

Original Research Article

Evaluation of Creatine Kinase as A diagnostic Tool for Thyroid Disorders

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Abstract: There is evidence of opposite relationship between creatine kinase and thyroid dysfunction disorders. This study aimed to evaluate serum CK level in hypothyroidism and hyperthyroidism patients and find its correlations with thyroid function tests. In this cross-sectional study 200 hundred subjects diagnosed with thyroid dysfunctions referred to advanced diagnostic center-Khartoum- Sudan were involved. A 100 had hypothyroidism aged 35 ± 10 years while other 100 ones had hyperthyroidism aged (42 ± 11) years. Laboratory analysis of thyroid function tests (TFT) via i-chroma, device, an immuno chromo genic process, and serum CK enzyme activity measurement via spectrophotometer, Bio system device were performed for all participants. Statistical analysis for the data obtained was conducted via spss program version 16. The CK activity level was significantly increased in hypothyroid patients compared to hyperthyroidism patients (183.2 ± 34.2 vs 47.2 ± 12.6 , p.value 0.001). In hypothyroidism patients, the serum activity level positively correlated with TSH level. In hyperthyroidism patients there was negative correlation between CK activity and duration of the disease. CK is considered a marker for variety of systems abnormalities as muscular damage and others, it could be used as monitor for thyroid dysfunction treatment state.

Keywords: thyroid dysfunction, CK activity.

INTRODUCTION:

The multiple hormones regulates almost all body functions, including metabolism, growth and development [1]. The thyroid secretes two major hormones, thyroxine and triiodothyronine, commonly called T4 and T3, respectively. Both of these hormones profoundly increase the metabolic rate of the body. Complete lack of thyroid secretion usually causes the basal metabolic rate to fall 40-50% below normal, and extreme excesses of thyroid secretion can increase the basal metabolic rate to 60-100% above normal. Thyroid secretion is controlled primarily by thyroid-stimulating hormone (TSH) secreted by the anterior pituitary gland. The thyroid gland is unusual among the endocrine glands in its ability to store large amounts of hormone. After synthesis of the thyroid hormones has run its course, each thyroglobulin molecule contains up to 30 T3 molecules and a few T4 molecules. In this form, the thyroid hormones are stored in the follicles in an amount sufficient to supply the body with its normal requirements of thyroid hormones for 2 to 3 months. Therefore, when synthesis of thyroid hormone ceases, the physiologic effects of deficiency are not observed for several months [1].

Thyroid disorders can range from a slightly enlarged thyroid gland that needs no treatment to life-threatening thyroid cancer. The most common thyroid problems involve the abnormal production of thyroid hormones. Thyroid function disorders can generally be grouped into two classes [2]: Hypothyroidism is defined as failure of the thyroid gland to produce sufficient thyroid hormone to meet the metabolic demands of the body [3]. The prevalence increases with age, and is higher in females than in males [4] while Hyperthyroidism: Over activity of the thyroid gland leads to high levels of thyroid hormones and the speeding up of the metabolism. The heart rate and blood pressure may increase, heart rhythms may be abnormal, and patients may sweat excessively, feel nervous and anxious, have difficulty sleeping, and loss of weight without dieting. Graves' disease (toxic diffuse goitre) is the most common cause of hyperthyroidism [5], it is affecting approximately 2 percent of women and 0.2 percent of men [6]; the patient may have triiodothyronine toxicosis [7]. Patients with subclinical thyroid disease have few or no symptoms or signs of thyroid dysfunction and thus by its very nature

subclinical thyroid disease is a laboratory diagnosis. Subclinical hypothyroidism is defined as a serum thyroid stimulating hormone (TSH) above the defined upper limit of the reference range, with a serum free thyroxine within the reference range. Other causes of a raised TSH, a past history of thyroid disease and patients on T4 hormone treatment need to be excluded. It is therefore critically important that the reference limits for TSH be standardised. The TSH method used should have a high functional sensitivity (at least 0.02 mU/L), although this is of most importance for the diagnosis of subclinical hyperthyroidism [8]. To diagnose thyroid dysfunction, TSH should be used to diagnose primary hypothyroidism [9]. While diagnosis of hyperthyroidism is based on clinical examination and TFT. Physical examination may reveal thyroid enlargement, tremor, hyperactive reflexes or an increased heart rate. The systolic blood pressure may be elevated. Subclinical hyperthyroidism is defined as a mild form of hyperthyroidism that is diagnosed by abnormal blood levels of thyroid hormones; often in the absence of any symptoms typically there are low TSH and elevated T3 and T4 [10].

Creatine kinase (CK) is a compact enzyme and it is found in both the cytosol and mitochondria of tissues where energy demands are high. In the cytosol, CK is composed of two polypeptide subunits and two types of subunit are found, M (muscle type) and B (brain type). These subunits allow the formation of three tissue-specific isoenzymes: CK-MB (cardiac muscle), CK-MM (skeletal muscle), and CK-BB (brain) [11]. (CK) is a central controller of cellular energy homeostasis. By reversible interconversion of creatine into phosphocreatine, CK builds up a large pool of rapidly diffusing phosphocreatine for temporal and spatial buffering of ATP levels. Thus, CK plays a particularly important role in tissues with large and fluctuating energy demands like muscle and brain [12]. Further functions of CK are based on the concepts of subcellular compartmentation of CK isoenzymes and limitations of free diffusion even of smaller molecules within the cell as, adenine nucleotides [13]. Raised levels of serum CK are still closely associated with cell

damage, muscle cell disruption, or disease [14], and that has been found in thyroid dysfunction states by many studies conducted in order to assess parameters beside monitoring TFT in those patients, typically in hypothyroidism CK activity increased, while in hyperthyroidism decreased [15, 16].

MATERIAL AND METHOD

In this cross-sectional study, 200 hundred subjects diagnosed with thyroid dysfunctions referred to advanced diagnostic center-Khartoum- Sudan were involved. From them , 100 subjects had hypothyroidism were 75% males and 25% female, the (mean+SD) of age as (35+10) years while other 100 ones had hyperthyroidism, were 68% males and 32% female and the (mean+SD) of age as (42+11) years . A formal consent obtained from the patients and ethical clearance from local authorities was obtained. 5 ml of blood was withdrawal from each subject under hygienic environment, allowed for auto-serum formation, separation and preserved at -20Co for subsequent analysis of thyroid function tests (TFT) via i-chroma, device, an immunochromogenic process and measurement of CK enzyme via spectrophotometer, Biosystem device and reagent. Analytical process conducted in faculty of medical laboratory science- Alneelain University, department of clinical chemistry. Statistical analysis of data conducted via SPSS program version 16

RESULT

This study involved a 200 thyroid dysfunction subjects attended to advanced diagnostic center, involved in this study, 100 patients were diagnosed with hypothyroidism, their Mean ±SD disease duration was (2.3±1.4) years and the other 100 subjects were diagnosed with hyperthyroidism and their Mean±SD of disease duration was (2.7±1.8) years). The comparison of T3, T4, TSH and CK enzyme activity measurements between two groups are shown in table1. CK showed positive Correlation with TSH in hypothyroidism patients and negative correlation with duration of the disease in hyperthyroidism patients (Table 2)

Table-1: Comparison of study parameters between hypo- and hyperthyroidism patients.

Parameters	Hypothyroid Mean+SD	Hyperthyroid Mean+SD	P value
T3	0.194±0.28	4.5±1.6	.000
T4	2.94±1.96	17.9±3.8	.000
TSH	17.8±10.5	0.14±0.01	.000
CK	182.3±34.2	47.2±12.6	.001

Student T. test was used to calculate P. value, P. value less than 0.05 was considered Significant

Table 2: Correlation of CK with age, duration, T3, T4, TSH in hypo and hyperthyroid patients

CK	Age	duration	T3	T4	TSH
Hyperthyroid	-.116	-.243*	.000	-.032	.062
Hypothyroid	.197	.006	-.027	-.104	.478**

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed)

DISCUSSION

This study was conducted to evaluate the creatine kinase enzyme level among patients with thyroid dysfunction whether hyperthyroidism or hypothyroidism, included hundred (100) subjects for each group. Both genders were participants. In this study, thyroid dysfunction distributed among males more than females, this disagrees with a study conducted on hypothyroidism subjects, female were more than males [17]. The outcome of this study showed the state of CK enzyme among each thyroid dysfunction group besides monitoring TFT. In primary hypothyroidism patients as decreased levels of both T3 and T4 and increased TSH, CK level was elevated. The activity of CK is correlated with TSH level. However, in hyperthyroidism the activity was not affected and was negatively correlated with durations of the study. These findings agree with previous studies [18], many mechanisms can causing increase of ck among hypothyroid patients, one of this mechanism, skeletal muscle is effected by hypothyroidism because T3 and T4 regulate and control the metabolic activity of creatine kinase, therefore decrease level of thyroid hormone lead to uncontrollable creatine kinase and it increase in circulation [19] patients with hypothyroidism are suffer from myopathy due to hypometabolic state, that lead to reduction in oxidative phosphorylation and glycolysis and reduction of (ATP) below the normal limit that lead to increase cell permeability and leakage creatine kinase from cell to circulation due to alteration of sarcolemmal membranes, CK-MM isoenzyme increased in hypothyroid that lead to increase of C.K activity which marker of skeletal muscle abnormality, and it major source of elevation serum creatine kinase [20-22] concentration with other studies conducted in monitoring drug administration in hyperthyroid state which it revealed that the CK level increased was while thyroid hormones targeted to be low, suggesting that increased CK level parallel with decreased thyroid hormones levels [16, 23] While disagreement with study involved both thyroid dysfunctions in order to monitor serum hormones levels, one of them was CK, which found significant elevated in both hypo and hyperthyroidism [24].

CONCLUSION

As CK is considered a marker for variety of systems abnormalities as muscular damage and others, it could be used as supportive parameter to diagnosing thyroid dysfunction, hypothyroidism screening and in thyroid treatment states.

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