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Study the Effects of Some Hormonal and Physiological Parameters in Patients with Thyroid Disease

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Abstract

The thyroid disease is a common disease of occurrence for different causes which including thyroid hyperthyroidism and hypothyroidism that reflecting deficient and excess thyroid hormone secretion respectively . There are relationship between thyroid hormones and metabolism and the metabolic rate through the influence of these hormones on the metabolism of carbohydrates, fats and proteins and thus energy produced from the hydrolysis of these compounds. In the present study, after blood sample was collected from twenty adults was conducted on newly clinical and laboratory diagnosed patients of thyroid disease and twenty healthy control group, thyroid hormone analysis to determine the thyroid disease and estimate of serum electrolytes (Na, K) conc. with glucose and cholesterol also were determined. .This study suggested a significant degree association between thyroid hormone (T3, T4, TSH) and electrolytes (Na, K) and glucose with cholesterol in the patients as compared with healthy groups. The results were revealed that serum TSH levels were significantly higher in cases (14.62± 16.07 µIU /ml) as compared to healthy group (1.349± 0.8096µIU/ml) at ($P < 0.05$) and serum potassium(K) was significantly decreased (37.56 ± 4.922) in patients than control (40.87± 2.513) at ($P < 0.05$), and the results of the present study showed a significant correlation between hormonal with electrolytes and biochemical criteria when compared with one another and with the healthy controls. The study concluded that the relationship between thyroid dysfunction and serum abnormal electrolyte with physiological parameters in that patients. As the results of this study it will be indicate that the serum electrolytes were significantly imbalanced in patients of thyroid disease , so it should be checked for serum electrolytes and biochemicals to prevent the possible complications.

Keywords: electrolytes, thyroid disease , thyroid hormones, biochemical parameters.

INTRODUCTION

The thyroid gland including two lobes lying on each side of the trachea produce hormones , thyroid hormones can "target ,influence and alter the metabolism of approximately every cell in the body "so that the thyroid gland becomes one of the "largest and most sensitive" endocrine glands in the body[1] . Thyroid stimulating hormone(TSH) synthesis in the anterior pituitary is stimulated by" thyrotropin-releasing hormone (TRH) and inhibition by thyroid hormone in a classical endocrine negative-feedback loop binds to the TSH receptor" in the thyroid gland, stimulating the production of "thyroglobulin, thyroid peroxidase, sodium –iodide symporter (NIS) protein, and thyroxin"[2]. Thyroid gland secreting hormones : thyroxin (T4) and triiodothyronine (T3) which control the body's metabolic rate and the rate of energy production[3], so "thyroid function regulates a wide array of metabolic activities" . Hypothyroidism is a case of thyroid dysfunction in which" less amount of thyroid hormones are produced by thyroid gland, accompany with lower metabolic rate and clinical symptoms " [4,5]. Many causes leading to hypothyroidism like insufficient thyroid gland stimulation by" the hypothalamus or pituitary gland" [6]. Accompany with "hyperthyroidism casing hormone excess" [7,8]. "The thyroid hormone is central regulator of body hemodynamics, thermoregulation and metabolism .It therefore has an influence on renal hemodynamics ,glomerular filtration ,as well as the renin angiotensin aldosterone system and renal electrolyte handling .Different electrolyte disorders were associated with thyroid dysfunction"[9,10] . Sodium and potassium are "important components of the enzymes Na +K+ ATPase, which is an enzyme present on the cell membrane that helps in the transport of water and nutrients across the cell membrane"[11]. So that thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues . "Thyroxin (T4) and insulin also connect in liver , where they mutually affect insulin growth factors (IGF) which are powerful muscle building control agents and in the absence of adequate levels of thyroid hormones " [12] . Triiodothyronine(T3) has "many physiological actions that changes in protein , lipid , carbohydrate , and vitamin metabolism " [13]. HDL cholesterol protects against atherosclerosis by" its inhibitory effect on cholesterol transport and anti-inflammatory effect" [14]. (High density lipoproteins)HDL cholesterol is" a clear predictor of vascular events in the overall population" [15].

The aim of study was established by estimate serum hormonal and biochemical with electrolytes concentrations, and determined the relationship between them in patients and compared with one another and with the healthy controls .

MATERIAL AND METHODS

This study was designed to investigate some parameters related to thyroid gland function in twenty adults (age range between 18 and 45 years) on newly clinical and laboratory diagnosed patients with thyroid disease and twenty adults healthy subjects. After written informed consent, 5ml of venous blood was obtained by venepuncture under aseptic conditions,
centrifuged and separated serum was used for estimation of thyroid hormones and electrolytes with biochemical assays. The diagnosis was based on detailed history of any chronic diseases such as "diabetes mellitus, hypertension, liver disease, renal disease, metabolic bone disorders, malignancy, hypo- or hyperparathyroidism, vitamin and mineral deficiency , steroid and anti-osteoporotic therapy " were excluded from the study. Thyroid stimulating hormone (TSH) was measured by "using the VIDAS® TSH assay which is intended for use on the instruments of the VIDAS family (Vitek® Immuno Diagnostic Assay system) as an automated quantities enzyme-linked fluorescent immunoassay (ELFA) for the determination of human thyroid stimulating hormone (TSH) concentration in human serum that is intended for use as an aid in the diagnosis of thyroid disorders (distributed by bioMerieux,Inc.100 Rodolphe Street Durham,North Carolina 27712-USA)". While the Total T3 (TT3) and Total T4 (TT4) were determined in human serum by" each of VIDAS® T3 kit and VIDAS® T4 kit (all these kits distributed by bioMerieux SA 376 Chemin de l'Orme 69280 Marcy-l'Etoile - France) using the ELFA technique (Enzyme Linked Fluorescent Assay)" . Calorimetric method was used to determine Na in serum, while Turbidimetric tetraphenylborate (TPB) method was used for potassium measurements in serum. In the current study many chemical tests were conducted including random blood sugar was estimated by using method GOD-PAP Test colorimetric technique enzymatic pour glucose (Wiesbaden,Germany) and HDL cholesterol was determined in serum by AGAPPE DIAGNOSTICS SWITZERLAND GmbH reagent.

Statistical Analysis

After maintain the studied data on excel spread sheet, the results were analyzed statistically using Graph Pad prism 5 program appoint the arithmetic mean value and standard errors (SE) and standard deviation (SD) of all variables and test the significance treatment groups used one-way ANOVA analysis of variance Tukey to compare the hormonal and biochemical parameters between patients and healthy controls. An association between study variables was assessed using MegaStat's correlation analysis. Differences were considered statistically significant at $p<0.05$.

RESULTS

All correlation of hormonal and biochemical parameters in patients and healthy control groups are revealed in the table (1) below which shown that serum TSH levels were significantly higher in cases (14.62± 16.07 µIU /ml) as compared to healthy group (1.349± 0.8096µIU/ml) at ($P < 0.05$) and serum potassium(K) was significantly decreased (37.56 ± 4.922) in patients than control (40.87± 2.513) at ($P < 0.05$), while there were no significant differences in the other studied parameters between the patient and healthy groups as the results were obtained that shown in the table (1)

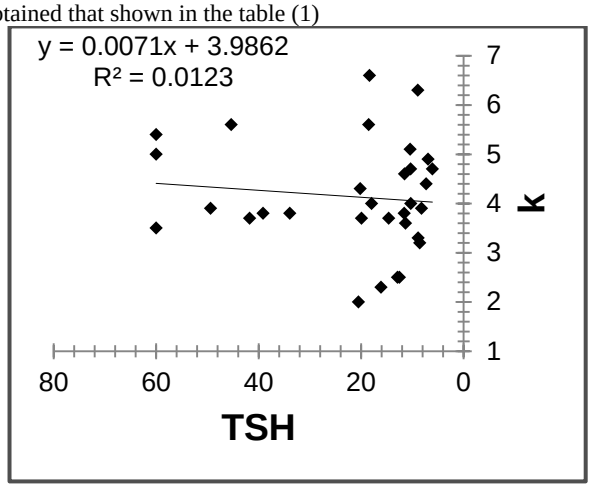

Figure 1. correlation between serum K and TSH level (r=- 0.110 , *p<0.05*)

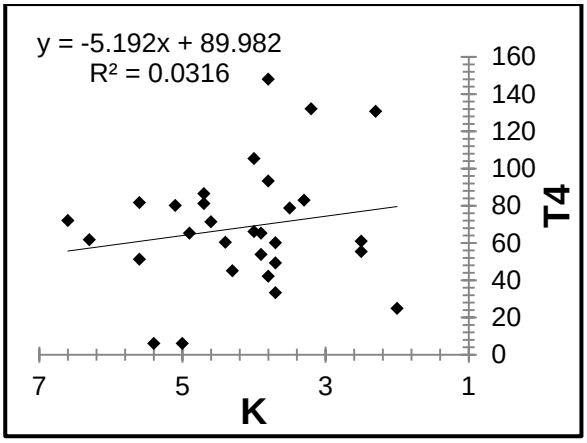

Figure 2. correlation between serum K and T4 level (r= 0.177 , *p<0.05*)

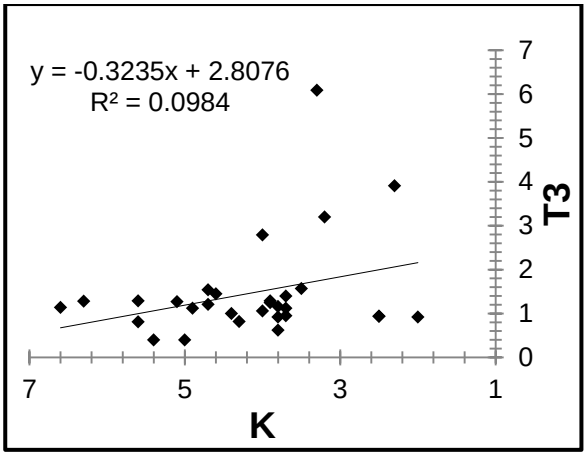

Figure 3. correlation between serum K and T3 level (r= 0.313 , *p<0.05*)

Table 1: Mean ± SD , ± SE values of all parameters in studies patients compared with healthy control groups

Parameter	Patients	Healthy Groups	P value <0.05
TSH(µIU/ml)	14.62 ± 16.07 ± 2.934	1.349± 0.8096 ± 0.1810	Sig.
T3(nmol/l)	1.462± 1.152 ± 0.2102	1.571± 0.2661 ± 0.0594	Non Sig.
T4 (nmol/l)	68.38± 32.62 ± 5.955	75.09± 4.186 ± 0.9361	Non Sig.
HDLCholesterol (mg/dl)	215.9± 68.67 ± 12.75	177.0±47.50 ± 10.36	Non Sig.
Glucose(mg/d L)	87.14± 19.69 ± 3.657	78.86± 14.99 ± 3.271	Non Sig.
Na(mmol/L)	25.63 ± 2.563 ± 0.460	26.65 ± 0.8488 ± 0.1898	Non Sig.
K(mmol/L)	37.56 ± 4.922 ± 0.8841	40.87 ± 2.513 ± 0.5619	Sig.

TSH : thyroid stimulating hormone; T3: Triiodothyronine hormone ; T4: Thyroxin hormone; HDLcholesterol : High density lipoproteins choles.; Glucose : sugar ; Na: Sodium ; K : Potassium.

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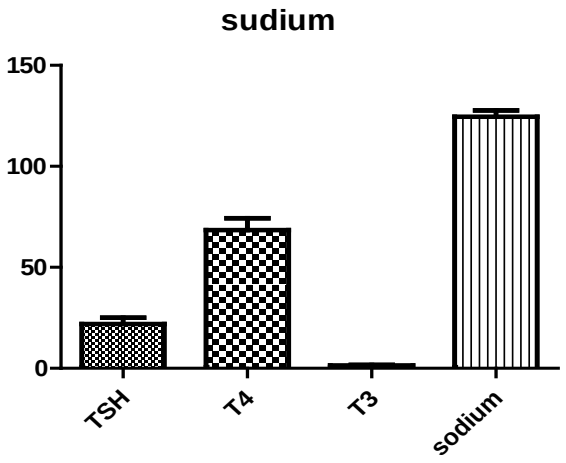

Figure 4. comparism between mean sodium with TSH and T4 and T3

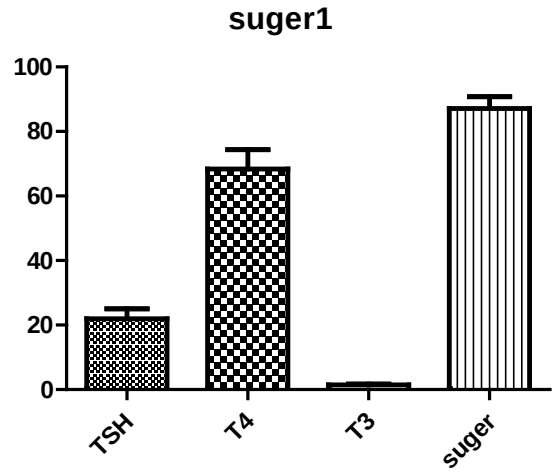

Figure 5. comparism between mean sugar with TSH and T4 and T3

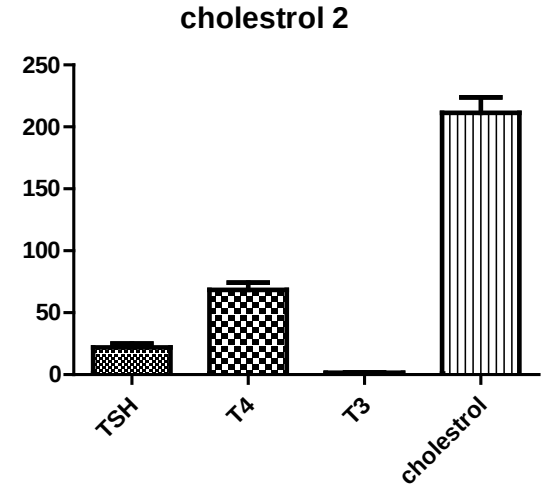

Figure 6. comparism between mean sodium with TSH and T4 and T3

On MegaStat's correlation analysis depicted a significant positive correlation between K level and TSH level (r=- 0.110 , p<0.05) (Figure 1), while the obtained data indicated that a significant and negative correlation between levels of K and T4 level (r= 0.177 , p<0.05) (Figure 2), also a negative correlation between levels of K with T3 level (r= 0.313 , p<0.05) (Figure 3) . While on Graph Pad prism 5 program the other correlation obtained data indicated had a significant Differences at (P < 0.05) between sodium , sugar and cholesterol with TSH and thyroid hormones figures (4,5,6) respectively

DISCUSSION

Thyroid dysfunctions are among the most common of the endocrine disorders whatever the causes ,and "the too little (hypothyroidism) or too much (hyperthyroidism) thyroid hormone secretion are largely predictable ,given the knowledge of the functions of the thyroid hormones" [13]. Importantly, there are the correlations between " thyroid hormones and metabolism by the metabolic rate through the influence of these hormones on the metabolism of carbohydrates, fats and proteins and thus energy produced from the hydrolysis of these compounds" . Through the current results, the TSH levels were significantly higher in patients (14.62± 16.07 µIU /ml) as compared to healthy group at (P < 0.05) was shown in table (1). The elevated TSH may be resulting from" a neuroendocrine dysfunction caused by deregulation of the hypothalamus pituitary axis" [8] . Furthermore, in the hypothyroidism case the low T4 secretion," is characterized by a generalized reduction in metabolic function that most often manifests itself as slowing of physical and mental activity "[16]. So when thyroxin in serum of patients will decrease , the negative feedback mechanism will be casing to secret thyroid stimulating hormone by pituitary gland, therefore the TSH will be increased in serum in response to feedback from the low levels of thyroxin and triiodothyronine hormones .On the other hand , This study was conducted , the results of serum potassium(K) was significantly decreased (37.56 ± 4.922) in patients than control at (P < 0.05) as showed in table (1), these result were agreed with Abdul Kareem Saad (2017)[17] that was found serum potassium levels were be lower than in hypothyroid patients when compared with controls and in the hyperthyroidism case that serum K levels is increased [18] , the reason may be as "thyroid hormone is a central regulator of body haemodynamics , thermoregulation and metabolism ,therefore, it has an influence on renal haemodynamics , glomerular filtration , as well as the renin angiotensin aldosterone system and renal electrolyte handling" [9] ,so "an impaired urinary dilution capacity due to non-osmotic release of anti-diuretic hormone ,as well as increased urine sodium loss was the major mechanism for hypothyroid induced hyponatraemia" [19] . Therefore the disorder of thyroid hormones casing defects of electrolyte concentration and the metabolic rate . So that , there are a relationship between serum electrolyte and thyroid function, as the resulting from " the different electrolyte disorders were associated with thyroid dysfunction" [20] . Concerning to the results of the present study were reported a significant correlation between serum K with thyroid hormones because of "Na and K are the most components that enter in the composition of enzyme Na+ K +ATPase in the cell membrane , the function of enzyme is responsible for the transport of water and nutrients across the cell membrane. Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues", so that in the less of thyroid hormones leading of low K levels, and "this enzyme is affected, resulting in accumulation of water inside the cells and causing edema", In order to function, a significant negative correlation between serum K with T4 and T3 as showed in figure (2,3) , "in hypothyroidism, the thyroid gland does not produce enough thyroid hormones (T3 ,T4),then decreased levels in hypothyroid patients are expected when

compared with normal people" . Moreover , "the thyroid gland plays an important role in glucose hemostasis" [21] . Importantly, in hypothyroidism , "decreased gluconeogenesis and glycogenolysis in liver .In addition to hypothyroidism lowers the glycogen phosphorylase activity in the liver" [22] while "In hyperthyroid humans increase glucose production and impaired suppression of glucose production by insulin" [23,24] leading to "glucose turnover hepatic glucose production are peripheral glucose utilization, abnormal glucose metabolism "[25] . Additionally, "hypothyroidism is associated with dyslipidemia resulting in hypercholesterolemia, elevated low-density lipoprotein (LDL) , decreased High density Lipoprotein (HDL) , and hypertriglyceridemia"[26] . Hypothyroid patients are "at increased risks to develop cardiovascular diseases due to this deranged lipid profile, endothelial dysfunction, metabolic, hormonal, and hemodynamic changes and coagulation disturbances" [27]. We can conclude from the current study that the relationship between thyroid dysfunction and serum abnormal electrolyte with physiological parameters in that patients. As the results of this study it will be indicate that the serum electrolytes were significantly imbalanced in patients of thyroid disease , so it should be checked for serum electrolytes and biochemical to prevent the possible complications.

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