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EFFECT OF GENDER AND AGE ON THYROID FUNCTION TESTS (TFT) AT HAYATABAD MEDICAL COMPLEX PESHAWAR, PAKISTAN

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ABSTRACT

Background:
Thyroid function tests (TFTS) are essential for evaluating thyroid function, sense they provide information about thyroid gland. Function based on factors including TSH. T3, T4. These characteristic can be effected by a number of factors, such as age and gender, which may have in effect on the diagnosis and treatment of thyroid problems.

Objective:
The objective of current study were to check the fffect of age on Thyroid hormone level. To find out gender-based variation on thyroid function test (TFT) and to determine relationship between age, Gender and thyroid function

***Methodology**:*
We conducted a cross-sectional secondary data analysis on participants who visited OPD of Hayatabad Medical Complex. A total 139 participants were included in our study.

Results:
Correlation study revealed that age is directly related to the thyroid hormone level. With increasing age thyroid hormone level also increase specifically T4 .Gender variation For T3 and T4 also showed positive result with T4 Being observed in Higher Number in Male relative to Female. Regression analysis Produced negative Result for the effect of age on thyroid hormone level while or gender base variation the result were statistically significant P value being 0.048 for the effect of male Gender on T4 hormone.

CONCLUSION:
The thyroid gland produces hormones T3 and T4, controlling metabolic rate and vital functions. Deranged levels can cause thyroid-related problems in both men and women. Research shows age correlates with T3, but gender may affect T4 level.

INTRODUCTION

1.1 Background:

1. CHAPTER INTRODUCTION

The thyroid is an endocrine gland positioned just behind the larynx on either side of the front trachea. It's a ductless gland. The adult gland has an average weight of 25-40 gm.(1) Thyroid hormones are essential for the development and maintenance of normal metabolic processes in people during their lifespans. Thyroid function is evaluated by testing levels of thyroid stimulating hormone (TSH) and free thyroid hormone.(2)

The gland secretes two metabolically active hormones, tetra-iodo-thyroxine or thyroxin (T4) and tri-iodo-thyroxine (T3), in quantities of 93% and 7%, respectively. T3 is four times more powerful than T4, but has a shorter half-life and lower concentration in the blood. TSH, the anterior pituitary hormone, regulates the gland, and the hypothalamus further controls it.(3)

Thyroid hormones have an important function in brain development. FT4 regulates thyroid secretion, and both FT3 and FT4 are indicators of thyroid health. The thyroid gland produces T3 and T4 in the presence of iodine and a protein known as thyroglobulin. Age, gender, body weight, nutrition, climate, and health status may all have an impact on T3 and T4 hormone production(4)

Thyroglobulin (TG) is produced when iodide is taken in by the follicular cell and then converted into its oxidized form by thyro-peroxidase (TPO). This process is used to generate thyroid hormone. Thyrotropin (TSH) is necessary for the series of gene activations that starts with the absorption and breakdown of thyroid gonadotropin (Tg) and culminates in the thyroid hormone being released. According to a typical negative feedback regulatory system, the hypothalamus hormone thyroprotein- releasing hormone (TRH) stimulates the synthesis and release of thyroid stimulating hormone (TSH), whereas thyroid hormones decrease it. The thyroid gland is the only organ that can produce serum thyroxine (T4), (5)

Although -monodeiodination of T4 produces more than 80% of plasma triiodothyronine (T3). One of the organs that contains the enzyme selenocysteine- deiodinase type I (DI-I) is the liver.

The general population is especially susceptible to non-specific symptoms associated with thyroid function abnormalities, which are common. For this reason, early screening is essential.

For various ailments. In most cases, assessing thyroid-stimulating hormone (TSH) is the most useful test for figuring out thyroid function, especially in people with hyper- or hypothyroidism.(6)

Based on certain research, when there is enough iodine available, the TSH levels in the general population tend to be greater and increase as people become older, unlike in locations where there is a lack of iodine. Failure to utilize population- specific reference values may result in the inaccurate categorization of older individuals with regards to thyroid function, particularly in relation to subclinical hypothyroidism. The precise mechanisms underlying the changes in TSH levels with ageing have not yet been elucidated.(7)

Thyroid function test changes have been associated to disease and death in hospitalized older persons. A recent retrospective research found that low T4 and high TSH patients had worse outcomes. In older patients, a low blood T3 level is a strong predictor of death while hospitalized.(8)

Through thyroid hormone production, the thyroid controls the development, growth, and metabolism of most human tissues. Clinical signs of thyroid disease, which affects 10% of the population, show how important the thyroid gland is to the heart, brain, bone, and metabolism. Low thyroid function can induce increased body weight, elevated levels of cholesterol, reduced cognitive function, feelings of sadness and hopelessness, and heightened sensitivity to cold temperatures. Hyperthyroidism can lead to weight loss, tachycardia, atrial fibrillation, and osteoporosis.(9)

Progress in healthcare and wellness has led to longer lifespans and, as a result, an increase in age-related illnesses. Hormonal interactions of great complexity and importance govern endocrine homeostasis, and any dysfunction in these interactions may be responsible for the adaptation to later life and its influence on health.(10)

The concept of age-related alterations in TSH is still a subject of debate, and only a limited number of research have specifically examined The study investigates the age-related fluctuations in thyroid hormone levels among major Asian populations. A study in epidemiology conducted on inhabitants living in areas with sufficient iodine levels revealed that females exhibited higher levels of TSH compared to males. Nevertheless, there was no notable correlation seen between age and TSH levels.(11)

1.2 Hyperthyroidism:

Hyperthyroidism is a condition characterized by an abnormally high level of thyroid hormones in the body's tissues. This can be caused by an overproduction of thyroid hormones, an excessive release of pre-existing thyroid hormones, or the presence of thyroid hormones from a source outside of the thyroid gland.(12)

Graves' disease is the primary cause of hyperthyroidism. Additional frequent factors encompass thyroiditis, toxic multinodular goiter, toxic adenomas, and adverse reactions of specific drugs. The diagnostic evaluation commences with a thyroid- stimulating hormone level examination. Measuring radionuclide uptake is useful in differentiating between potential reasons when test results are inconclusive.(13)

Toxic nodular goiters result in hyperthyroidism as a result of the independent excessive activity of certain regions inside the thyroid gland. Hyperthyroidism can be treated using three recognized modalities: anti-thyroid medications, surgery, and radioiodine. While all methods are efficacious, none of them provide a definitive remedy. Patients diagnosed with Graves' disease may receive a prescription for anti- thyroid medications for a duration of 12 to 18 months in order to achieve a sustained remission. These medications are frequently administered temporarily to bring the patient's thyroid function to a normal level before undergoing final treatment with radioiodine or thyroidectomy.(14)

1.3 Hypothyroidism:

Hypothyroidism can arise due to either primary gland failure or inadequate stimulation of the thyroid gland by the brain or pituitary gland. Primary gland failure may occur due to congenital defects, autoimmune damage (such as Hashimoto disease), iodine shortage, or infiltrative illnesses.(15)

Hypothyroidism can be categorized into two types: primary, which occurs when the thyroid gland fails to function properly, and secondary (central), which is caused by insufficient release of thyroid-stimulating hormone (TSH) from the pituitary gland or thyrotropin-releasing hormone (TRH) from the hypothalamus(16)

The measurement of TSH is regarded as the primary diagnostic test for identifying thyroid disorders, particularly overt and subclinical hypothyroidism, due to three key factors. The concentrations of TSH and FT4 have an inverse log-linear relationship. Therefore, even slight decreases in FT4 levels are linked to a significant rise in TSH levels. Furthermore, the majority of hypothyroidism cases encountered in clinical practice are caused by primary dysfunction of the thyroid gland. Furthermore, immunometric tests for TSH exhibit a sensitivity and specificity above 99%.(17)

1.4 Problem Statement:

Approximately 33% of the global population resides in regions characterized by a lack of iodine. Endemic goiter typically occurs in regions where the daily intake of iodine is 50 mg, but congenital hypothyroidism is observed when the daily consumption drops to 25 mg. Goiter is quite prevalent in regions with significant iodine shortage, with rates reaching up to 80%. Vulnerable populations often reside in geographically isolated and hilly regions in South-East Asia, Latin America, and Central Africa.(18)

Thyroid dysfunction is a prominent endocrine condition. It constitutes around 30% to 40% of the patients observed in an endocrine practice. According to the American Association of Clinical Endocrinologists (AACE), almost 13 million individuals in the United States, which is approximately 4.78% of the population, have undiagnosed thyroid dysfunction. The study used data from all age groups and determined that a level of 4.5 mIU/liter represents the 97.5 percentile. Elderly patients were discovered to have elevated levels of serum TSH, with concentrations slightly over the upper limit of the normal range, specifically between 4.5 and 10 mIU/liter. The occurrence of serum TSH levels exceeding 4.5 mIU/liter also rose as patients grew older. In a population devoid of any documented or acknowledged thyroid disorder or ant thyroid antibodies, not undergoing thyroid medication, and without any other characteristics that increase the likelihood of thyroid dysfunction,(19)

The study utilized information from all age groups to establish the threshold of 4.5 mIU/liter as the 97.5 percentile. The majority of elderly patients with elevated serum TSH levels have a slight increase just over the top limit of the normal range, ranging from 4.5 to 10 mIU/liter. The occurrence of serum TSH levels above 4.5 mIU/liter also tends to increase with age. In a study conducted on a population with no reported or known thyroid disease, no ant thyroid antibodies, no use of thyroid medication, and no other risk factors for thyroid dysfunction, the value of 4.5 mIU/liter was determined as the 97.5 percentile by considering data from all age categories. The majority of elderly individuals with elevated serum TSH levels have a slight increase that is slightly beyond the upper limit of the normal range, ranging from 4.5 to 10 mIU/liter. The

occurrence of serum TSH levels above 4.5 mIU/liter also tends to increase with age. Within a population lacking any documented or recognized thyroid disorders or ant thyroid antibodies, not utilizing thyroid medication, and devoid of any additional conditions that increase the likelihood of thyroid dysfunction(20).
In light of the growing recognition that both subclinical and clinical forms of hyperthyroidism and hypothyroidism in the United States may contribute to health issues such as osteoporosis, hyperlipidemia, hypercholesterolemia, hyperhomocysteinemia, and cardiovascular and neuropsychiatric diseases, particularly among older individuals, we conducted this study to establish reference data for TSH, T4, TgAb, and TPOAb in the United States. We also aimed to assess the overall thyroid function based on data obtained through the population sampling methodology of NHANES III(21).
The study found that the rates of overt and subclinical hypothyroidism, as well as autoimmune thyroiditis, increased as the iodine intake levels increased in different regions of China. These regions had iodine intake levels that ranged from mildly deficient (median urinary iodine excretion of 84 mg per litre) to more than adequate (median of 243 mg per litre) and excessive (median of 651 mg per litre)(22)

1.5 Significance of the Study:

Understanding the effect of gender and age on thyroid function tests (TFTs) is crucial for several reasons. First, it enhances the accuracy of diagnosing thyroid disorders. Thyroid function varies with age and gender, which can influence the interpretation of TFT results. For instance, TSH levels tend to increase with age, which can sometimes be misinterpreted as subclinical hypothyroidism in elderly patients if age-specific reference ranges are not considered. Similarly, women are more prone to thyroid dysfunctions, particularly autoimmune thyroid diseases, which necessitates gender-specific diagnostic criteria.
Second, this understanding aids in tailoring treatment plans. Personalized treatment approaches that consider demographic factors can improve patient outcomes. For example, older adults may require different therapeutic strategies compared to younger individuals due to the physiological changes that occur with aging. Recognizing gender differences in thyroid function can also help in optimizing treatment protocols for men and women, thereby reducing the risk of over- or under- treatment.
Third, it contributes to the broader field of endocrinology by filling existing gaps in the literature. While there is substantial research on thyroid function and its disorders, studies specifically focusing on the combined effect of age and gender on TFTs in diverse populations are limited. This study, conducted in the local context of Hayatabad Medical Complex (HMC) in Peshawar, provides valuable data that can enhance the global understanding of thyroid function variations.
Finally, this research has public health implications. Early detection and management of thyroid disorders can significantly reduce the burden of these conditions on healthcare systems. By identifying how age and gender influence TFT results, this study can inform public health strategies aimed at improving thyroid health awareness and screening programs, ultimately leading to better health outcomes .

1.6 RATIONALE:

It is essential to have an understanding of the ways in which age and gender influence thyroid function in order to improve the diagnosis and treatment of thyroid problem. The study of how levels of thyroid hormone fluctuate with age and how they differ between the sexes, we may enhance our ability to recognize and manage thyroid disorders, which will eventually lead to better health outcomes for everyone.

1.7 AIMS AND OBJECTIVE:

The objective of current study were.

i. Effect of age on Thyroid hormone level.
ii. To find out gender-based variation on thyroid function test (TFT)
iii. To determine relationship between Age, Gender, and thyroid function.

2 CHAPTER LITERATURE REVIEW

Iqbal F, Ghaffar T, Shah MA, and Ahmad R. Probing. The study sought to ascertain the frequency of thyroid disorders among the native population of Khyber Pakhtunkhwa (KP) Province in Pakistan. This cross-sectional research was conducted at the Department of Endocrinology HMC Peshawar from January 2020 to January 2021. It involved gathering clinical and laboratory data through the use of a questionnaire. Out of the total 868 participants, 88 individuals (10.1%) were found to have thyroid disorders. Hypothyroidism accounted for 48% of the cases, while Hashimoto's thyroiditis was observed in 35% of the cases, making these the most prevalent conditions. The overall incidence of thyroid disease was determined to be 10.1%. The increasing prevalence highlights the necessity of developing proactive and therapeutic approaches for thyroid disorders in the area.

Ahad A, Bibi R, Rehman SU, Shah MA, Ullah. Journal of Rawalpindi Medical College. 2022; 26(4). A study conducted at a tertiary care hospital in Peshawar investigated the prevalence of congenital hypothyroidism in neonates admitted with neonatal jaundice. The study revealed that the frequency of congenital hypothyroidism in this group was 1%. The study comprised 489 moms between the ages of 18 and 30, consisting of 279 men and 210 females. The findings revealed that 3% of the mothers had a confirmed record of hypothyroidism, while the remaining 97% had no such history.

Sajjad Ahmad and colleagues According to a 2021 study conducted at Quaid- e-Azam Medical College in Bahawalpur by, women have greater serum levels of Thyroid Stimulating Hormone (TSH) than men. There were 196 female participants and 222 male participants in the study, ages 16 to 75. The findings indicated that TSH levels were greater in women (2.11mU/L ±1.54) than in men (1.59mU/L ±1.2). In addition, FT4 levels were lower in women (1.33ng/dL ±0.50) than in men (1.48ng/dL
±0.48). The study also discovered that the mean TSH was lowest in the fall (2.4mU/L) and highest in the winter (2.98mU/L). Wintertime FT3 levels were also found to be higher in the study.

Najdana Gligorovic Barhanovic In 2019 reviewed 946 female participants, ages 20 to 69. The following antibodies were tested: fT3, fT4, thyroid peroxidase, and thromboglobulin. Two distinct systems were used to analyze the eighty samples. Age- related increases in TSH were seen, but no discernible change in fT3 levels. The two oldest groups had higher fT4 levels, though. With 5.2% of individuals having higher TSH levels than the cohort-specific threshold but lower than the upper reference limit, the 20–29 age group had the highest proportion of reclassification. Whereas the difference for fT4 assays was around 13.8%, the interassay absolute mean difference between the comparing TSH tests was 24.5%.

Attaullah et al. (2016) was to clarify the correlation between demographic variables and thyroid dysfunctions, with a particular emphasis on the populations of Peshawar and Charsadda, Pakistan. The research emphasizes a substantial gender disparity in the prevalence of thyroid abnormalities, with females exhibiting a higher frequency of these conditions than males. This discovery is in accordance with global trends, which indicate that thyroid dysfunctions are more prevalent in women. This phenomenon may be attributed to hormonal fluctuations associated with reproductive factors.

Khan G, ET al.observational study was carried out between January and June 2017 to ascertain the prevalence of thyroid dysfunction in individuals diagnosed with type 1 diabetes mellitus (DM). The study encompassed all individuals diagnosed with type 1 diabetes mellitus, irrespective of their age or gender. Thyroid function was evaluated through the use of thyroid stimulating hormone (TSH), free T4 (FT4), and free T3 (FT3) examinations. The patients were classified into five groups: thyroid, subclinical hypothyroidism, overt hypothyroidism, subclinical hyperthyroidism, and overt hyperthyroidism. The study had a total of 104 patients, with 38 (36.5%) being men and 66 (63.5%) being females. The study participants had an average age of 20.5
± 4.4 years, an average body mass index (BMI) of 24.9 ± 1.6, and an average duration of diabetes of 3.7 ± 1.4 years. The average HBA1c level was 7.9 ± 0.71%, and the average TSH level was 5.4 ± 4.4 mIU/mL. Out of the patients, 12 (11.5%) were diagnosed with hypothyroidism, 16 (15.4%) had subclinical hypothyroidism, and 76 (73.1%) had normal thyroid function (euthyroid). There were no instances of hyperthyroidism observed. The study determined that thyroid dysfunction, including overt and subclinical hypothyroidism, is frequently observed in individuals diagnosed with type 1 diabetes mellitus.

Attaullah and Haq (2017) investigated the link between subclinical thyroid dysfunction (STD) and dyslipidemia at the Pakistan Health Research Centre, Khyber Medical College, and Khyber Medical University. This cross-sectional study comprised 30 Peshawar patients aged 10 to 70 years. Patients with subclinical

hypothyroidism (SCH-I) exhibited significantly higher levels of total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C), with mean values of 194.67 ± 34.81 and 146.56 ± 47.6, respectively. Patients with subclinical hyperthyroidism (SCH-II) exhibited reduced mean TC and LDL-C levels of 151.29 ± 35.22 and 89.48 ± 27.15, respectively. Triglycerides (TG) were greater in SCH-II (125.62 ± 68.98) than SCH-I (91.89 ± 33.62). The study discovered that serum TC and LDL-C levels were significantly elevated in SCH-I patients (p-values 0.033 and 0.029, respectively), whereas serum TC, LDL-C, VLDL-C, and TG levels were negatively correlated with STD, with correlation coefficients of -0.601, -0.533, -0.401, and -0.401, respectively. These findings show that lipid profile changes are more pronounced in subclinical hypothyroidism, while preclinical hyperthyroidism has no significant effect on lipid profiles, emphasizing the necessity of monitoring lipid levels in patients with subclinical thyroid disease.

Barhanovic et al. (2019) conducted a cross-sectional study to establish reference values for thyroid function tests in Montenegrin females and investigate the impact of age-related changes and interassay bias on three regularly used immunoassays. The study comprised 946 females aged 20 to 69 who were tested for TSH, fT3, fT4, thyroid peroxidase, and thyroglobulin antibodies, with 80 samples undergoing further immunochemistry analysis on two different platforms. The findings demonstrated that median TSH levels gradually increased with age, but fT3 levels stayed constant and fT4 levels were considerably higher in the oldest age groups. Age-specific TSH reference intervals resulted in the largest reclassification rate (5.2%) in the 20-29 age group, with 7.7% of the oldest participants having TSH levels above the cohort-specific but below the age-related upper reference range. Significant interassay variances were discovered, with the biggest mean differences observed in TSH (24.5%) and fT4 (13.8%) assays, and low correlation coefficients for fT3 assays from different manufacturers. The study emphasized the relevance of age- specific TSH reference intervals, as well as the need for thyroid function test standardization, in order to increase diagnostic accuracy and consistency.

Choi et al. (2022) studied the use and characteristics of thyroid function test (TFT) results, including serum thyroid stimulating hormone (TSH), free thyroxine (free T4), and total triiodothyronine (total T3), in Korean adults who visited local clinics and hospitals between 2018 and 2020. The study examined 69,575 specimens from 47,685 adult Korean patients (4,878 men and 42,807 women), with an average age of 42.7 years (SD 13.2). Of them, 23,581 specimens were examined for TSH alone, 38,447 for TSH plus free T4 (including 17,978 without total T3), and 20,469 for all three. The proportion of euthyroidism was 80.0% across all specimens, 71.2% among those evaluated for TSH and free T4, and 64.2% for all three TFTs. Approximately 6.9% of the 20,469 specimens with all three TFTs had patterns that were difficult to interpret and necessitated further clinical data. Notably, no specimen in this group shown increases in all three metrics. This data on TFT result prevalence is useful for better understanding patient population characteristics and increasing test utilization.

Tapper et al. (2017) conducted a study to evaluate the relationship between thyroid-stimulating hormone (TSH) and free thyroxine (FT4), as well as TSH and free triiodothyronine (FT3), in clinical thyroid function tests (TFTs). This study retrieved TFT results from a chemical pathology laboratory information management system, encompassing tests performed between February and December 2015. The results were categorized based on TSH levels into suppressed, mildly suppressed, normal, mildly elevated, and elevated, and these categories were then correlated with FT3 and FT4 levels. Additionally, the results were classified into clinical categories such as overt hyperthyroidism, subclinical hyperthyroidism, normal, subclinical hypothyroidism, overt hypothyroidism, and ―others,‖ and analyzed based on age and gender. The study found that FT4 and FT3 correlated best with TSH at suppressed and elevated levels. Mean TSH was significantly higher in males compared to females, but only in those with normal FT4 and TSH. The highest TSH levels were observed in the 41-60 age group, with females in this cohort having significantly higher

levels than males. There was an inverse correlation between FT4 and TSH, and FT3 and TSH, particularly at suppressed and elevated TSH levels. These findings emphasize the complex relationship between TSH, FT4, and FT3, highlighting the importance of considering age and gender when interpreting TFT results.

Javaid et al. (2022) conducted a comprehensive study in 2018 to assess thyroid function testing frequency and factors influencing serum thyrotropin (TSH) levels in a hospital laboratory serving a population of 604,000. Excluding those on thyroid- affecting medications or with relevant conditions, the study found that 28% of the local population underwent thyroid function testing that year, with significant differences by gender (28.2% women vs. 23.4% men) and age groups, peaking at over 50% for those over 80 years old and remaining below 2% for those under 16.

Symptoms frequently associated with thyroid dysfunction showed no significant difference across thyroid dysfunction groups. Serum TSH levels were 0.1 mIU/L higher in older people, notably after the age of 60, and in women during the early morning hours, as well as in the winter and spring seasons. The study proposed potential cost savings by recalibrating TSH reference intervals across demographics and seasons, emphasizing the need for refined diagnostic approaches to better align testing with symptomatic thyroid disorders and optimize resource utilization in clinical practice.

Jimoh et al. (2020) conducted a retrospective study at a rural tertiary health institution in Nigeria to look at the biochemical patterns of thyroid function tests (TFTs) and clinical impressions of thyroid diseases. After analyzing data from 297 TH assay requests and removing cases with insufficient clinical information, the study discovered a significant female predominance among patients (female-to-male ratio of 9.9:1). Goiters were the most common reason for TFTs (36.5%), followed by gynecological diseases (20.9%) and clinical thyroid disorders (17.9%). Despite clinical suspicions, 45.8% of goiter cases were biochemically euthyroid, while 13.5% had primary hyperthyroidism. Clinical impressions revealed thyroid problems in 47 instances, with 27.7% euthyroid, 17% biochemically hyperthyroid, and 10.6% hypothyroid. Only 7.3% of patients with gynecological problems revealed biochemical evidence of TH change, with the majority being euthyroid (56.4%). Routine medical examinations found that 46.6% of patients had abnormal thyroid hormone levels, which included both hyperthyroidism and hypothyroidism. The study underlines goiter as the primary thyroid condition in this rural milieu and emphasises the mismatch between clinical suspicion and biochemical TFT results

3 CHAPTER MATERIAL AND METHOD

3.1 STUDY DESIGN:

Cross sectional

3.2 sample size :

The sample size was calculated using an online WHO software formula, resulting in a requirement of 139 participants. This calculation was based on a 95% confidence level, an anticipated population proportion of 0.1, and a 5% margin of error.

We calculate sample size of the study by Online WHO software formula

Sample size 139
Confidence level % 95%
Anticipated population proportion 0.1
Margin of error (percent) 5 %

3.3 STUDY SETTINGS:

•HMC (Hayatabad Medical Complex Peshawar).Pakistan

3.4 Ethical Considerations:

The ethical review committee of Hayatabad Medical Complex (HMC) granted ethical permission for the project.

3.5 PARTICIPANT RECRUITMENT:

Participants were recruited by providing them with information about the study. Once they agreed and provided written informed consent Annexure, they were included in the study.

3.6 DATA COLLECTION:

Data were collected using a structure annexure designed to gather relevant demographic information (age, gender) and medical history.

3.7 BLOOD SAMPLE COLLECTION:

Blood samples were collected by trained medical personnel, ensuring the safety and comfort of participants. The samples were then processed to separate the serum for analysis.

3.8 SAMPLE STORAGE:

•Aliquot serum or plasma samples are stored at -20°C for short-term storage (up to a few weeks).
•For long-term storage (more than a few weeks), samples are stored at -80°C to preserve the integrity of thyroid hormones and other analytes.

3.9 LABORATORY ANALYSIS:

The serum samples were analyzed using Chemiluminescent Micro particle Immunoassay (CMIA) to measure the concentrations of T3, T4, and TSH. This test utilizes the CMIA principle, where chemiluminescent micro particles linked to antibodies capture or detect specific antigens or antibodies in the sample. On a COBAS machine, the capture antibody on the micro particles binds to the desired analyte in the sample. After washing away unbound substances, a chemiluminescent- labeled antibody is added, forming a sandwich complex with the captured analyte. Upon triggering, the chemiluminescent label emits light in proportion to the amount of analyte bound, enabling precise detection. CMIA tests are renowned for their sensitivity, specificity, and accuracy, making them optimal for clinical diagnosis and monitoring of illnesses.

3.10 SAMPLING METHOD:

Participants were selected using a convenience sampling method from individuals visiting the Hayatabad Medical Complex, Peshawar. This method was chosen due to its practicality and the availability of participants within the specified location and timeframe.

3.11 PARTICIPANT CHARACTERISTICS:

Participants included in the study were adult individuals aged 18 to 65 years. Both males and females were included, provided they gave written informed consent to participate in the study.

3.11.1 Inclusion Criteria:

- Adult individuals aged 18 to 65 years.
- Both males and females.
- Written informed consent provide by the participant.

3.11.2 Exclusion Criteria:

- o Individuals below 18 years or above 65 years of age.
- o Individuals without written informed consent

4 CHAPTER RESULTS;

Demographic Data:

Table 1Gender distribution

		Frequency	Percent
Valid	Male	66	47.5
	Female	73	52.5
	Total	139	100.0

demographic data presented in the study at Hayatabad Medical Complex Peshawar, Pakistan" illustrates the gender distribution of the participants. Out of a total of 139 participants, 66 (47.5%) were male, and 73 (52.5%) were female. All of the participants belonged from different areas of Pakistan with different socioeconomic status.

Figure 1Distribution of T4 with Age Groups

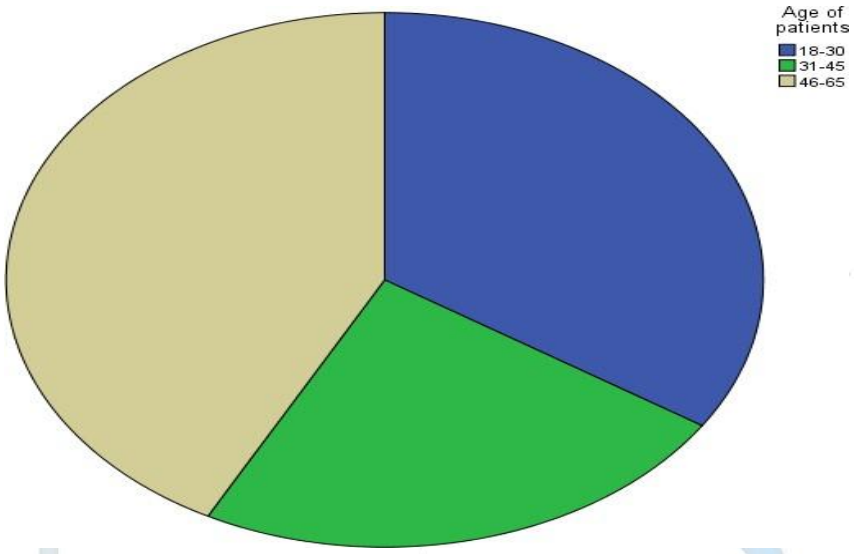

Table 2Age Distribution

		Frequency	Percent
Valid	18-30	48	34.5
	31-45	36	25.9
	46-65	55	39.6
	Total	139	100.0

The age distribution of participants in Hayatabad Medical Complex Peshawar, Pakistan" is detailed in the table, showing a diverse range of ages. Out of the 139 participants, 48 (34.5%) are aged between 18 and 30 years, 36 (25.9%) are aged
between 31 and 45 years, and 55 (39.6%) are aged between 46 and 65 years. This distribution highlights that the largest group of participants falls within the 46-65 age range, followed by the 18-30 age group, with the 31-45 age group being the smallest. This varied age distribution is essential for the study's aim of analyzing the impact of age on thyroid function tests, as it allows for a comprehensive evaluation of how thyroid function may differ across different age groups, contributing to a deeper understanding of age-related variations in thyroid health.

Figure 2Age wise distribution of T3 and T4 hormone

Distributions of Thyroid Hormones with Age Groups:

The Histograms Illustrate The Distribution Of T3 And T4 Levels Categorized By Age Groups (18-30, 31-45, And 46-65). For T3 Levels, A Noticeable Increase Is Observed in Both the Youngest (18-30) and oldest (46-

65) age groups, with a slight dip in the middle group (31- 45). Similarly, T4 levels show a pattern of higher concentrations in the youngest and oldest age groups, peaking significantly in the oldest group. Comparing T3 and T4 distributions, both hormones exhibit comparable levels in the youngest age group, while T4 levels notably surpass T3 in the middle and oldest age groups. Data sources include [mention source or study cohort], providing insights into age-related variations in thyroid hormone levels.

Analysis of Variance:

Table 3Anova table for T3

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.071	2	0.535	1.906	0.153
Within Groups	38.202	136	0.281		
Total	39.272	138			

Table 4Anova table for T4

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	170.314	2	85.157	2.290	0.105
Within Groups	5057.196	136	37.185		
Total	5227.510	138			

One-way Anova results for both T3 and T4 indicate that there are no statistically significant differences in their mean levels across the three age groups. The F statistics for T3 is 1.906 with a p value 0.153 and for T4 the F statistics is 2.290 with a p value 0.105. Both p values are greater than 0.05 leading us to fail to reject null hypothesis in both cases. Any observed difference in T3 and T4 levels among the age groups are likely due to random variation rather than a systematic effect of age. These findings are important as they suggest that age does not significantly impact T3 and T4 levels. It implies that thyroid function markers remain relatively stable across different age groups. This knowledge is valuable for clinicians and researchers as it indicates that age related changes in thyroid hormones may not be a major concern, allowing for a more consistent interpretation of thyroid function tests across a wide age range

Descriptive:

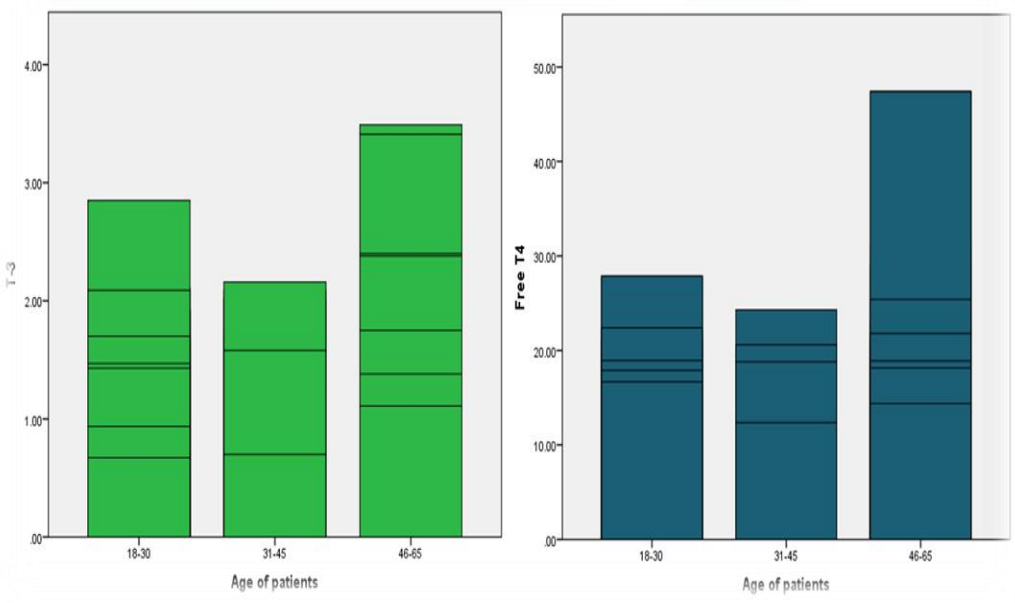

Table 5Effect of Age on thyroid Hormones

Age Group	N	Free T4 Mean	Free T4 Std. Deviation	T-3 Mean	T-3 Std. Deviation
18-30	48	17.2977	4.11737	1.3498	0.40610
31-45	36	15.8869	3.35457	1.4187	0.37267
46-65	55	18.6660	8.46185	1.5504	0.68839

Across different age groups (18-30, 31-45, and 46-65), variations in Free T4 and T-3 levels are observed. Free T4 levels exhibit a trend of increase with age, with the highest mean level observed in the 46-65 age group (18.6660), followed by the 18-30 age group (17.2977), and the lowest in the 31-45 age group (15.8869). Similarly, T-3 levels also show a slight increase with age, with the highest mean observed in the 46-
65 age group (1.5504), followed by 31-45 (1.4187), and then 18-30 (1.3498). Variability in hormone levels, especially in Free T4 among the older age group, suggests potential age-related differences in thyroid function, warranting further investigation into their clinical implications.

Table 6Gender based Variations on Thyroid Hormones (TFT)

Gender	N	Free T4 Mean	Free T4 Std. Deviation	T-3 Mean	T-3 Std. Deviation
Male	66	18.7297	7.75030	1.5528	0.64538
Female	73	16.3382	3.95269	1.3514	0.38716

This table provides an overview of the mean and standard deviation of Free T4 and T- 3 levels for male and female participants. Male participants generally exhibit higher mean levels of Free T4 and T-3 compared to females, with Free T4 showing greater variability among males. These findings suggest potential gender-based differences in thyroid hormone levels, highlighting the need for further statistical analysis to explore these differences in depth.

Table 7; Relationship between Age, Gender and Thyroid hormones (T3 and T4)

Dependent Variable	Predictor	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)		Sig.
Free T4	(Constant)	21.907	3.24	-	6.75	.000
			3		4	
	Age of	-0.214	0.76	-0.030	-	.779
	patients		1		0.28	
					2	
	Gender	-2.618	1.30	-0.213	-	.048
			9		2.00 0		
T3	(Constant)	1.584	0.28 1	-	5.63 7		0.00 0
	Ag of patients	0.046	0.06 6	0.066	0.07 5	0.70 5	.482
	Gender	-0.152	0.11 3	-0.143	- 1.34		.182

The regression analysis reveals that gender significantly affects Free T4 levels, with males having significantly lower Free T4 levels than females (p=.048p = .048p=.048). However, age does not significantly predict Free T4 (p=.779p = .779p=.779) or T3 levels (p=.482p = .482p=.482). Additionally, gender does not significantly predict T3 levels (p=.182p = .182p=.182). In summary, gender is an important factor in determining Free T4 levels, whereas age does not significantly influence either Free T4 or T3 levels.

5 CHAPTER DISCUSSION:

The Study Includes All Participants From Various Regions Of Pakistan After Obtaining Their Written Consent. The Participants Exhibited Diverse Socioeconomic Positions, Educational Backgrounds, And Degrees Of Awareness Regarding Thyroid Disorders And Associated Hormones. The Primary Aims Of Our Study Were To Examine The Impact Of Age On Thyroid Hormone Levels, Explore Gender-Related Differences In Thyroid Hormones, And Establish The Correlation Between Age, Gender, And Thyroid Function. The Average Age Of The Participants, Encompassing Both Males And Females, Was 57.6 Years, With 66 Males And 73 Females.

The Primary Aim Of Our Study Was To Investigate The Impact Of Ageing On Thyroid Hormone Levels. Statistical Research Revealed That There Were Changes In Free T4 And T3 Levels Across Different Age Groups, Specifically The Age Groups Of 18-30, 31-45, And 46-65. As Individuals Get Older, Their T4 Levels Tend To Increase. This Was Validated By Analyzing The Association Between Age And T4 Levels. The Greatest Average T4 Level Was Found In The 46-65 Age Group (18.6660), Followed By The 18-30 Age Group (17.2977), And The Lowest In The 31- 45 Age Group (15.8869). The Levels Of T3 Also Exhibited A Marginal Rise As Individuals Became Older, With The Highest Average Value Recorded In The 46-65 Age Bracket (1.5504), Followed By The 31-45 Group (1.4187), And Finally The 18- 30 Group (1.3498). These Findings Align with Prior Research Indicating That as Individual‘s Age, There Is a Wider Variation in Thyroid Hormone Levels, Which May Result in Thyroid Issues If Not Addressed. Possible Causes For These Alterations May Be Attributed To Inadequate Dietary Habits And Physiological Variables, Such As Reduced Responsiveness To Thyroid Hormones And Insufficiencies In Essential Nutrients. Autoimmune Illnesses Are One Of The Pathological Reasons That Contribute To The Variation In Thyroid Hormone Levels That Occurs With Age (Woeber, 1996; Mariotti Et Al., 1995). Woeber's Study Examines The Impact Of Ageing On The Metabolism Of Thyroid Hormones, Specifically Noting Reduced Sensitivity And Deficits In Nutrients. This Corresponds With Our Own Studies That Indicate Higher Levels Of T4 And T3 As Individuals Grow Older. Mariotti Et Al. Similarly Address The Vulnerability Of Elderly Individuals To Thyroid Malfunction As A Result Of Comparable Variables, Corroborating Our Findings. Our Dataset Also Comprised People From Both Sexes

And Revealed Disparities In Thyroid Hormone Levels Between Males And Females. On Average, Male Participants Had Higher Levels Of Free T4 And T3 Compared To Females. Among Males, Free T4 Levels Showed More Variation. These Variations Can Be Ascribed To Physiological And Pathological Reasons. Sex Hormones, Namely Testosterone, Have A Notable Impact On The Levels Of Thyroid Hormones. Androgens Enhance The Activity Of Thyroid-Binding Globulin, Hence Influencing The Availability Of Hormones. In General, Males Have A Faster Metabolic Rate And Lean Body Mass, Which Is Correlated With An Elevated Production Of Thyroid Hormones. Autoimmune Thyroid Disorders Have A Higher Prevalence In Females And Specifically Impact Thyroid Hormones (Duntas & Brenta, 2012; Hollowell Et Al., 2002). The Study Conducted By Duntas And Brenta Emphasises The Impact Of Testosterone On Thyroid Hormone Levels. Additionally, Hallowell Et Al. Present Data On The Variations In Thyroid Hormones Across Genders, Which Aligns With Our Discovery Of Elevated T4 And T3 Levels In Males.

A Linear Regression Analysis Was Performed To Ascertain Any Causal Correlations Between Age, Gender, And Thyroid Hormones. An Evident And Strong Association Was Found Between Age And Thyroid Hormones, Particularly T4, And A Minor Positive Correlation For T3. This Implies That There Is A Clear Correlation Between Age And T4 Levels, With T4 Levels Increasing As Age Increases. Additionally, There

Is A Minor Increase In T3 Levels. Nevertheless, The Regression Analysis Results For T3 Did Not Show Statistical Significance (P = 0.482), And For T4, The P-Value Was 0.779. This Suggests That Age Does Not Have A Causal Effect On Changes In Thyroid Levels, But It Is Positively Associated With Higher Levels Of Thyroid Hormones. Gender-Based Regression Analysis Revealed A Statistically Significant Finding For T4 (P = 0.048), Suggesting That T4 Hormone Levels Are Influenced By Gender. Specifically, T4 Hormone Levels Are Lower In Females and Greater In Males, Possibly Due To Elevated Levels of Thyroid-Binding Globulin and Testosterone. The Regression Analysis Conducted On T3 Hormones Yielded A Non-Statistically Significant Result (P = 0.182), Indicating That There Is No Evidence Of Gender-Based Changes In T3 Levels. The Results Indicate Possible Disparities In Thyroid Hormone Levels Based On Gender, Emphasizing The Necessity For More Statistical Examination (Aoki Et Al., 2007; Brabant Et Al., 2006). Aoki Et Al. Investigated The Associations Among Age, Gender, And Thyroid Function, And Discovered Notable Disparities That Align With Our Own Results. Brabant Et Al.
Examined The Fluctuations In Thyroid Function Tests And Emphasized The Importance Of Taking Into Account Age And Gender When Interpreting Thyroid Hormone Levels.

5.1.1 CONCLUSION:

Thyroid Gland produces hormones T3 and T4 which controls the metabolic rate of our body and perform many other vital functions. Due to pathological reasons, the hormone levels become deranged and cause different thyroid related problems in men and women. Many research studies have been conducted to relate the thyroid hormone level with Age of the individuals and explore gender-based variations among these hormones. Surprisingly different studies produce different results worldwide but most studies coherently produce the results for correlating thyroid hormones with Age of the individuals to be directly related to one another. Our findings based on regression analysis do not produce significant results for T3 but T4 results were significant for Gender which concluded that Male gender is producing some effect on T4 levels due to physiological reasons behind it.

5.1.2 LIMITATIONS AND FUTURE DIRECTIONS:

The Data is collected on self-administered preforms and only one hospital was focused in the research study. The sample size is very small and convenient sampling technique is used. Only Age and gender were considered variables in connection to the thyroid hormone level differences. There is a need to discover more variables are which might come in direct relation to the thyroid hormone levels and Clinical biomarkers must be considered in future research studies to produce Some clinically relevant data

REFERENCES

Ahmed Z, Khan MA, ul Haq A, Attaullah S, ur Rehman J. Effect of race, gender and age on thyroid and thyroid stimulating hormone levels in North West Frontier Province, Pakistan. Journal of Ayub Medical College Abbottabad. 2009;21(3):21-4.

Taylor PN, Lansdown A, Witczak J, Khan R, Rees A, Dayan CM, et al. Age- related variation in thyroid function–a narrative review highlighting important implications for research and clinical practice. Thyroid research. 2023;16(1):7.

Dabla P, Sharma S, Sinha N. Effect of age, gender and season on thyroid hormones status in children of East Delhi-a hospital based study. J Endocrinol Diabetes. 2018;5:1-11.

Ahmad S, Rashid HM, Hassan H, Mujahid M, Gul M. Age, Gender, and Seasonal Effects on Thyroid Profile in Adults with Normal Thyroid Functions. RADS Journal of Biological Research & Applied Sciences. 2021;12(1):17-23.

Costa VMCd, Moreira DG, Rosenthal D. Thyroid function and aging: gender- related differences. 2001.

Wang D, Li D, Guo X, Yu S, Qiu L, Cheng X, et al. Effects of sex, age, sampling time, and season on thyroid-stimulating hormone concentrations: a retrospective study. Biochemical and biophysical research communications. 2018;506(3):450-4.

Barhanovic NG, Antunovic T, Kavaric S, Djogo A, Spasojevic VK. Age and assay related changes of laboratory thyroid function tests in the reference female population. Journal of Medical Biochemistry. 2019;38(1):22.

Iglesias P, Ridruejo E, Muñoz A, Prado F, Macías MC, Guerrero MT, et al. Thyroid function tests and mortality in aged hospitalized patients: a 7-year prospective observational study. The Journal of Clinical Endocrinology & Metabolism. 2013;98(12):4683-90.

Porcu E, Medici M, Pistis G, Volpato CB, Wilson SG, Cappola AR, et al. A meta-analysis of thyroid-related traits reveals novel loci and gender-specific differences in the regulation of thyroid function. PLoS genetics. 2013;9(2):e1003266.

Meng Z, Liu M, Zhang Q, Liu L, Song K, Tan J, et al. Gender and age impacts on the association between thyroid function and metabolic syndrome in Chinese. Medicine. 2015;94(50):e2193.

Chen X, Zheng X, Ding Z, Su Y, Wang S, Cui B, et al. Relationship of gender and age on thyroid hormone parameters in a large Chinese population. Archives of Endocrinology and Metabolism. 2019;64:52-8.

Kravets I. Hyperthyroidism: diagnosis and treatment. American family physician. 2016;93(5):363-70.

Reid JR, Wheeler SF. Hyperthyroidism: diagnosis and treatment. American family physician. 2005;72(4):623-30.

Gittoes NJ, Franklyn JA. Hyperthyroidism: current treatment guidelines. Drugs. 1998;55(4).

Gaitonde DY, Rowley KD, Sweeney LB. Hypothyroidism: an update. South African Family Practice. 2012;54(5):384-90.

Kostoglou-Athanassiou I, Ntalles K. Hypothyroidism-new aspects of an old disease. Hippokratia. 2010;14(2):82.

Bensenor IM, Olmos RD, Lotufo PA. Hypothyroidism in the elderly: diagnosis and management. Clinical interventions in aging. 2012:97-111.

Vanderpump MP. The epidemiology of thyroid disease. British medical bulletin. 2011;99(1).

Garmendia Madariaga A, Santos Palacios S, Guillén-Grima F, Galofré JC. The incidence and prevalence of thyroid dysfunction in Europe: a meta-analysis. The Journal of Clinical Endocrinology & Metabolism. 2014;99(3):923-31.

Surks MI, Hollowell JG. Age-specific distribution of serum thyrotropin and antithyroid antibodies in the US population: implications for the prevalence of subclinical hypothyroidism. The Journal of Clinical Endocrinology & Metabolism. 2007;92(12):4575-82.

Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA, et al. Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). The Journal of Clinical Endocrinology & Metabolism. 2002;87(2):489-99.

Teng W, Shan Z, Teng X, Guan H, Li Y, Teng D, et al. Effect of iodine intake on thyroid diseases in China. New England Journal of Medicine. 2006;354(26):2783- 93.

Afridi MH, Ghaffar T, Hayat I, Khan MK, Ahmad W. Thyroid Disease Prevalence.

Ahad A, Bibi R, Rehman SU, Shah MA, Ullah M. Frequency of congenital hypothyroidism in new born admitted with neonatal jaundice at tertiary care hospital peshawar. Journal of Rawalpindi Medical College. 2022;26(4).

Attaullah S, Haq BS, Muska M. Thyroid dysfunction in khyber pakhtunkhwa, pakistan. Pakistan journal of medical sciences. 2016 Jan;32(1):111.

Khan G, Ghaffar T, Ahmed I, Ullah F, Khan R, Aamir AU. THYROID DYSFUNCTION IN PATIENTS WITH TYPE 1 DIABETES: A cross-sectional study. Journal of Postgraduate Medical Institute. 2019 Oct 10;33(2).

Attaullah S, Haq BS. CORRELATION OF SUBCLINICAL THYROID DYSFUNCTION WITH DYSLIPIDEMIA. Journal of Postgraduate Medical Institute. 2017 May 12;31(2).

Barhanovic NG, Antunovic T, Kavaric S, Djogo A, Spasojevic VK. Age and assay related changes of laboratory thyroid function tests in the reference female population. Journal of Medical Biochemistry. 2019 Mar;38(1):22.

Choi R, Lee SG, Lee EH. Patient Population and Test Utilization for Thyroid Function in Local Clinics and Hospitals in Korea. Diagnostics. 2022 Jul 5;12(7):1638.

Tapper MA, Francis CA, Dilworth LL, McGrowder DA. Evaluating thyroid function in the clinica laboratory. Thyroid Research and Practice. 2017 Sep 1;14(3):118-21.

Javaid U, Kennedy D, Addison C, Tsatlidis V, Razvi S. Frequency, determinants and costs of thyroid function testing in a laboratory serving a large population. European Journal of Endocrinology. 2022 May; 186(5):553-60.

Jimoh AK, Ghazal MS, Adeleke AB, Adeniyi AA, Adebara IO, Babalola FO, Ajani GO, Agboola MS, Busari OA. Biochemical pattern of thyroid function test and clinical impression of thyroid disorder in a rural tertiary health institution in Nigeria. Annals of African Medicine. 2020 Apr 1; 19(2):89-9.