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Research Article

THYROID STIMULATING HORMONES AND FREE THYROXINE AS AN INDICATION OF THYROID DYSFUNCTION AT PATHOLOGY LABORATORY OF MNAZI MMOJA HOSPITAL, ZANZIBAR

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ABSTRACT

BACKGROUND: Iodine is a fundamental micronutrient intended for usual human growth and development. It is predictable that more than 1.6 billion people reside in iodine-deficient situations; however there are still some countries and areas where the prevalence of iodine-deficiency disorders is unknown. Iodine deficiency disorder (IDD) is major public health problem in many parts of the world as well as Zanzibar everywhere its consequence including thyroid dysfunction abnormalities, endemic goiter and cretinism.

METHODS: In a cross-sectional study, based on laboratory investigation to find out the levels of free T4, freeT3 and thyroid stimulating hormone (TSH). All patient aged 10 and above suspected having thyroid. A total of 288 samples were collected from the patients suspected having a thyroid dysfunction and those samples were processed by automatic multi scan Elisa reader automated machine at clinical chemistry department of pathology laboratory MMH.

RESULTS & CONCLUSION: This study shows lower levels of TSH in women are 26(9%) and male are 9(3.1%) and the higher levels are 20(7%) and 12(4.1%). The lower levels of fT3 in women are 11(4%) and 3(1%) in male and the high levels of fT3 in women are 78(27%) and 31(11%) in male. Lower levels of free T4 in women 10(3%). High levels women are 117(41%) and 44(15%) in male. According to these results women had more thyroid dysfunction compare to males.

Keywords: TSH, fT3, fT4, Elisa, MMH

INTRODUCTION AND LITERATURE REVIEW

Thyroid gland positioned at anterior aspect of the lower neck, is leading endocrine organs and weighed around 20gm, microscopically the gland fabricated by two lobes coupled by thin band of tissue. The central hormones secreted by the thyroid gland is thyroxin (T4) and triiodothyronine T3, the synthesis of this hormones require iodine which contain 66% and 88% of molecular weight of free T4 and T3 respectively [1].

Thyroxin T4 circulate in the blood as equilibrium of free and serum protein bound hormone thyroxin bound goblin (TBG) albumin and pre-albumin bind. Free T4 and its associate thyroid hormones T3 responsible for regulating assorted biochemical course of action throughout the body[2]. Clinically free T4 (fT4) quantity encloses extensively predictable as an aid in the evaluation and diagnosis of thyroid status. Elevated T4 values are characteristically seen in patients with hyperthyroidism while measurement of serum level of TSH is useful in case of suspected hyperthyroidism rather than in hypothyroidism[3].

Thyroid diseases in Tanzania, the extent of different thyroid disorder in Tanzania community is largely unknown for more than three decades. Now it is known that some parts of the community are affected by iodine deficiency disorder (IDD). The earliest report of thyroid disease in Tanzania in 1965 where a survey revealed in prevalence of endemic goiter in high land of southern part of country, about 40% population is at risk of IDD because of living in iodine deficiency endemic areas[4].

Zanzibar is an island of Unguja and Pemba is surrounded by 2,332km and it is the part of United Republic of Tanzania. It implicit that residents encircled by ocean contains ample iodine status from utilization of seafood and sea plants rich in iodine but renowned actuality confirms that population existing on islands or in close proximity to seacoast are not free from iodine deficiency disorders. It has long been known that such populations are in requiring the intake of iodine [5].

Iodine is a fundamental component of the hormones produced via the thyroid gland. Thyroid hormones and iodine are essential for mammalian life. Iodine (as iodide) is widely but unevenly scattered in the atmosphere. Most iodide is found in the oceans (≈50 μg/L), iodide ions in seawater are oxidized to basic iodine which evaporate into the atmosphere and is returned to the soil by rain. However, iodine cycling in many regions is slow and incomplete therefore the soils and ground water become lack of iodine. Crops in these soils are having low levels of iodine, humans and animals consuming food grown in these soils become iodine deficient.

Measurement of TSH at the moment serves as the mainly sensitive and precise indication for biological effect of circulating thyroid hormones all varieties of thyrotoxicosis and hypothyroidism are essential which change in the thyroregulation control metabolism whereby raised TSH level are characteristic of primary hypothyroidism [6].

Disorder of thyroid include hypothyroidism, non-thyroid illness (NTI), euthyroid seek syndromes and those resulting from medication[7], hypothyroidism commonly is caused by disease on treatment that destroy tissue and interfere with thyroid hormones biosynthesis[8]. Thyroid enlargement (goiter) may or may not be present, individual with primary hypothyroidism small decrease in T4 and T3 concentration laid high level of serum TSH[9].

Hyperthyroidism caused by excessive amount of T4 and T3 these elevated levels may raise from hyper function of thyroid. Increased T4 and T3 suppress circulating TSH to undetectable levels, except in rare case in which hyperthyroidism is mediated by TSH itself. The pattern of low TSH level and an elevated free T4 level is usually sufficiently to establish the diagnosis of hypothyroidism, if TSH level is low but free T4 level is normal, a total T3 measurement should be performed.

Total free T4 is used as an aid in thyroid status, T4 and its associate thyroid hormone T3 are responsible for regulating diverse

biochemical process through the body which are essential for normal metabolic activities. Free T4 is normal present in human serum approximately 50 - fold excess of circulating T3 to the power of 2 and account for more than 90% of circulating (TBP), the hormones is transported bound primary to the thyroxin binding globulin (TGB) and secondary by thyroxin binding pre albumin (TBPA) and albumin less than 0.05% of total circulating free T4 is un bound and therefore biological action[10].

Iodine deficiency in the fetus is due to insufficient within mother. The consequence of iodine deficiency during pregnancy is impaired synthesis of thyroid hormones by the mother as well as fetus. Low levels of thyroid hormones to the budding brain may possibly result in mental retardation [5, 11-13]. The physiologic role of thyroid hormones is to ensure that normal growth and development occurs through specific effects on the rate of cell differentiation and gene expression. Thyroid hormone is exerted through the binding of T3 to nuclear receptors which regulate the expression of specific genes in special brain regions during fetal and early postnatal life. The T3 which is bind to the nuclear receptors is mostly dependent on its local intracellular production from T4 via type II deiodinase and not from circulating T3 [14].

METHODOLOGY

Samples

A total of 288 samples are collected from the people those are suspecting the thyroid dysfunction above 10 year. To find out the levels of free T4, freeT3 and TSH performed at clinical chemistry department of MM Hospital at Zanzibar.

Data collection Method

All sample submitted for investigation of TSH, freeT3 and free T4 analyzed at that time, and other data will be retrieved from available laboratory register book and computer.

Data analysis

The data obtained is analyzed by using Statistical Package for Social Science (SPSS) version 20. Frequency distributions, mean, range and proportion are used to explain the variable association. The findings are shown as Pie chart, Bar chart and linear graph.

Ethical Issue

Permission to conduct this study will be granted from MMH through head of pathology laboratory.

RESULTS

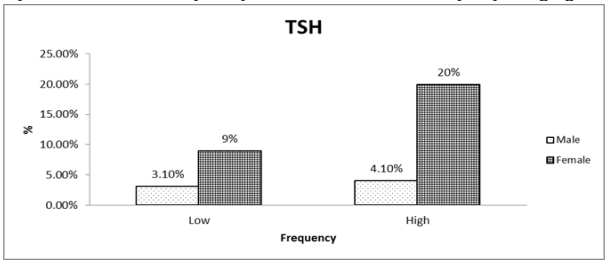
A total of 288 samples are collected from the patients suspected having a thyroid dysfunction and those samples are processed by automatic multi scan Elisa reader automated machine at clinical chemistry department of pathology laboratory MMH.

The frequencies and percentage of the study result are illustrated by tables and bar charts below:

Table 1: The distribution of low level, normal level and high range of thyroid stimulating hormone (TSH)levels among male and female population according to their age groups

Age group	Low		Normal		High		Total
	Male	Female	Male	Female	Male	Female	
10 – 20	3	1	18	26	8	6	62
21 – 30	0	5	7	42	1	2	57
31 – 40	0	8	8	51	1	5	73
41 – 50	1	7	6	22	1	3	40
51 – 60	3	5	8	20	0	2	38
>60	2	0	5	8	1	2	18
	9	26	52	169	12	20	
Total	35		221		32		288

The table 1: shows that a total of 215 numbers of women and 73 male were processed for TSH level. The lowest levels are seen in the age group of 10 – 20 and were 4(11%), 21 – 30 were 5(14%), 31 – 40 were 8(23%), 41 – 50 were 8(23%), 51 – 60 were 8(23%), and > 60 were 2 (6%). Normal levels are seen in the age group of 10 – 20 and were 44(20%), 21 – 30 were 49(22%), 31 – 40 were 59(27%), 41 – 50 were 28(13%), 51 – 60 were 28(13%), > 60 were 13(5%) and highest levels are seen in age group of 10 – 20 and were 14(44%), 21 – 30 were 3(9%), 31 – 40 were6(19%), 41 – 50 were 4(13%), 51 – 60 were 2(6%), > 60 were 3(9%). The highest rate of TSH were 14(44%) seen in age group of 10 – 20, and lowest rate of TSH were 2(6%) in age group of >60.

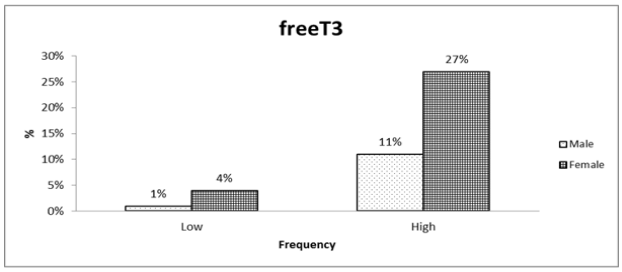


The figure 1: shows the percentage frequency distribution of serum TSH values in both male and female. 26 women (9%) were significantly showing lower levels and 20(7%) were significantly showing high. Also 9 male (3.1%) were significantly lower levels and 12(4.1%) were significantly showing high.

Table 2: The distribution of low level, normal level and high range of free T3 levels among male and female population according to their age groups

Age group	Low		Normal		High		Total
	Male	Female	Male	Female	Male	Female	
10 – 20	1	2	12	22	14	10	62
21 – 30	1	0	6	27	1	22	57
31 – 40	1	5	5	38	3	20	73
41 – 50	0	1	6	16	4	13	40
51 – 60	0	1	6	17	5	9	38
>60	0	2	4	4	4	4	18
Total	3	11	39	126	31	78	
	14		165		109		288

The table 2: show that a total of 215 number of women and 73 male were processed, 3(22%) are seen in the age group of 10 – 20 and were significance lower level,21 – 30 were 1(7%), 31 – 40 were 6(43%), 41 – 50 were 1(7%), 51 – 60 were 1(7%), > 60 were 2(14%).The normal range are seen in age group of 10 – 20 and were 35(21%), 21 – 30 were 33(20%), 31 – 40 were44(27%), 41 – 50 were 22(13%), 51 – 60 were 23(14%) and>60 were 8(5%) and significance high are seen in age group of 10 – 20 and were 24(22%), 21 – 30 were 23(21%), 31 – 40 were 23(21%), 41 – 50 were 17(16%), 51 – 60 were 14(13%), >60 were 8(7%). The highest free T3 were 24(22%) in age group of 10 – 20 and lowest rate were 1 are seen in age group of 21 – 30, 41 – 50 and 51 – 60.

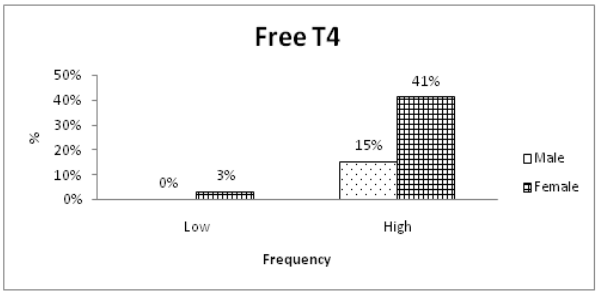


The figure 2: showing percentage frequency distribution of serum T3 values in both male and female. The lowest levels for women were 11(4%) and highest levels were 78(27%). The lowest levels for male were 3(1%) and the highest levels were 31(11%).

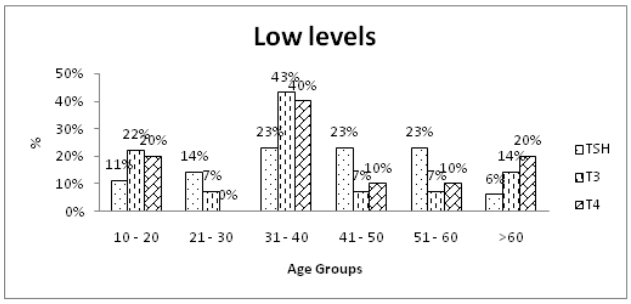
Table 3: The distribution of low level, normal level and high level of free T4 levels among male and female population according to their age groups

Age group	Low		Normal		High		Total
	Male	Female	Male	Female	Male	Female	
10 – 20	0	2	7	20	22	11	62
21 – 30	0	0	3	15	5	34	57
31 – 40	0	4	7	27	3	32	73
41 – 50	0	1	2	14	6	17	40
51 – 60	0	1	8	10	3	16	38
>60	0	2	3	1	5	7	18
Total	0	10	30	87	44	117	
	10		117		161		288

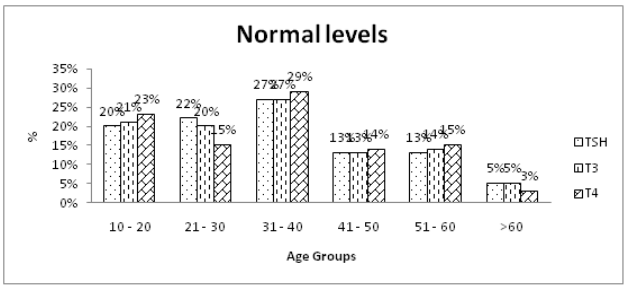
The table 3: show that a total of 215 number of women and 73 male were processed, in age group of 10 – 20 were 2(20%), 21 – 30 were 0(0%),31 – 40 were 4(40%), 41 – 50 were 1(10%), 51 – 60 were 1(10%), >60 were 2(20%) were significance low levels, the normal range are seen in age group of 10 – 20 and were27(23%), 21 – 30 were 18(15%), 31 – 40 were 34 (29%),41 – 50 were 16(14%), 51 – 60 were 18(15%), >60 were 4(3%) and high levels are seen in age group of 10 - 20 and were 33(20%), 21 – 30 were 39(24%), 31 – 40 were 35(22%), 41 – 50 were 23(14%), 51 – 60 were 19(12%), >60 were 12(7%). The highest rate of free T4 were 39(24%) in age group of 21 – 30 and lowest rate were 1(10%) in age groups of 41 – 50 and 51 – 60.



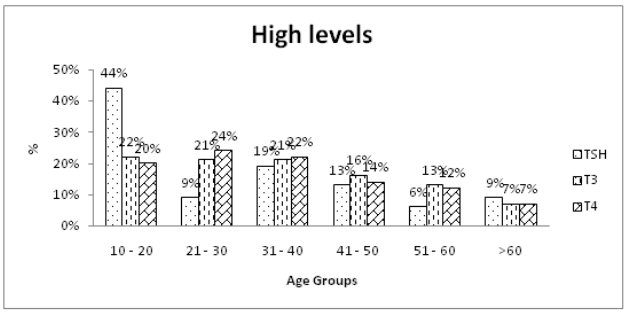
The figure 3: shows percentage frequency distribution of serum free T4 values in both male and female.10 women (3%) were significantly showing lower levels, normal levels were 88(31%) and 117(41%) were significantly showing high. Also 0(0%) for male were significantly showing lower levels, the normal levels were 29(10%) and highest levels were 44(15%).



The figure 4: show percentage frequency distribution of low levels of serum TSH, free T3 and freeT4 according the age groups.



The figure 5: showing percentage frequency distribution of normal levels of serum TSH, free T3 and free T4 according the age groups.



The figure 6: showing percentage frequency distribution of high levels of serum TSH, free T3 and free T4 according the age groups.

DISCUSSION:

According to this study, about 26(9%) number women were significantly lower levels of TSH and 20(7%) were significantly high. Also 9 male (3.1%) were significantly lower levels and 12(4.1%) were significantly high levels of TSH. This is commonly caused by disease on treatment that destroys tissue and interferes with thyroid hormones biosynthesis[8], thyroid enlargement (goiter) may or may not be present. Women were more significantly affected than male.

Previous study showed that hyperthyroidism is 5 to 10 times more likely to occur in women than men. Risk factors for developing hyperthyroidism include having another autoimmune disease (e.g., type 1 diabetes, pernicious anemia), a family history, eating large amounts of iodine, being a woman, and previous goiter[15]. Also a higher prevalence of TSH elevation was observed in the obese group (11.7%) than in the control group (0.7%). Positive thyroid peroxidase and thyroglobulin antibodies were observed in higher frequency in the obese subgroup with an elevated TSH level. The obese subgroup with positive thyroid antibodies also had higher TSH levels. Therefore, some instances of high TSH, especially those associated with antibodies are likely due, at least in part, to thyroid disease, and others (possibly a majority) may be due to obesity, not its cause. It remains to be seen whether any children with mild TSH elevation benefit from thyroid hormone treatment [16].

TSH levels are positively associated with BMI. These finding are done in euthyroid individuals. An interesting result from the analysis revealed that TSH levels were associated with BMI, but the relationship was different for different racial groups and for different smoking status groups [6]. TSH is a sensitive indicator of iodine status in the newborn period[17]. Compared to the adult, the newborn thyroid contains less iodine but has elevated rates of iodine yield. Particularly when iodine supply is low, maintaining high iodine turnover requires increased TSH stimulation. Serum TSH concentrations are therefore increased in iodine deficient infants for the first few weeks of life, a condition termed transient newborn hypothyroidism. In areas of iodine deficiency, an increase in transient newborn hypothyroidism, indicated by >3 % of newborn TSH values above the threshold of 5 mIU/L in whole blood collected 3 to 4 days after birth, suggests iodine deficiency in the population[18].

Also in this study, about 11(4%) number of women and 3(1%) number of male were significantly low levels free T3, also 10(3%) number of women had low levels of free T4, had hypothyroidism (decrease level of T3 and T4 concentration), women were more significance low than male there is due to endemic iodine deficiency especially during pregnancy. Also fall of level of free T3 and T4 is due to high prevalence of disease in old age [14].

Also this study show numbers of women were 78(13%) and numbers of male were 31(11%) were significantly high levels of free T3. About 117(41%) number of women and 44(15%) number of male were significantly high levels of free T4, were hyperthyroidism (Increase levels of free T3 and T4 concentration).

Previous study showed that hypothyroidism is common in pregnancy with an estimated prevalence of 2-3% and 0.3-0.5% for subclinical and overt hypothyroidism respectively[19]. Endemic iodine deficiency accounts for most hypothyroidism in pregnant women worldwide while chronic autoimmune thyroiditis is the most common cause of hypothyroidism in iodine sufficient parts of the world[20].

The presentation of hypothyroidism in pregnancy is not always classical and may sometimes be difficult to distinguish from the symptoms of normal pregnancy. A high index of suspicion is therefore required especially in women at risk of thyroid disease e.g. women with a personal or family history of thyroid disease, goiter, or co-existing primary autoimmune disorder like type 1 diabetes[21].

Previous study showed that in pregnancy, estrogen levels increase and thyroid-binding globulin concentrations rise, which leads to an increase in T4 and T3. In the first trimester, serum TSH also falls due to the effect of human chorionic gonadotropin (HCG), which may be associated with a slight and transient increase in FT4. These changes are small and in most of the pregnant women, FT4 concentrations remain within the normal range for non-pregnant women[3]. In the second and third trimesters, FT4 and FT3 decrease, sometimes below the non-pregnant women's reference level. There is insufficient evidence to recommend for or against screening in pregnant women.

Previous study showed that thyroid hyperplasia induced by iodine deficiency is associated with an altered pattern of thyroid hormonogenesis: the abnormal configuration of the poorly iodinated thyroglobulin in the thyroid colloid is accompanied by an increase in poorly iodinated compounds, monoiodotyrosine (MIT) and T3, and a decrease in diiodotyrosine (DIT) and T4. The increase of the MIT/DIT and T3/T4 ratios is closely related to the degree of iodine depletion of the gland .The T3/T4 ratio in the serum may be elevated in conditions of iodine deficiency because: 1) thyroidal secretion of T4 and T3 is in the proportion in which they exist within the gland; and/or 2) preferential secretion of T3 or increased peripheral conversion of T4 to T3. The shift to increased T3 secretion plays an important role in the adaptation to iodine deficiency because T3 possesses about 4 times the metabolic potency of T4 but requires only 75 % as much iodine for synthesis[22].

There was no IDD control programmer in Zanzibar before 2001. The high coverage of iodated salt consumption reported in Unguja was an incidental finding since there was no USI programmer. In Pemba Island, almost no iodated salt was consumed. This was confirmed by the prevalence of goiter found in both islands, but being much worse in Pemba Island that had TGPs indicative of severe IDD. Higher altitudes and lower availability of iodated salt in Pemba seem to have contributed in worsening of the IDD situation. These findings seriously challenged the common assumption that accessibility to seafood can protect a population from the risks of IDD[23]. The main factor that contributed to the high goiter prevalence in Zanzibar islands was inadequate dietary iodine intake, as had previously been emphasized.

The present study show number of 8(23%) in age group 31 – 40, 41 – 50 and 51 - 60 were low levels TSH and number of 14(44%) were high levels. Number of 6(43%) of age group 31 – 40 were low levels T3 and 24(22%) number of age group 10 – 20 were high levels, also 4(40%) number of age group 31 – 40 were low levels T4 and 39(24%) number of age group 21 – 30 were high levels.

The overall of this study which involved 288 sample suspected having thyroid dysfunction show that,26 women (9%) and 9(3%) number of male were significantly low levels of TSH,169(58.7%) number of women and 52(18%) number of male were significantly normal levels. 20(7%) number of women and 12(4.1%) men were significantly high levels TSH.

The lowest levels free T3 for women were 11(4%) and male were 3(1%). 126(44%) number of women and 39(13%) number of male had normal levels of free T3, also 78(27%) number of women and 30(10.8%) male were significantly high levels.

Also 10(3%) number of women and 0(0%) were significantly low, 88(31%) number of women and 29(10%) number of male were in

normal levels of free T4,and 117(41%) number of women and 44(15%) number of male were significantly high levels of free T4.

Number of 8(23%) in age group 31 – 40, 41 – 50 and 51 - 60 were low levels TSH and number of 14(44%) were high levels. Number of 6(43%) of age group 31 – 40 were low levels T3 and 24(22%) number of age group 10 – 20 were high levels, also 4(40%) number of age group 31 – 40 were low levels T4 and 39(24%) number of age group 21 – 30 were high levels.

CONCLUSION

According to these results thyroid dysfunction is high in females than males. It assumed that populations surrounded by ocean have adequate iodine status from consumption of seafood which is rich in iodine, but well known fact confirms that population living on islands or near seacoast are not free from iodine deficiency disorders. It has long been known that such populations are in need of intake of iodine.

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