



ORIGINAL RESEARCH PAPER

Biochemistry

AN ASSESSMENT OF SERUM ELECTROLYTES IN PATIENTS WITH HYPOTHYROIDISM.

KEY WORDS:

Hypothyroidism, hyponatremia, hypokalemia.

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ABSTRACT

Background- Hypothyroidism is known to affect electrolyte, fat, protein and carbohydrate metabolism. The effect on thyroid hormones on electrolytes has not been well established and the underlying mechanisms are not well understood. Only few data on the association between thyroid function and electrolyte disorders exists. Thus our aim was to assess the levels of serum electrolytes in the patients with hypothyroidism.

Materials and methods: 100 patients and 100 controls were included. Thyroid hormones (T3, T4, TSH) were measured. Serum sodium, potassium were estimated using ion selective electrodes. Statistical analysis was done using SPSS 16.

Results: Patients with subclinical hypothyroidism showed significant decrease in serum sodium levels and serum potassium levels ($p < 0.001$).

Conclusion: Thyroid patients should be regularly checked for serum electrolytes. Early detection and treatment can prevent the further complications and will be helpful during the management of thyroid patients.

INTRODUCTION

Electrolytes play an important role in many body processes, such as controlling fluid levels, acid-base balance (pH), nerve conduction, blood clotting and muscle contraction [1]. Thyroid hormone is a central regulator of body haemodynamic, thermoregulation and metabolism. Thyroid hormones perform a wide array of metabolic functions including regulation of lipid, carbohydrate, protein and electrolyte and mineral metabolisms. While the effect of thyroid hormones on lipid metabolism is well known, the effect on electrolytes and minerals has not been well established and also the underlying mechanisms are not well understood [3].

Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissue. Prospective studies show that hypothyroidism is associated with Hyponatremia [9, 10, 11,]. An impaired urinary dilution capacity due to non-osmotic release of antidiuretic hormone as well as increased urinary sodium loss is the major mechanism for hypothyroid induced hyponatremia in rats [12]. Thyroid hormones modulate the expression of sodium potassium ATPase mRNA and protein and hence regulate the activity of this critical component of renal sodium transport [13]. Hypothyroidism could be a cause of hypokalemia. Plasma Aldosterone (PA) may be suppressed in hypothyroidism probably due to dysfunction of juxtaglomerular cells and glomerulosa cells in zona glomerulosa respectively and the possibility that suppression of PRA and PA in patients with hypothyroidism is related to exaggerated sodium excretion and decrease in potassium excretion cannot be ruled out (Saruta T et al 1980) [14]. In hypothyroidism, because of low potassium level and increased intracellular sodium concentration results in accumulation of water inside the cells and causing edema.

Sodium and potassium are important components of the enzyme 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. Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues. In recent years research has focused on outcomes of patients with electrolyte disorders, mainly hypo- and hypernatraemia, which were found to be associated with increased mortality.

MATERIALS AND METHODS

The present work was carried out in JLN Medical Hospital,

Ajmer on patients attending outpatient department and admitted in the Medicine Department of the same college and Hospital, in the period of January 2021 to August 2021. The study type was case-control. The study included 100 clinically established hypothyroid cases and 100 healthy individuals as control groups of both sexes. All the patients having overt hypothyroidism of either sex between the ages 25-60 years were included in the study. Pediatric age group patients with renal disorders, hepatic disorders, bone disorders and diabetes mellitus and patients on medication e.g. diuretics, calcium and iron tablets were excluded in the study. Method of analysis was by taking 2 ml of venous blood sample was drawn from cases and controls and serum was separated. Following Biochemical investigations were carried out in both cases and controls. A. Thyroid hormone Assay: total serum T3, total serum T4, Serum TSH which were measured by E.C.L.I.A (Electro Chemi Luminescence Immuno Assay) method. Electrolyte levels (Na⁺, k⁺ & Cl⁻) were measured by ion selective electrode.

RESULTS

Table 1: Comparison of analytes between control and hypothyroidism patients.

Tests	Hypothyroid patients	Control	P value
T3 (tri-iodothyronine)	60.1±4.2	1.5±0.06	<0.001***
T4 (thyroxine)	45.5±3.0	98.2±1.3	<0.001***
TSH (thyroid stimulating hormone)	3.12±0.15	8.3±0.14	<0.001***
Na (sodium)	131.4±0.31	142.2±0.23	<0.001***
K (potassium)	3.22±0.05	3.91±0.05	<0.001***

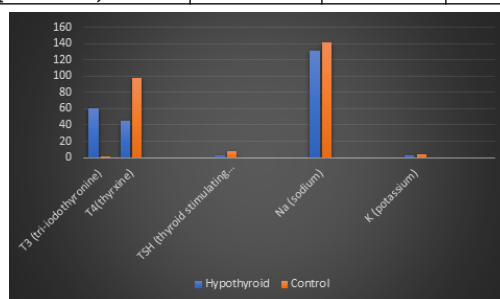


Figure 1- showing the comparison of T3, T4, TSH, Na, K in Hypothyroid subjects and controls.

DISCUSSION

Hypothyroidism is one of the most prevalent endocrine diseases. It can lead to a variety of clinical situations, including congestive heart failure, electrolyte disturbances and coma. Hyponatremia is the most common electrolyte abnormality encountered in clinical practice. Thyroid hormone is a central regulator of body hemodynamics, thermoregulation and metabolism. Therefore, it has an influence on renal hemodynamics, glomerular filtration and electrolyte handling [6].

Hypothyroidism is a very common condition and seen more in females than males. The present study showed majority of the patients were women (64%) and in the age group of 30 to 40 years which is in accordance with study done by Roopa Murgod et al (Roopa M et al 2012) [7]. The higher prevalence of thyroid disease in women suggests that estrogen might be involved in the pathophysiology of thyroid dysfunction. Estradiol has an antagonistic effect on the hormones T3 and T4. The reason being, estradiol competes with T3 and T4 for binding sites on the receptor proteins (Vasudevan N et al, 2002) [5].

In the present study the serum sodium and potassium levels were significantly decreased in cases of hypothyroidism as compared to healthy controls (p<0.001). Our study is in conformity with the study done by Roopa M et al, Schwarz [20], and Jaskiran Kaur [9]. According to them, thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues (Ismail Beigi F and Edelman IS, 1971) [8]. In hypothyroidism, because of low potassium levels, and because of deficiency of thyroid hormones, this enzyme is affected, resulting in accumulation of water inside the cells and causing oedema. This is said to be one of the mechanisms responsible for weight gain seen in hypothyroid patient.

Sodium and potassium are important components of the enzyme Na-K ATPase, which is an enzyme on the cell membrane that helps in the transport of water and nutrients across the cell membrane. Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues. In hypothyroidism, because of low potassium levels, and because of deficiency of thyroid hormones, this enzyme is affected, resulting in accumulation of water inside the cells and causing edema. This is said to be one of the mechanisms responsible for weight gain seen in hypothyroid patients [4].

CONCLUSION

In this study we found that when the cases and controls were compared, TSH level was significantly increased in cases as compared to controls. Total T3 and total T4 level was significantly decreased in cases as compared to controls. Our study also demonstrated that hypothyroid patients showed low total sodium, potassium levels. This suggests that hypothyroid and hyperthyroid patients should be regularly checked for serum electrolytes. Early detection and treatment can prevent the further complications related to the disorder and will be helpful during the management of thyroid patients.

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