

Prevalence of Thyroid Disorders and Reference Range of Thyroid Hormones in Khartoum State, Sudan

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ABSTRACT

Introduction: Thyroid hormones are the commonly used biochemical markers to diagnose thyroid malfunctions they are also been used to follow-up treatment specifically thyrotropin, total triiodothyronine, free triiodothyronine, total thyroxin and free thyroxin (TSH), (T3), (FT3), (T4) and (FT4) respectively.

Objectives: The aim of this study is to calculate the Prevalence of thyroid disorders in Khartoum state and to relate them with, gender, age, and BMI, also to find the ratio of unforeseen thyroid hormonal function disorders in Khartoum and to initiate normal levels of thyroid related hormones

Material and methods: Thyroid hormones were measured from 493 participants selected randomly to measure the prevalence of thyroid disorders and set a reference range for Khartoum state.

Results: The overall prevalence of thyroid disorders were 120 (24.3%), 23.3% of them were hyperthyroidism and the rest 1% were hypothyroidism. The reference range for TSH, T3 and T4 were (0.10 mIU/L–5.60 mIU/L), (1.77 nmol/L–1.94 nmol/L), and (118.02 nmol/L–125.21 nmol/L) respectively.

Conclusion: A Thyroid disorder in Khartoum State in Sudan was not uncommon, and was much lower than Darfur state. The reference range for thyroid hormones was different from other different studies.

Key words: Thyroid hormones, TSH, Reference range, Khartoum state

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INTRODUCTION

Thyroid hormones are the commonly used biochemical markers to diagnose thyroid malfunctions they are also been used to follow-up treatment specifically thyrotropin, total triiodothyronine, free triiodothyronine, total thyroxin and free thyroxin (TSH), (T3), (FT3), (T4) and (FT4) respectively [1].

As these hormones (TSH, T3 and T4) are the most widely used thyroid hormones tests, still there is a difference on the optimal reference range values for these hormones. This difference in values are affected by genetic and environmental factors, so

these hormones reference range is not normally distributed, Thus it wise for different setting to set its own reference range for these hormones. Therefor the reference range for these hormones was established in many countries with good resources [2].

Many researches on endemicity of enlarged thyroid in Sudan was done early as in 1967 Kambal et al. performed a survey to study goiter in people of Darfur, the survey included 17470 participant. The survey showed that 57% were goitrous and 18.5% of these had large goiter [3]. Another study in Darfur showed that about 85% of schoolchildren were suffering from endemic goiter [4]. Abdelmonim, et al. after comparing the treating effects of thyroxine versus iodine in treating simple goiter, found that the occurrence of goiter in population was 22.3% [5]. In 2008 he studied the prevalence

of the hypothyroidism in Khartoum and Nyala and found them 14.5% and 64.09% respectively [6]. A study done among high secondary schools girls in Nyala in Darfur to detect goiter, reported that percentage of goiter grade 2 were 41% [7].

According to most recent study done by Alia et al. in a comparative study between iodine deficient area and non-iodine deficient regions the prevalence of thyroid disorder caused by iodine deficiency was improved significantly during the last decade. The hypothyroidism cases ratio decreased in Nyala from 64.09% to 0.6%. All the results were calculated using the standard range of Sudanese [2].

Thyrotropin (TSH), total triiodothyronine (T3), total thyroxine (T4), free triiodothyronine (FT3), and free thyroxin (FT4) are used as the routine biochemical markers for assessing thyroid functions and diagnosing thyroid disorders. TSH is the most sensitive marker and usually used to diagnose even subclinical thyroid disorders. In addition, it plays a great role in treatment of thyroid disorders by adjusting the dose for treating both hyper and hypothyroidism [8].

Iodine deficiency disorders (IDD) happens as an effect of Iodine deficiency. Which results in poor manufacturing of thyroid hormones and goiter? It is estimated by WHO that up to 2003, about 3 billion in 54 countries worldwide had insufficient iodine intakes that pregnant, lactating women and infants, being the most affected groups [9]. Andersson et al. found that the number of iodine-deficient countries decreased from 54 country to 32 [10].

METHODS

A four hundreds and ninety-three participants who were referred from different clinics to Hormonal and Tumor Markers center-Khartoum during 2018 for thyroid function test, were selected randomly and recruited. The sample included both males and females; ages were between 11 and 77 years. It excluded known cases of thyroid disorders, pregnant women, cancer patients, patients using drugs known to affect thyroid function e.g. psychiatric drugs. All those who agreed to participate signed an informed consent. To measure quantitative

thyroid related hormones (T4, T3, TSH) serum were separated from the collected blood samples and stored at -20 oC. the samples tested by radioimmunoassay (RIA) using gamma counter (German made-Riostad) and Chinese provided nuclear isotope kits. TSH used as a marker to diagnose thyroid disorders the the cutoff level used was from 0.7 to 5 mIU/L.

SPSS statistical software version 25 was used for all calculations were. Normality was tested by Kolmogorov-Smirnov test. Outliers were identified using the Mahalanobis Distance Multivariate method. All the data was normally distributed. For the parameters we calculated the central 95% of the distribution limits on both ends. Fisher Exact test and Pearson Chi-square were applied to see associations between qualitative variables. A p-value was considered as statistically significant if it is below 0.05.

RESULTS Out of 493, 434 were male while 59 were females. Most of the participants 70.2% were at the age group between 25 to 44 years, 14.4% were below 25 years of age, 13.4% were from 45 to 64 years and only 2% were above 64 years. The median age was 33 years. The study showed that 334 (67.7%) of the participants were having normal body mass index (BMI), 141 (28.6%) were overweight, 11 (2.2%) were obese and 7 (1.4%) were underweight, the median BMI was 23 (Table 1).

The overall prevalence of thyroid disorders were 120 (24.3%), 23.3% of them were hyperthyroidism and the rest 1% were hypothyroidism. As shown in Table 2, 85.2% of the hyperthyroidism and 100% of hypothyroidism patients were female but the association were not statistically significant (P value = 0.353). Most of the hyperthyroidism patients (60.9%) and all the hypothyroidism were in the age group from 25 to 44 years, and the statistical association is not significant (P value = 0.209). Also the study showed that there is no significant statistical association between thyroid disorders and body mass index (P value = 0.924) as 68.7% of the hyperthyroidism and 60% of the hypothyroidism patient were normal in weight. The reference range is shown in Table 3.

Table 1: Demographic and clinical characteristics.

	Frequency	Percent
Gender		
Female	434	88%
Male	59	12%
Total	493	100%
Age		
< 25 years	71	14.40%
25 – 44 years	346	70.20%
45 – 64 years	66	13.40%
> 64 years	10	2%
Total	493	100%
Body Mass Index		
Underweight	7	1.40%
Normal	334	67.70%
Over weight	141	28.60%
Obese	11	2.20%
Total	493	100%
TSH		
Normal	373	0.757
Hyperthyroidism	115	0.233
Hypothyroidism	5	0.01
Total	493	1

Table 2: Relation between gender, age, BMI and TSH level.

	Hyperthyroidism	Hypothyroidism	P value
Gender			
Female	98 (85.2%)	5 (100%)	0.353
Male	17 (14.8%)	0 (0%)	
Total	115 (100%)	5 (100%)	
Age			
< 25 years	25 (21.7%)	0 (0%)	0.209
25 – 44 years	70 (60.9%)	5 (100%)	
45 – 64 years	20 (17.4%)	0 (0%)	
Total	115 (100%)	5 (100%)	
Body Mass Index			
Underweight	3 (26%)	0 (0%)	0.924
Normal	79 (68.7%)	3 (60%)	
Over weight	32 (27.8%)	2 (40%)	
Obese	1 (0.9%)	0 (0%)	
Total	115 (100%)	5 (100%)	

Table 3: Reference range of thyroid hormones in Khartoum State (n=493).

	Lower limit of 95% distribution	Upper limit of 95% distribution
TSH (mIU/L)	0.1	5.6
T3 (nmol/L)	1.77	1.94
T4 (nmol/L)	118.02	125.21

DISCUSSION

The overall thyroid disorders were 24.3%, the result was far below the results of Kambal, et al. who studied goiter in people of Darfur and found the prevalence was 57%, and the study of Abdelmonim, et al. who found the prevalence among schoolchildren in Darfur were about 85%. Those high result were because Darfur was considered as an endemic area for goiter because of iodine deficiency [3,5]. The prevalence

was similar to the study done by Abdelmonim, et al. in Khartoum (22.3%) [6].

As shown in the results the relation between the thyroid disorders and the gender, BMI, and different age groups are not statistically significant and this may be due to that the sample was institutional based and not community based. Also there may be an important role of genetic factors in thyroid disorders pathogenesis as concluded from the study of Strieder, et al. [11].

In Table 3 the study showed that the reference range in Khartoum state is different from the values recommended by the manufacturer of reagents [12]. The reference range for TSH show significant differences in the lower limit from other studies, (0.10 compared to 0.75 mIU/l) and the upper limit was almost the same results (5.0 compared to 5.32 mIU/L) [13]. Again, the levels of T3 and T4 are different from other different studies, T3 in this study (1.77–1.94 nmol/L) compared to (1.15–2.32 nmol/L) where the upper limit in our study is very low. T4 (118–125.21 nmol/L) compared to (73.49–126.30 nmol/L) [13]. These differences in the results are dependent on the size and type of the sample and the methodology. The criteria used for selection of the sample population is very important, as our population was selected from those who were sent for testing their thyroid function during the period of the study [14]. The source of the study population was institutional based, because of lack of logistical difficulties to perform community-based study.

CONCLUSION

Thyroid disorders in Khartoum State in Sudan were not uncommon, and were much lower than Darfur state. The reference range for thyroid hormones was different from other different studies. It needs further community based studies.

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