thyroid function test results of patients who attended Citimed Hospital in 2024.

This section provides the analysis of the thyroid function tests results of patients attending Citimed Hospital in 2024. The data above showed that for all the 3 different tests that were done on the 90 patients, 58 tests confirmed positive for thyroid dysfunctional. These were denoted with low of the 3 tests (35.6%), and high for the 3 tests (28.9%). However, normal tests (that is, negative) for thyroid dysfunctional were 35.5%. The data showed that among the 3 types of tests performed, fT4 had the highest percentage of confirmed low samples. The least on this category was found to be fT3 (5.6%). On high values the TSH was found to have been dominating with 11.1% with the least being fT3 with 7.8%.

4.5 The prevalence of thyroid disorders among the patient population at Citimed Hospital in 2024.

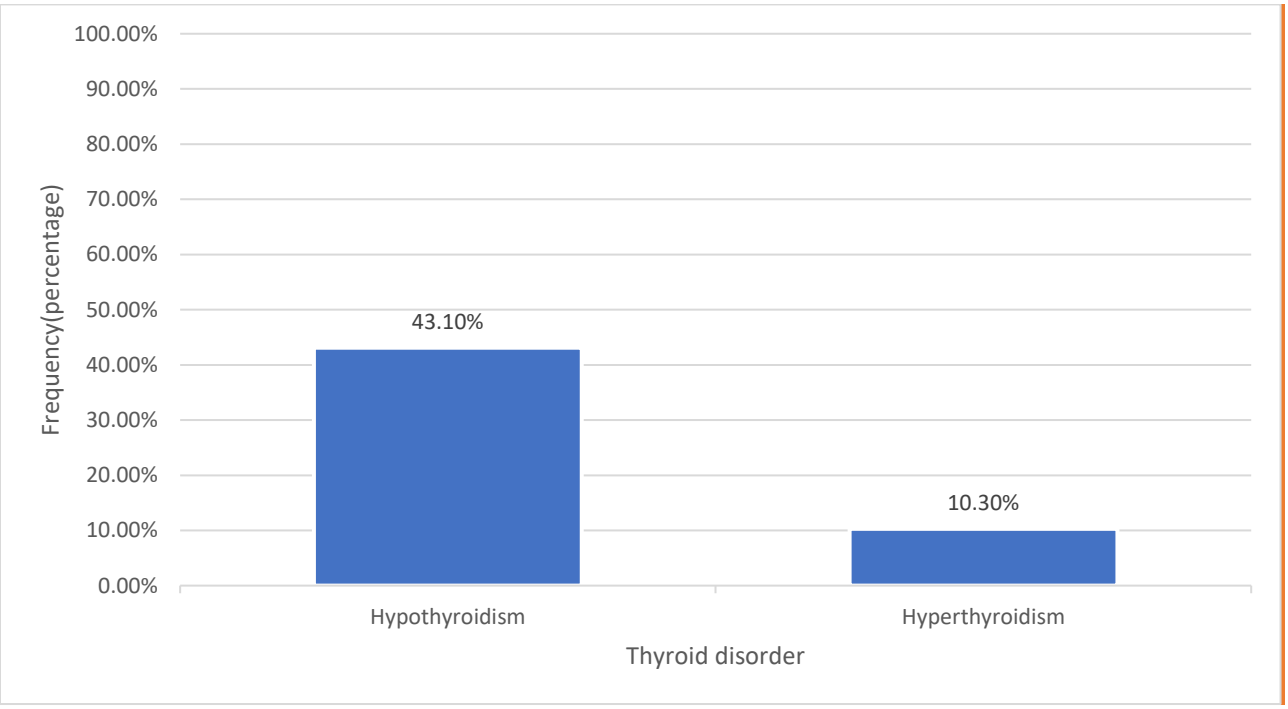

Figure 5: Prevalence of thyroid disorders that are found in patients at Citimed Hospital in 2024.

This section provides the prevalence of the thyroid disorders that are found among the patients at Citimed Hospital in 2024. The figure above showed that the most found thyroid disorder in Zimbabwe is hypothyroidism (43.1%). The least most common thyroid disorder is hyperthyroidism (10.3%).

4.5 Chapter summary

This chapter was for the results presentation, discussion and analysis of the study on thyroid dysfunction among patients at Citimed Hospital in Chitungwiza Zimbabwe, in 2024. However, in this chapter, socio-demographic characteristics associated with thyroid

dysfunction among patients attending Citimed Hospital in 2024 were identified. The thyroid function test results of patients attending Citimed Hospital in 2024 was analyzed. The prevalence of thyroid disorders among the patient population at Citimed Hospital in 2024 was assessed.

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMENDATION

5.1 Introduction

This chapter covers the discussion of the major findings of the study. In this study, the conclusions are also focused on. The recommendations are given in this chapter also.

5.2 Discussion

5.2.1The socio-demographic characteristics associated with thyroid dysfunction among patients attending Citimed Hospital in 2024.

The study showed that more females 40(44.4%) suffer from thyroid dysfunctional especially hypothyroidism than their counterparts (males) with 18(20.0%) and this correlates with the research done in Brazil which showed that the risk of developing hypothyroidism rises with age, especially in women (Olmos et al., 2015a). A study done in Eastern and Southern Europe also confirmed that hypothyroidism is more common in women than in men (Chaker L, Bianco AC, 2017).

This gender difference in thyroid disorders can be attributed to various factors, including hormonal influences, genetic predisposition, and autoimmune mechanisms. Female sex hormones, particularly estrogen, can influence thyroid function. Estrogen has been associated with increased levels of thyroid-binding globulin (TBG), which can affect the binding and transport of thyroid hormones in the bloodstream. This hormonal influence may contribute to the higher prevalence of thyroid dysfunction in females (Smith et al. 2014). Females are more likely to inherit genetic susceptibility to autoimmune thyroid disorders, leading to a higher prevalence of these conditions in women compared to men (Tomer et al. 2015). Autoimmune thyroid diseases occur when the immune system mistakenly attacks the thyroid gland, leading to inflammation and dysfunction.

The higher prevalence of autoimmune thyroid disorders in females may be attributed to differences in immune response and hormonal factors (Hollowell et al. 2002).

The data also showed that as the people get older, they pose a risk of thyroid dysfunctional. The results therefore showed that the most affected age groups are those 40 and above with those more than 60years having the most risk (22; 24.4%), this matches with a study done in Brazil in 2015 where hypothyroidism was higher in older adults (65 years of age and older), with estimates as high as 25% in community-based populations, while the prevalence of hyperthyroidism is higher in younger adults, especially women between the ages of 20 and 44 (Olmos et al., 2015a). The lowest risk age group are the youths between 18-30 (4.4%). The observation that individuals aged 60 years and older are more likely to be affected by thyroid dysfunction compared to those below 30 years can be supported by several factors, including age-related changes in thyroid function, cumulative effects of environmental factors, and increased prevalence of thyroid disorders with advancing age. Thyroid function undergoes age-related changes, with alterations in thyroid hormone production and metabolism occurring as individuals grow older. Studies done in UK in 2013 showed that the prevalence of hypothyroidism, particularly subclinical hypothyroidism, increases with advancing age, because thyroid function in the elderly has drawn more attention due to the correlation between thyroid health and longevity, cognitive function, disability, and risk of cardiovascular disease(Aggarwal & Razvi, 2013). Aging is associated with a decreased response of the thyroid gland to thyroid-stimulating hormone (TSH), leading to a higher prevalence of hypothyroidism in older adults.

Limited access to health care had also impact with 28(31.1%) patients having alluding to this. Poor nutrition was the least of the socio-economic factors with 14(15.6%) having thyroid dysfunctional.

Limited access to healthcare, poor nutrition, and high stress levels are important factors that can contribute to thyroid dysfunction through various mechanisms, including hormonal imbalances, immune dysregulation, and inflammation. These factors can impact thyroid health and increase the risk of developing thyroid disorders, such as hypothyroidism and autoimmune thyroid diseases. Limited access to healthcare resources, including a lack of routine screenings, diagnostic tests, and medical care, can lead to undiagnosed and untreated thyroid disorders. Access to healthcare is frequently impeded for those with lower socioeconomic status, which increases the prevalence of untreated thyroid disorders, which correlates to a study in the US, where untreated hypothyroidism was linked to irregular access to healthcare (Ettleson et al., 2021). Delayed diagnosis and management of thyroid dysfunction may result in the progression of the disease and exacerbation of symptoms. Individuals with limited access to healthcare services may not receive appropriate thyroid hormone replacement therapy for hypothyroidism or immunomodulatory treatment for autoimmune thyroid diseases, leading to uncontrolled thyroid dysfunction (Kim et al. 2016).

Nutritional deficiencies, particularly iodine deficiency and micronutrient imbalances, can impair thyroid function and contribute to thyroid dysfunction. Iodine is an essential micronutrient required for the synthesis of thyroid hormones, and inadequate iodine intake can lead to hypothyroidism and goiter. Poor nutrition, including low intake of essential vitamins and minerals, can affect thyroid hormone production and metabolism, leading to disturbances in thyroid function. Studies have shown that micronutrient deficiencies, such as selenium and zinc, can impact thyroid health and contribute to the development of thyroid disorders (Zimmermann et al. 2009).

5.2.2 Analysis of thyroid function test results of patients attending Citimed Hospital in 2024

The data above showed that for all the 3 different tests that were done on the 90 patients, 58 tests confirmed positive for thyroid dysfunctional. These were denoted with low of the 3 tests (35.6%), and high for the 3 tests (28.9%). However, normal tests (that is, negative) for thyroid dysfunctional were 35.5%. The data showed that among the 3 types of tests performed, FT4 had the highest percentage of confirmed low samples. The least on this category was found to be fT3 (5.6%). On high values the TSH was found to have been dominating with 11.1% with the least being Ft3 with 7.8%. Low and high levels of thyroid-stimulating hormone (TSH) can be indicative of thyroid dysfunction and may be associated with different thyroid disorders. Abnormal TSH levels are often used as diagnostic markers for thyroid conditions, including hypothyroidism, hyperthyroidism, and thyroid nodules. Low TSH levels, also known as TSH suppression, are commonly seen in individuals with hyperthyroidism, a condition characterized by excessive production of thyroid hormones. Hyperthyroidism can lead to symptoms such as weight loss, palpitations, tremors, and heat intolerance. In some cases, low TSH levels may be caused by thyroid hormone resistance or other pituitary disorders, resulting in reduced feedback inhibition of TSH secretion (Biondi et al. 2013). High TSH levels indicate an underactive thyroid gland and are typically seen in individuals with hypothyroidism. Hypothyroidism is characterized by insufficient production of thyroid hormones, leading to symptoms such as fatigue, weight gain, cold intolerance, and depression. Elevated TSH levels reflect the pituitary gland's attempt to stimulate the thyroid to produce more hormones in response to decreased circulating thyroid hormones. Chronic thyroiditis, iodine deficiency, and thyroid hormone resistance can cause high TSH levels in hypothyroid individuals (Chaker et al. (2017). Abnormal TSH levels may also be observed in individuals with thyroid nodules, thyroid cancer, or autoimmune thyroid diseases such as Hashimoto's thyroiditis. Thyroid nodules can be autonomous and produce excess thyroid hormone (resulting in low TSH levels) or

be non-functioning (resulting in normal or high TSH levels). Thyroid cancer may affect TSH levels due to the destruction of thyroid tissue or the presence of thyroid hormone-producing tumors. Autoimmune thyroid diseases can lead to fluctuations in TSH levels, with high TSH levels often observed in the early stages of Hashimoto's thyroiditis (Singer et al. 2018).

Free triiodothyronine (fT3) levels play a crucial role in evaluating thyroid function and can provide valuable insights into thyroid disorders. Both low and high levels of fT3 can indicate thyroid dysfunction and may be associated with various thyroid conditions, including hypothyroidism, hyperthyroidism, and thyroid hormone resistance. Low levels of free triiodothyronine (fT3) are commonly observed in individuals with hypothyroidism, a condition characterized by an underactive thyroid gland that does not produce enough thyroid hormone. Hypothyroidism can result in symptoms such as fatigue, weight gain, cold intolerance, and depression. Reduced fT3 levels indicate decreased thyroid hormone activity, and fT3 measurements are often used in conjunction with other thyroid function tests to assess thyroid health in individuals with hypothyroidism (Hollowell et al. (2002). Elevated levels of free triiodothyronine (fT3) are typically seen in individuals with hyperthyroidism, a condition characterized by excessive production of thyroid hormones. Hyperthyroidism can lead to symptoms such as weight loss, rapid heartbeat, tremors, and heat intolerance. Increased fT3 levels reflect the hyperactivity of the thyroid gland and can be used to diagnose and monitor thyroid function in individuals with hyperthyroidism. fT3 levels are often measured in combination with other thyroid tests, including free thyroxine (fT4) and thyroid-stimulating hormone (TSH) levels, to assess thyroid hormone levels accurately (Bahn et al. 2018).

Low levels of free thyroxine (fT4) are commonly observed in individuals with hypothyroidism, a condition characterized by an underactive thyroid gland that does not produce enough thyroid

hormone. Hypothyroidism can result in symptoms such as fatigue, weight gain, cold intolerance, and depression. Reduced fT4 levels indicate decreased thyroid hormone activity and can be used as a diagnostic marker for hypothyroidism. Studies have shown that fT4 levels are often decreased in individuals with primary hypothyroidism (Hoermann et al. 2019). Elevated levels of free thyroxine (fT4) are typically seen in individuals with hyperthyroidism, a condition characterized by excessive production of thyroid hormones. Hyperthyroidism can lead to symptoms such as weight loss, rapid heartbeat, tremors, and heat intolerance. Increased fT4 levels reflect the hyperactivity of the thyroid gland and can be used to diagnose and monitor thyroid function in individuals with hyperthyroidism.

5.2.3 The prevalence of thyroid disorders among the patient population at Citimed Hospital in 2024.

The highest prevalent of the thyroid disorders is hypothyroidism (43.1%), followed by hyperthyroidism (10.3%). Hypothyroidism is more prevalent in Zimbabwe compared to other thyroid disorders and it correlates with a study conducted in Zimbabwe in 1991 which revealed a high frequency of hypothyroidism, with raised TSH levels (above 5.0 mu/l) in 66 out of 188 participants and low total thyroxine (T4) levels below 60 nmol/l in 19 out of 36 subjects with elevated TSH levels (above 7.0 mu/l) (Ch & D, 1991). One key factor is the high prevalence of iodine deficiency in the country. Nyarango et al. (2003) found that approximately 63% of the population in Zimbabwe is affected by iodine deficiency, which is a major cause of hypothyroidism. Iodine is an essential nutrient required for the production of thyroid hormones, and its deficiency can lead to underactive thyroid function. Socio-economic factors such as poverty and limited access to healthcare services can also contribute to the high prevalence of hypothyroidism in Zimbabwe (Bonuck et al. 2019). Genetic factors may also play a role in the

prevalence of hypothyroidism in Zimbabwe. Certain genetic variations can predispose individuals to thyroid disorders, including hypothyroidism (Tafirenyika et al. 2017).

Hyperthyroidism is less prevalent in Zimbabwe compared to other thyroid disorders due to several factors. One key factor is the low prevalence of autoimmune thyroid diseases, such as Graves' disease, which is a common cause of hyperthyroidism. According to a study by Burger et al. (2016), autoimmune thyroid diseases are less common in African populations, including Zimbabweans, compared to populations in Western countries. This lower prevalence of autoimmune thyroid diseases contributes to the lower prevalence of hyperthyroidism in Zimbabwe.

Iodine deficiency, which is a major risk factor for hypothyroidism, can also protect against the development of hyperthyroidism. Adequate iodine levels are necessary for the production of thyroid hormones, and a lack of iodine can lead to hypothyroidism. In regions with a high prevalence of iodine deficiency, such as Zimbabwe, the risk of hyperthyroidism may be reduced due to the limited availability of iodine for thyroid hormone synthesis. Certain genetic variations and polymorphisms have been associated with an increased risk of hyperthyroidism, particularly in autoimmune thyroid diseases (Matimba et al. 2014). Thyroid dysfunction, particularly hypothyroidism, has a high prevalence of more than 50% in Zimbabwe.

Several factors contribute to this high prevalence in the country. One major factor is the insufficient intake of iodine, a vital nutrient for thyroid hormone production. In Zimbabwe, iodine deficiency is a common issue, with many people not consuming enough iodine-rich foods such as iodized salt. This lack of dietary iodine can lead to hypothyroidism and other thyroid disorders. Environmental factors such as pollution and exposure to toxins can also contribute to thyroid

dysfunction in Zimbabwe. Comparing these findings to other studies, a study conducted in Nigeria found a similar high prevalence of thyroid dysfunction, with 43.9% of participants having abnormal thyroid function tests (Ogbera et al., 2012). Like Zimbabwe, Nigeria also faces challenges with iodine deficiency and environmental pollution, which can contribute to thyroid disorders in the population. United States found a lower prevalence of thyroid dysfunction, with only 4.6% of participants having abnormal thyroid function tests (Hollowell et al., 2002). This lower prevalence may be attributed to the higher availability of iodine-rich foods and stricter environmental regulations in the US compared to Zimbabwe.

5.3 Limitations to the Study

The analysis of thyroid function tests among patients at Citimed Hospital faced several limitations. Time constraints restricted the depth and breadth of the study, affecting sample size and data collection. Strict exclusion criteria, including the exclusion of pregnant women and individuals under 18, limited the demographic representation, potentially overlooking significant trends in these groups. Additionally, focusing solely on one hospital may not provide a comprehensive view of thyroid function across different populations in Zimbabwe, making it difficult to generalize findings. The limited sample size and potential selection bias further underscore the need for caution in interpreting results. These limitations highlight the necessity for future research to encompass multiple centers and a broader demographic to enhance the reliability and applicability of the findings.

5.4 Conclusion

The study concluded that the socio-demographic factors that causes thyroid dysfunctional among patients are; age, gender and socio-economic status. The study also concluded that low or high

TSH, fT4 and fT3 are related to the thyroid dysfunctional results on patients. In this study it was concluded therefore that hypothyroidism is the most prevalent thyroid disorder (43.1%) and hyperthyroidism (10.3%) follows.

5.5 Recommendations

- Citimed should focus on age, sex and socio-economic status in order to properly diagnose thyroid disorders.
- Affordable equipment should be available at Citimed to easily and test the three most critical tests such as TSH, fT4, and fT3.
- Thyroid disorders particularly hypothyroidism should be not only tested among those that visit the hospital but also awareness campaigns should be carried out by Citimed in order to make people aware.

5.7 Areas of further study

- There should be a study to assess the impact of hypothyroidism in patients that visits Citimed Hospital.

5.8 Dissemination of results

The findings of this study will be disseminated through academic presentations, conferences, and publication in peer-reviewed journals. A summary of the results will be shared with Citimed Hospital, where the study was conducted, to support improvements in practice and policy. Additionally, a summary of the results will be shared with relevant stakeholders, including educational institutions and policymakers, to inform future strategies and decision-making. Digital platforms and university repositories will also be used to enhance accessibility and reach a wider audience.

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APPENDICES

Appendix 1: Study budget

ITEM	Unit Cost (US$)	Multiplying factor	Total Cost (US$)
Stationery (Pens, Pencils etc.)	5	1	5
Data collection materials	20	1	20
Transportation	20	1	20
Printing costs for reports	15	1	15
lunch	10	1	10
Miscellaneous expenses	5	1	5
Total			**75**

Appendix 2: Study site approval letter

Citimed Hospital

14656 Hadzinanhanga rd

Chitungwiza

Harare

Africa University

Biomedical Sciences Department

07 February 2025

To: Pauline Chipako

Subject: Approval for Research Study Site

We are pleased to inform you that your request for approval to conduct your research on thyroid dysfunction amongst patients attending Citimed Hospital from January to December 2024 has been reviewed and approved by the Citimed Hospital board. If you have any questions or require further information, please do not hesitate to contact us.

Regards

Mr J Mudzimiri

SOUTH MEDICAL
CHITUNGWIZA LABORATORY
11 FEB 2025
P.O. BOX 390 CHITUNGWIZA

Appendix 3: Gannt Chart

ACTIVITY	PERIOD			
	October 2024 – January 2025	February 2025	March 2025	April 2025
Research proposal drafting				
Submission of research proposal to AUREC				
Data collection and data analysis				
Submission of final proposal for marking				

"Investing in Africa's future"
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3685/25

11 March, 2025

PAULINE CHIPAKO
C/O Africa University
Box 1320
MUTARE

RE: *THYROID DYSFUNCTION AMONGST PATIENTS ATTENDING CITIMED HOSPITAL IN 2024*

Thank you for the above-titled proposal you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following. a)
Research proposal

- APPROVAL NUMBER AUREC 3685/25
  This number should be used on all correspondences, consent forms, and appropriate document
- AUREC MEETING DATE NA
- APPROVAL DATE March 11, 2025
- EXPIRATION DATE March 11, 2026
- TYPE OF MEETING: Expedited
  After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- SERIOUS ADVERSE EVENTS All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
- MODIFICATIONS Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- TERMINATION OF STUDY Upon termination of the study a report has to be submitted to AUREC.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
APPROVED
P.O. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU