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Evaluation of serum Manganese and Zinc in non-cancerous thyroid disorders in Khartoum State-Sudan

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ABSTRACT

Background: The thyroid gland is responsible for the production of two hormones. Those are regulating body metabolism, neurologic development, and numerous other body functions. So this study aimed to determine the level of serum Zinc and Manganese in Sudanese patient with non-cancerous thyroid disorders in Khartoum state.
Material and Methods: This study was designed as case control, which includes 100 blood samples, a 60 from these samples were collected from patient with non-cancerous thyroid disorders and 40 samples were collected from health individual as control group. A total of 60 blood samples from the patients the males is 32 sample 53% and females is 28 sample 47%. Carried out in different Hospital in Khartoum state and the sample is collected by using sterile disposable syringes and separated by centrifuge, during period from March to June 2018. And the serum levels of zinc and manganese determined by atomic absorption spectrophotometer (OPERATOR'S MANUAL January 2003 VER 3.94 C), and the obtained results were analyzed by SPSS.
Results: The study showed that there was significant different because the mean of serum Zn was 0.285 in test group and 0.720 in control group with p.value of 0.001 in serum level of Zn and Mn in patient compared to control subject, significant decrease in the serum levels of Zn and increase in Mn. Mean of Mn in test group was 0.428 and 0.406 control group with p.value of 0.006. Also the study showed the age, gender of the patient and duration of the disease have no effect on the serum level of Zn and Mn.
Conclusion: This study conclude that the serum level of Zn is decrease and Mn is increase in patients with non-cancerous thyroid disorders and the age, gender of the patient and duration of the disease have no effect on the serum level of Zn and Mn.

Keywords: Thyroid disorders, Zinc, Manganese, Sudanese

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BACKGROUND

The thyroid gland is responsible for the production of two hormones: thyroid hormone and calcitonin. Calcitonin is secreted by parafollicular C cells and is involved in calcium homeostasis. Thyroid hormone is critical in regulating body metabolism, neurologic development, and numerous other body functions. Clinically, conditions affecting thyroid hormone levels are much more common than those affecting calcitonin. [1]

Thyroid hormone is critical to neurologic development of the fetus. Iodine is an essential component of thyroid hormone. In parts of the world where severe iodine deficiency exists, neither the mother nor the fetus can produce thyroid hormone and both develop hypothyroidism. Congenital hypothyroidism occurs in 1 of 4,000 live births. [2] If the mother has normal thyroid function, the fetus will be protected during development by small amounts of maternal thyroid hormone crossing the placenta. In the developed world, screening tests are performed on all newborns to diagnose congenital hypothyroidism and prevent catastrophic complications by the timely institution of thyroid hormone therapy.

The thyroid disease may be hyperthyroidism or hypothyroidism. Hypothyroidism defined as a low free T4 level with a normal or high TSH, is one of the most common disorders of the thyroid gland, occurring in 5%–15% of women over the age of 65. Symptoms of hypothyroidism vary, depending on the degree of hypothyroidism and the rapidity of its onset. When thyroid hormone is significantly decreased, symptoms of cold intolerance, fatigue, dry skin, constipation, hoarseness, dyspnea on exertion, cognitive dysfunction, hair loss, and weight gain have been reported. On physical examination, those with severe hypothyroidism may have low body temperature, slowed movements, bradycardia, delay in the relaxation phase of deep tendon reflexes, yellow discoloration of the skin (from hypercarotenemia), hair loss, diastolic hypertension, pleural and pericardial effusions, menstrual irregularities, and periorbital edema. [3]

The maintenance of optimal health requires an adequate supply of carbohydrates, proteins, lipid, and macronutrients, micronutrients, and trace elements. [4] Many trace elements play an essential role in number of biological processes through their action as activators or inhibitors of enzymatic reactions, by competing with other elements and proteins for binding sites, by influencing the permeability of cell membranes, or through other mechanisms. Trace elements are known to influence hormone at level of action, including hormone secretion and activity and binding to target tissue. Conversely, hormones influence trace metals metabolism at several levels of action, including excretion and transport of trace metals. Hence, trace elements assay in biological fluids can be used as diagnostic or prognostic aid in patients with different hormonal disturbances alongside with other biochemical parameters. [5]

Thyroid hormones regulate the rate of metabolic processes and consequent development of organism, deficiency of thyroid hormones causes many metabolic processes to slow down. [6] Zinc is an important element for numerous biochemical processes as well as for cell proliferation. Zinc is extensively studied by bioinorganic chemistry and it is known that there are many metalloproteins with specific enzymatic activity contain zinc. Carbonic anhydrase, liver alcohol dehydrogenase and alkaline phosphatase are some examples of zinc enzyme. [7] Zinc has been shown to have an antioxidant effect and stabilized cell membrane. [8] Zinc is a metal that affects thyroid hormone function at several levels. For example, zinc deficiency inhibits TRH synthesis, [9] and depresses plasma TSH, T4, T3 (triiodothyronine). It is necessary for extrathyroidal T4 to T3 conversion, and it plays a role in T3 binding to nuclear receptor as well as the binding of the receptor to DNA. [10]

Manganese may affect thyroid hormone homeostasis and neuro developmental processes as a result of both direct dysregulation at the level of the thyroid gland and thyroid hormones, or indirectly via alterations in dopaminergic control of the thyroid gland and its hormones. Dopamine is a known modulator of both TSH and TSH subunit secretion. An additional effect of manganese on thyroid hormones homeostasis may be mediated through their metabolizing enzymes. Current data suggests that manganese can affect thyroid hormones directly by regulating the deiodinase enzymes. [11]

MATERIAL AND METHODS

Case control study, this study was conducted in Khartoum state, in different hospital. This study was done during the period from March to June 2018. This study was included Case group: 60 Sudanese patients with non-cancerous thyroid disorders for different duration (less than 5 and more than 5years), age (27–485years) and including both males and females. And Control group: 40 apparently healthy Sudanese individuals. Volunteers enrolled in this study were Sudanese patient with non-cancerous thyroid disorders, also apparently healthy individuals as control (age matched) involved. All volunteers was enrolled after being fully informed by the aim study, more over an informed consent will be taken from every volunteer. One hindered blood specimen was included in this study. 60 of these samples were collected from Sudanese patient with non-cancerous thyroid disorders and 40 samples were collected from apparently healthy Sudanese individuals as control group. A volume of 3 ml of venous blood sample was collected from both cases using sterile disposable syringe and aseptic standard non traumatic vein puncture technique was applied, and emptied in a sterile plane containers. And then was centrifuged at 4000 rpm for 10 min, then the serum was separated and transferred into plain container. Separated serum were stored at-20ºC until analysis. This data was collected through interview using self-administered questionnaire. Collected data was computed and analyzed by using the application of SPSS (statistical package for social sciences) version 21. The test used is a T test. And the serum levels of Manganese and Zinc determined by the use of atomic absorption spectrophotometer.

Ethical Consideration :Ethical approval was obtained from ethical committee of University of Shendi and Informed consent will be taken from all the participants prior to their inclusion in the study. All the procedures will inform to the patients in their native language and informed written consent will be taken from them.

Sampling Procedure: A volume of 3 ml of venous blood sample was collected from both cases using sterile disposable syringe and aseptic standard non traumatic vein puncture technique was applied, and emptied in a sterile plane containers. And then was centrifuged at 4000 rpm for 10 min, then the serum was separated and transferred into plain container. Separated serums were stored at-20ºC until analysis.

Quality Control: The precision and accuracy of all methods use in this study were checked at each batch using commercially prepared control sera.

Data analysis :Collected data was computed and analyzed by using the application of SPSS (statistical package for social sciences) version 21. The test used is a T test.

RESULTS

Table 1: Comparison between the means of serum Zinc in case and in control group

Study group	Number	Mean (mg/L)	Std.Deviation	P.value
Case	60	0.285	0.081	0.001
Control	40	0.720	0.137	

Table 2: Comparison between the means of serum magnesium in case and in control group

Study group	Number	Mean (mg/L)	Std.Deviation	P.value
Case	60	0.428	0.287	0.006
Control	40	0.406	0.062	

Table 3: Comparison between the means of serum Zn and Mn in patients with age less than 45years and in patients with age more than 45 years

Trace Element	Age						P. value
	Up to 45 years			More than 45 years			
	Frequency	Mean (mg/L)	Std.De	Frequency	Mean (mg/L)	Std.De	
Zinc	24	0.298	0.065	36	0.279	0.09	0.216
Manganese	24	0.387	0.27	36	0.456	0.297	0.353

Table 4: Comparison between the means of serum Zn and Mn in male patients and in female patients

Trace Element	Gender						P. value
	Male			Female			
	Frequency	Mean (mg/L)	Std.De	Frequency	Mean (mg/L)	Std.De	
Zinc	32	0.282	0.89	28	0.301	0.076	0.390
Manganese	32	0.384	0.27	28	0.464	0.29	0.475

Table 5: Comparison between the means of serum Zn and Mn in patients with duration less than 5years and in patients with duration more than 5 years

Trace Element	Duration of disease						P. value
	Up to 5 years			More than 5 years			
	Frequency	Mean (mg/L)	Std.De	Frequency	Mean (mg/L)	Std.De	
Zinc	24	0.289	0.075	36	0.278	0.094	0.686
Manganese	24	0.406	0.295	36	0.479	0.269	0.487

Table 6: Comparison between the means of serum Zn and Mn in hyperthyroidism and in hypothyroidism

Trace Element	Thyroid disease						P. value
	Hyperthyroidism			Hypothyroidism			
	Frequency	Mean (mg/L)	Std.De	Frequency	Mean (mg/L)	Std.De	
Zinc	35	0.292	0.076	25	0.276	0.088	0.493
Manganese	35	0.204	0.050	25	0.742	0.184	0.208

DISCUSSION

The present study was carried out to investigate trace element (zinc and manganese) among patient with thyroid disease in different Hospital, in Khartoum state in the Sudan during period from March to June 2018; 100 blood samples were collected, a 60 from these samples were collected from patient with thyroid disease and 40 samples were collected from health individual as control group.

In the present study shown statistically significant difference between the mean of the serum levels of zinc and manganese of the test group compared with that of the control group (mean of Zn is 0.285 and mean of Mn was 0.428) with (P-value = 0.001) and (P-value = 0.006) respectively, the serum level of zinc is decrease in case group than in control group (mean of case = 0.285mg/dl and control = 0.720mg/dl) and the serum level of manganese is increase in case group than in control group (mean of case = 0.428mg/dl and control = 0.406mg/dl). That illustrated in tables 4.1 and 4.2. This agree with (Rebab Osman Ahmed and AbdElkarim A. Abdrabo 2016) who were reported statically significant different in the serum level of zinc and manganese in the study group when compared with control group, the serum level of zinc is decrease in case group than in control group and manganese is increase.

Also other similar study cared in Japan by (Yoshikazu Nishi, Ryosokawate and Tomofusausui 1980) agree with serum zinc level, who report significant decreased in serum zinc level in case group compared to the control group.

The results of this study showed a non-significant difference between the serum levels of zinc and manganese of the test group according to the age (P-value = 0.216) and (P-value = 0.353). That illustrated in table 4.3. And also according to the gender (P-value = 0.390) and (P-value = 0.475) respectively. That illustrated in table 4.4.

Also the results of this study showed there is no significant difference between the serum levels of zinc and manganese of the test group according to the duration of disease (P-value = 0.686) and (P-value = 0.487). That illustrated in table 4.5. And types of thyroid disease hypo and hyperthyroidism (P-value = 0.493) and (P-value = 0.208). That illustrated in table 4.6.

CONCLUSION

This study concludes the serum zinc is significant low than in control. Serum manganese is significant high than in control. The age of patients have no effect on the serum levels of zinc and manganese. The genders of patients have no effect on the serum levels of zinc and manganese. The duration of disease have no effect on the serum levels of zinc and manganese.

REFERENCES

1. Greenspan FS. The thyroid gland. In Greenspan FS, Strewler GJ, eds. Basic & clinical endocrinology. 5th ed. New York: Appleton & Lange, 1997.
2. Lavin L. Manual of endocrinology. 2nded. Boston, Mass.: Little, Brown & Co, 1994:395.
3. Michael L. Bishop, Edward L.fody, LarryE. Schoeff, Clinical chemistry, 2010, chapter 22th.
4. Solomon's N, Trace Elements in Clinical Nutrition: Parenteral Nutrition 2nd edition. Philadelphia, USA. pp .150-183. 1993.
5. Stands bury JB, Kroc RL, Human Development and Thyroid Gland: Relation to Endemic Cretinism, plenum press, New York.p.19.2000.
6. Tapiero H, Tew KD. Trace elements in human physiology and pathology: zinc and metallothioneins. Biomed. Pharmacother. 2003; 57(9):399-411.
7. Bertini I,the Coordination Chemistry of Metalloenzymes. The Role of Metals in reactions Involving water, dioxygen, and related species.1982.
8. Drago R S, LuchinatC, Canada. Published by R iedel Publishing Company. NATO Advanced Study Institute, 2013
9. Powell Saul R. The antioxidant properties of Zinc. J. Nutr. 130:1447S-1454S.200.
10. Morley JE, Gordon J, etal. Zinc deficiency, chronic starvation, and hypothalamic-pituitary-thyroid function. Am. J. Clin.Nutr. 1980; 33(8):1767-70.
11. Pekary AE, Lukaski HC, etal. Processing of TRH precursor peptides in rat brain and pituitary is zinc dependent. Peptides. 1991; 12(5):1025-32.1991.