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Full Length Research Paper

Assessment of Endemic Goitre of Children in Eastern Sudan (Red Sea State) Using Ultrasonography and ELISA

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The thyroid gland is a butterfly-shaped organ located at the base of your neck. It releases hormones that control metabolism—the way your body uses energy. The thyroid gland has an essential role in regulating vital body functions. This study aimed to assess an endemic goiter in school-aged children in Eastern Sudan (Red Sea State) and to estimate the measurement of standard thyroid gland dimensions and thyroid hormones level Using Ultrasonography and ELISA Technique. A total of 100 children (50 males, 50 females) with mean age of 10.96 ± 3.4 . Ranged from (6-18) year old., this study was conducted done in the period from May 2017 to August 2017, All the participants undergone thyroid ultrasound and thyroid hormone level test, subjects with history of goiter thyroid disease were excluded from the study, thyroid measurements (length, width, and depth) were used to estimate thyroid volume using ellipsoid formula. Thyroid hormones (TSH, T3, and T4) were estimated using Toso full automation. The study revealed that subjects of the study (17%) of the participants had goiter, four female (4%) and 13 males (13%) with age ranged (6-11 years) with an increase in TSH and T3 and decreased in T4 level. The mean of thyroid volume for normal participants was 5.03 ± 0.92 mL and for those who had goiter was 5.72 ± 1.77 mL. TSH, T3, T4 for normal participants and for those with goiter were (1.83 ± 0.81 , 1.4 ± 0.58 Ulu/nL), (3.56 ± 0.34 , 4.07 ± 0.58 Pg/NI) and (1.19 ± 0.15 , 1.68 ± 0.72 ng/DI) respectively. It concluded that there were positive correlations between the age and the thyroid volume, it increases with the age increase, the Rt. lobe was more large than the Lt. lobe, the thyroid volume higher in male than female, and this study found the TSH, T3 and T4 decreases with ages in normal and goiter subject

Keywords: Thyroid gland, TSH, Goiter, Hormone Level

INTRODUCTION

Thyroid Ultrasound has become one of the primary

imaging modalities for the assessment of the major glands of internal secretion within the cervical region. The thyroid gland is among the most commonly imaged glands using ultrasound due to the limitation of clinical examination (Archie and Alexander, 1996). Computed tomography (CT) and magnetic resonance imaging (MRI)

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provide structural information of the thyroid gland just like ultrasound but are relatively more expensive. Thyroid ultrasound appears suitable in tropical Africa (Anele, 2001; Ryan and Nicholas, 1994) where more sophisticated modern imaging techniques may not be readily available or are very expensive.

Anatomically, the normal thyroid gland consists of two lobes which lie on the anterolateral surface of the trachea extending from the thyroid cartilage superiorly to the sixth tracheal ring inferiorly. They are asymmetrical with the right lobe being larger than the left, and the thyroid gland is larger in males (Ryan and Nicholas, 1994; Tahir and Yusuph, 2001). In recent decades, sonography has become the gold standard for assessment of the thyroid gland (Massol et al., 1993).

Sonography has improved with the development of high-frequency transducers, which allow a more detailed study of the thyroid gland (Bruneton et al., 1994). As a result, the World Health Organization (WHO) and the International Council for the Control of Iodine Deficiency Disorders (ICCIDD) now consider sonography the diagnostic method for assessment of goiter (World Health Organization, 1997). It is most often used in assessing the incidence of goiter in Third World populations, especially in children (Brown and Spencer, 1978). Intra- and interobserver variation can lead to differences in volume calculation, irrespective of the correction factor. Nevertheless, a more optimal correction factor will give a more realistic measurement of thyroid volume.

Volumetric evaluation of the thyroid gland is based on the use of an ellipsoid model. Hence, a value is obtained that replaces clinical evaluation of volume. With the ellipsoid model, the height, the width, and the depth of each lobe are measured and multiplied. The obtained result is then multiplied by a correction factor (Brunn et al., 1981).

The work of Brunn et al. (Brunn et al., 1981) in 1981 was based on volume measurement of cadaver glands subsequently immersed in water. Brunn et al. (Brunn et al., 1981) study concluded that a modified correction factor of 0.479 resulted in a more accurate assessment of thyroid volume compared with the previously accepted correction factor of $\pi/6$ or 0.524.

In Sudan, there is absence of The researchers in this current study didn't find a domestic reference for Sudanese thyroid volume in open literature. No available published work. ; in Sudan, for as we know, no study was published in the open literature, regarding the thyroid volume.

This current study aimed to survey the epidemic endemic goiter in Sudanese children using ultrasound and Enzyme-Linked Immunosorbent Assay (ELISA) technique.

MATERIALS AND METHODS

This study was done in the Red Sea State-Sudan during the period from May 2017 up to August 2017, the ultrasound machine system used is was Mindary DP2200 medical system. made by Mindray Bio-Medical Electronics Co., Lt, and AGrey scale real-time ultrasound machine, fitted with a 10 MHz transducer was used for the study.

Eliza machine

Fluorescence Enzyme Immunoassay, LED illuminant, non-flow cell/TOP-TOP photometry method 36 tests per hour Antigen-antibody reaction: 10 minutes, France was used for Lab. thyroid tests.

Volunteer Study participants

A total of 100 students from the Red Sea State primary schools were involved in this descriptive cross-sectional study. The ethics and research committee of the college of medical radiological science, Sudan university of science and technology (SUST) approved the study, and consents were obtained from all volunteers before the examination

Inclusion and Exclusion Criteria

The inclusion criteria included Sudanese children from primary schools in Port Sudan. Students above 18 (14) years old and those who had previous clinical evidence of thyroid disease were excluded.

Measurement Technique for Thyroid Volume

The thyroid volume for all participants was measured according to the ellipsoid model, (the height length, the width, and the depth of each thyroid lobe are were measured and multiplied. The obtained result was then multiplied by a correction factor, which is $\pi/6$ or 0.524) (Schlögl et al., 2001). The subjects All participants were examined in a supine position, with the pillow placed under their shoulders to hyperextend the neck. U/S gel was applied to the thyroid area. The transducer was directly placed on the skin over the thyroid gland, and an image of each lobe was obtained in transverse and longitudinal planes.

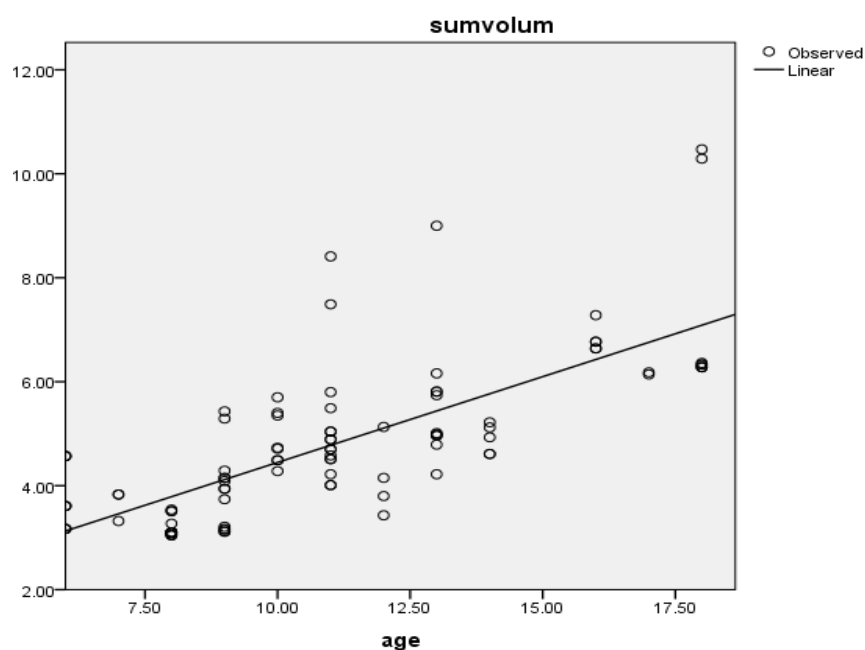
The craniocaudal and the sagittal dimensions of both lobes were measured on the longitudinal image. The transverse dimension was measured in the transverse image.

Table 1. Mean Volume of the thyroid gland and TSH, T3 T4 concerning the age of normal children.

Age(y)	N	Volume(ml)	TSH(Ulu/nL)	T3(Pg/nL)	T4(ng/Dl)
6 – 8	23	3.3±0.34	1.94±0.94	3.63±0.32	1.38±0.12
9 – 11	22	4.16±0.5	2.18±0.99	3.79±0.23	1.27±0.16
12 – 14	20	5.12±1.13	1.98±1.25	3.45±0.54	1.02±0.23
15 – 18	8	7.54±1.78	1.22±0.07	3.37±0.29	1.12±0.1

Table 2. Mean Volume of the thyroid gland and TSH, T3 T4 concerning the age of children with goiter.

Age(y)	N	Volume(ml)	TSH(Ulu/nL)	T3(Pg/nL)	T4(ng/Dl)
6 – 8	6	5.6±2.48	1.95±0.44	4.1±0.53	1.7±0.67
9 – 11	11	5.86±1.07	1.74±0.73	4.05±0.5	1.67±0.78

**Figure 1.** Correlation of thyroid volume and subject age.

Measurement Technique for Thyroid Hormones

We In this study Blood samples were collected from the same participants children under study in blood bags, and then the diapers were transferred to Port Sudan Central Laboratory, and the examination was carried out by TOSO Bioscience ALA-360.

Statistical analysis

The data of the study was collected through a data collection sheet then organized and analyzed using SPSS for windows version 17 and excel. Scattered blots and regression was used to achieve statistical associations between study variables.

RESULTS

A total of 100 children (50 males, 50 females) with mean age of 10.96 ± 3.4 . Ranged from (6-18) year old were included in this study. (Table 1). The study revealed that 17 participants of the study (17%) with had goiter, four female (4%) and 13 males (13%) with age ranged (6-11 years). with the decrease in the lab. results showed that the hormone level of TSH, T4 and T3 for the same participants was decreased (Table 2). The mean of thyroid volume for normal participants was 5.03 ± 0.92 mL and for those who had goiter was 5.72 ± 1.77 mL, and TSH, T3, T4 for normal participants and for those with goiter were $(1.83 \pm 0.81, 1.4 \pm 0.58$ Ulu/nL), $(3.56 \pm 0.34,$

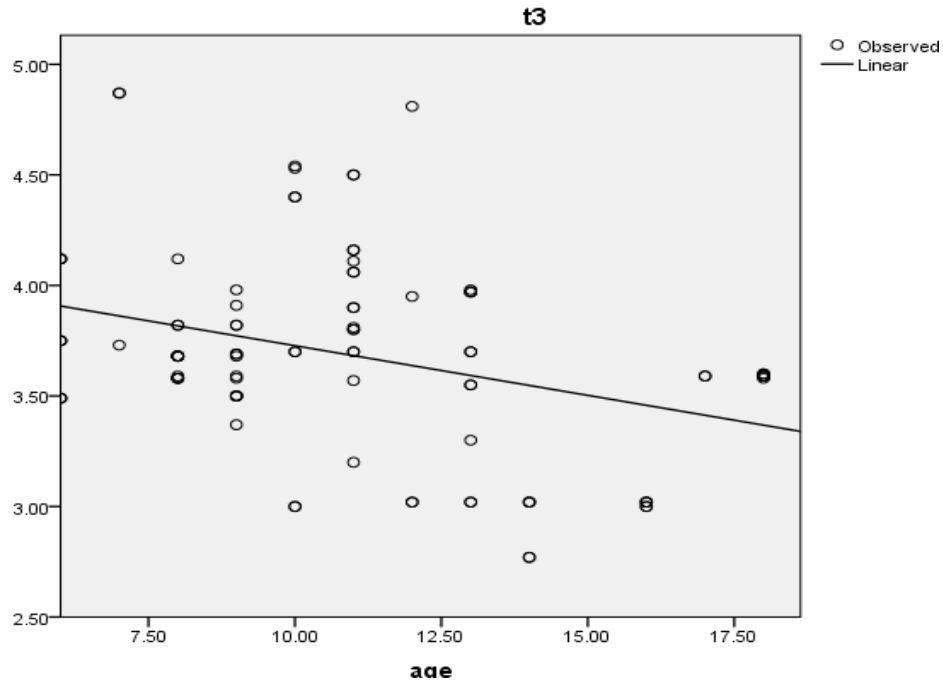


Figure 2. Correlation of T3 and subject age.

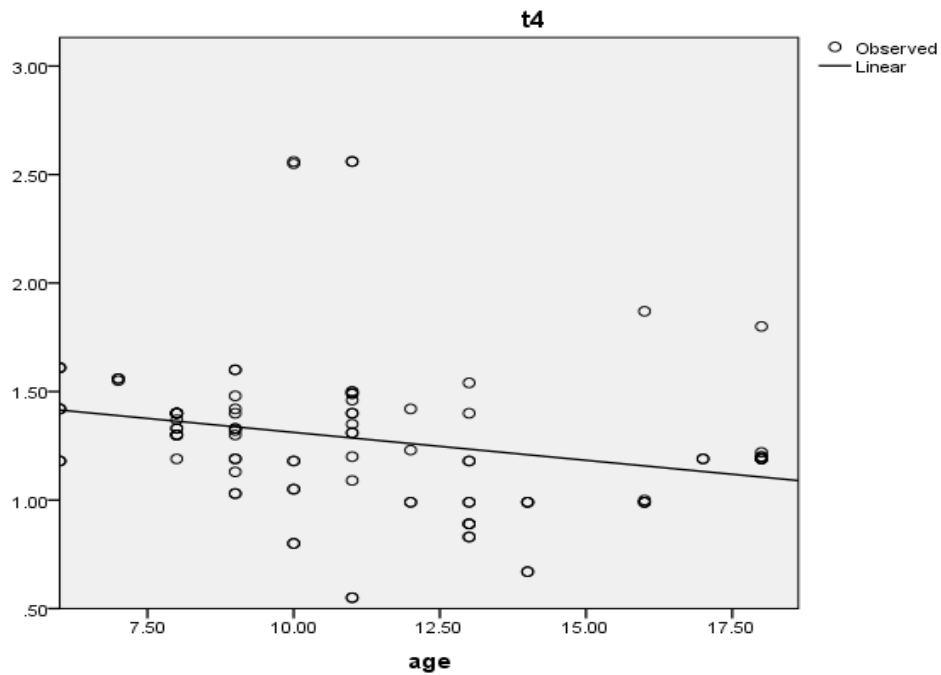


Figure 3. Correlation of T4 and subject age.

4.07±0.58 Pg/NI) and (1.19± 0.15, 1.68±0.72 ng/DI) respectively.

Also, the results of this study as shown in the (Table 2) revealed Mean Volume of the thyroid gland and concerning the age of children with goiter that there was the significant association between the thyroid

measurements and subjects of healthy and goiters cases. The result of this study as shown in Figures 1 through 4 summarize a statistical correlation between participants age and thyroid volume, T3, T4 and TSH. there was linear association between thyroid volume and children age as shown in figure 1.

DISCUSSION

The aim of this study was to assess endemic goiter and to estimate the measurement of normal thyroid gland dimensions and thyroid hormones level in school-aged children Using Ultrasonography and ELISA Technique in Eastern Sudan (Red Sea State). A total of 100 children (50 males, 50 females) with mean age of 10.96 ± 3.4 . this study was done in the period from May 2017 to August 2017, All the subject undergone thyroid ultrasound and thyroid hormone level test, subjects with history of goiter were exclude from the study, thyroid dimension (length, height, and diameter) Thyroid volume was estimated using ellipsoid formula and thyroid hormones (TSH, T3, and T4) using Toso full automation. The study revealed that 17 subjects of the study (17%) with had goiter, four female (4%) and 13 males (13%) with age ranged the high percentage was among the age group (6-11 years old) with the decreased in TSH, T3, and T4 levels were observed. The mean of thyroid volume for normal subject and subject of goiter, (5.03 ± 0.92 , 5.72 ± 1.77 mL) respectively, and TSH, T3, T4 (1.83 ± 0.81 , 1, 84 ± 0.58 Ulu/nL), (3.56 ± 0.34 , 4.07 ± 0.58 Pg/NI), (1.19 ± 0.15 , 1.68 ± 0.72 ng/DI level respectively).

The study showed that the mean thyroid volume concerning age of normal children most cases in this study is (5.03 ± 0.92) for both males and females in age group of (6 – 8years) followed by (4.16 ± 0.5) table (1).

Also, the results of this study as shown in the table (2) revealed Mean Volume of the thyroid gland and concerning the age of goiter children that there is the significant association between the thyroid measurements and subjects of healthy and goiters cases. The result of this study as shown in figures (4) which is linear regression showed that there are a linear relationship thyroid volume and children age as shown in figure 1, and there is the strong negative correlation between age T4, TSH and T3 level and children age.

This study revealed that in normal subjects the mean of thyroid volume of the right lobe (2.31) of the thyroid gland was greater than the left lobe (2.17) this agree with the study done by Yousef M et al (Yousef et al., 2011).

This study has shown 17 children (17%) with goiter most of them are males in age between (6-11 yrs.)- Table (2) this agree with the study done by Yousef M et al (Yousef et al., 2012).

The mean thyroid volume in the males is greater than that females in the this agree with the study done by Mohamed Yousef et al. (2011)

CONCLUSION

The thyroid volume obtained in this study revealed that there were positive correlations between the age and the thyroid volume, it increases with increase the age, the RT lobe more larger than the LT lobe, the thyroid volume

higher in female than male ,and this study found the TSH T3 and T4 is de-crease with ages in normal subject and goiter children, further studies are required to establish national references thyroid volume in Sudan.

A local reference to thyroid volume, T3, T4, and TSH was established in Eastern Sudan (Port Sudan city).

In Sudan, there is an absence of domestic reference for thyroid volumes in Sudan, as far as we know; no study was published in the open literature, regarding the thyroid volume.

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