

COMPARATIVE ESTIMATION OF SERUM ZINC AND URIC ACID LEVELS AMONG PATIENTS OF HYPOTHYROIDISM OF MANIPURI POPULATION IN INDIA: A CASE CONTROL STUDY

Biochemistry

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ABSTRACT

Background: Hypothyroidism is one of the most prevalent disorders of endocrine system in general population. Presently it is an established disorder among all races in both over developed and under developed countries in the world. It is mostly prevalent among the places where there is scarcity of Iodine in the soil especially in remote inland areas where general diet is usually devoid of any marine food and in hilly regions where food is cultivated in soil devoid of Iodine. Hypothyroidism is a bedside clinical syndrome produced by lack of thyroid hormones which provides inhibition of normal metabolic speed. The present study is focussed to get the serum zinc and uric acid levels among hypothyroid patients in the Shija Hospital and research institute, Imphal, Manipur, India. **Methods:** The study was organized at Shija Hospital and Research Institute in Imphal, Manipur from June 2023 to February 2024. There were 40 cases and 40 controls in the age group from 20 to 70 years. Standard protocol has been maintained while collection of fresh samples and performing the tests. Serum Zinc level was estimated by Spectrophotometric analysis and Uric acid level was estimated by semi auto analyzer. **Results:** Serum level of Zinc was significantly low (p value <0.001) and Uric acid level was significantly high in hypothyroid patients as compared to healthy controls. **Conclusions:** In this study, low level of serum Zinc was observed due to inadequate gastro intestinal uptake of Zinc among cases with hypothyroidism or by the degradation of Zinc produced by the hepatocytes and high level of Uric acid was produced due to both renal plasma flow and glomerular filtration rate reduction simultaneously.

KEYWORDS

Zinc, Uric acid, Hypothyroidism.

INTRODUCTION

Presently in modern world, the importance of thyroid gland places a pivotal part in maintaining good health. Thyroid hormone is secreted as thyroxine (T4) and triiodothyronine (T3) from the endocrine gland thyroid gland itself.¹

The word "Hypothyroidism" is derived from Greek word where 'Hypo' means 'reduced', 'threo' means 'shield' and 'eidos' means 'form'. It is a very common disorder of our endocrine system where thyroid gland cannot produce sufficient thyroid hormone.²

Both hypothyroidism and hyperthyroidism are very much prevalent across the world. Almost 200 million people of the world have been cursed with some forms of thyroid disorders. Around 3% of the general population have the positive incidence of hypothyroidism all over the world.³

The functions of both thyroid hormones (T3 and T4) are regulation of metabolic rate, overall growth and increment of basal metabolic rate which utilizes our energy overall by producing metabolic heat.⁴ Hypothyroidism is a bedside syndrome which provides excessive slowing of metabolic process, expansion of thyroid gland which is expressed as goitre, obesity, reduction of cognitive behaviour, slowing of physical and mental activity and increased chance of ischemic heart disease.^{5,6}

Hypothyroidism is characterised by a reduction of renal plasma flow and glomerular filtration rate. It is seen in more than 55% of adults which are having hypothyroidism.⁷

Hypothyroidism is also associated with significant increment of serum Uric acid level. Here hypothyroidism is often added with hyperuricemia caused by reduced glomerular filtration rate and renal blood flow.⁸ Zinc, on the other hand, is an essential trace element that provides pivotal role in thyroid metabolism. It causes the mechanism of action and formation of thyrotropin releasing factor and facilitates bonding between triiodothyronine to its nuclear receptors. Zinc also causes thyroid hormone synthesis. This low level of Zinc is often associated with decreased thyroid hormones synthesis and hypothyroidism in the long run. Conversely uptake of Zinc is facilitated by thyroid hormones and hypothyroidism itself can for acquired deficiency of Zinc.⁹

So from the aforementioned discussion we can establish that the level of serum Zinc is decreased and serum Uric acid level is increased among hypothyroid patients. Here in this following work the serum levels of Zinc and Uric acid will be estimated in hypothyroid cases and comparison will be done with healthy controls.

Aims and Objectives

A) To evaluate:

- Concentrations of serum Zinc
- Concentrations of serum Uric acid in patients with hypothyroidism and healthy controls.

B) To establish:

- Inter-relationships between Zinc and Uric acid among the patients.

MATERIALS AND METHODS

This study has been conducted in Department of Biochemistry of Shija Academy of Health Sciences and associated Shija Hospital and Research Institute, Imphal along with the required investigations and tests. The hypothyroid patients who got admitted in the wards of Shija Hospital including both the inclusion and exclusion criteria were selected for the study. The healthy control group was obtained from the under graduate students of Shija Academy of Health Sciences, staff and attendants.

The study was conducted upon 80 subjects which was observational cross sectional in nature. Among the 80 subjects, 40 subjects were considered as cases who were the patients of hypothyroidism and 40 were healthy controls consists matched age and sex. The aforementioned subjects with classical signs and symptoms of hypothyroidism, age between 20-70 years and serum levels of T3 <1.31 nmol/l and TSH >4.21 μ U/ml were featured as hypothyroid patients. The exclusion criteria for this study were any patient with pregnancy, liver and kidney disorders, gastrointestinal disorder, malignancy, endocrine disorder and patients undergone previous thyroid surgery in the past.

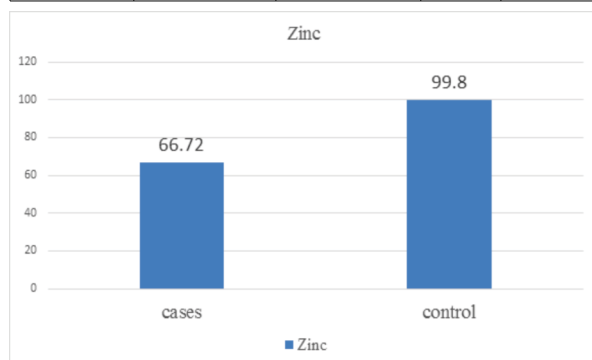
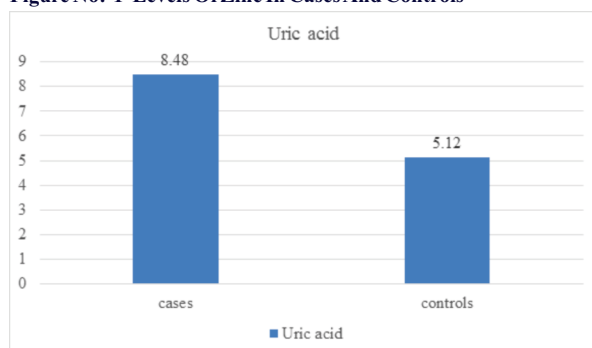
Serum TSH was determined through sandwich assay and T3 and T4 levels were estimated through competitive ECL method. Serum uric acid level was calculated by colorimetric method in semi auto analyser through commercially available reagents kit. Uricase enzymatic method has been conducted for estimation of serum Uric acid level and spectrophotometric analysis involving AAS (Atomic Absorption Spectrophotometer) has been performed for the estimation of serum Zinc level.

RESULTS

The blood samples of both cases and healthy controls were collected and analysed for serum Zinc and Uric acid levels. The table No. 1 provides plasma levels of Zinc and Uric acid among cases and healthy controls with difference which was significant in nature (Figure 1 and 2). Serum levels of Zinc were significantly decreased among patients with hypothyroidism (66.72 ± 7.48 , $p < 0.001$) and levels of serum Uric acid among patients with hypothyroidism were significantly increased (8.48 ± 0.58 mg/dl, $p < 0.001$).

Table No:-1 Levels Of Zinc And Uric Acid In Cases And Controls

Parameters	Mean $\pm$ SD Control group	Mean $\pm$ SD Study group	p value	t value
Zinc	99.8 $\pm$ 12.08	66.72 $\pm$ 7.48	<0.001	14.644
Uric acid	5.12 $\pm$ 0.96	8.48 $\pm$ 0.58	<0.001	18.886

**Figure No:-1 Levels Of Zinc In Cases And Controls****Figure No:-2 Levels Of Uric Acid In Cases And Controls**

DISCUSSION

There is a presence of possible interrelationship between gastro intestinal function, Renal glomerular filtration and primary hypothyroidism. A statistically significant increase in serum Uric acid level was found in the aforementioned study among hypothyroid patients as compared to healthy control groups. Decrease in the glomerular filtration rate secondary to a reduced renal plasma flow caused by hemodynamic changes observed in severe hypothyroidism may be the cause behind it. The reduction in serum Zinc level is probably due to impaired gastro intestinal uptake of Zinc probable because of malabsorption, decreased intestinal motility, myxodematous infiltration and associated autoimmune disorder. Serum Uric acid may be increased because of hypothyroid myopathy.

A study was conducted by Giordano et al. among 28 patients accompanied with primary hypothyroidism. The study elicits 33.3% presence of hyperuricemia in patients with hypothyroidism.⁸ Khan AH et al. has estimated serum Uric acid level of hypothyroid patients and found the serum level of it being significantly higher in hypothyroid patients.³

The study is also in similarity with Simbita Marwah et al. which shows significant increase in serum Uric acid in hypothyroid patients as compared to controls. Ambookenbetsy et al. performed a study upon Zinc deficiency accompanied by hypothyroidism. It is observed that Zinc deficiency probably attributed significantly for the development of hypothyroidism.¹⁰

Sibel et al.(2010) have conducted a study portraying the relationship between Zinc levels, thyroid volume caused by appropriate iodine supplementation and thyroid hormones. In this study, there were significant relationships between serum Zinc level and thyroid volume in nodular goitre patients.¹¹

Neha Sharma et al. (2016) have presented a case control study where there are increments of serum Uric acid, Creatinine level and decrease in the serum Zinc level among hypothyroid patients in Bikaner, Rajasthan, India.

CONCLUSION

In this case control study, mean Zinc was found significantly lower and mean Uric acid was found significantly higher among hypothyroid patients compared to controls which provides info regarding positive assistance of thyroid hormones upon gastrointestinal and renal function. Through this knowledge we can bypass unnecessary worry in patients along with both excessive investigations and treatment cost of patients with gout associated with undetermined thyroid status. Hypothyroidism is often associated with renal dysfunctions that produces adverse clinical consequences particularly among patients on medications excreted by kidneys.

So thyroid function should be regularly observed among patients with deranged renal activity. Serum Zinc and Uric acid levels are also be explored among patients with hypothyroidism. The profound output of hypothyroidism upon the metabolism of Zinc also should not be ignored as Zinc deficiency may cause loss of taste and appetite, hair loss and mental depression which are prevalent among hypothyroid patients. Regular exploration of Zinc deficiency is often neglected which is warranted in all subtypes of hypothyroidism.

REFERENCES

1. Marwah S, Mehta M, Shah H, Haridas N and Trivedi A. "Correlation of serum uric acid and serum creatinine in hypothyroidism". Natl J Physiol Pharm.2015;5:232-235.
2. "Hypothyroidism" . Musby's Medical Dictionary. Elsevier Health Sciences. 2013;9:887.
3. Khan AH and Majumder L. " Serum creatinine and uric acid level of hypothyroid patients". Bangladesh J Med Biochem. 2010;3(2):61-63.
4. Burtis CA, Edward ER, Bruns DE. Tietz Textbook of Clinical chemistry. 4th edition Philadelphia, PA: WB Saunders,2006.
5. Helford M, Grapo LM. "Screening for thyroid diseases". Ann intern med. 1990;112(11):840-58.
6. Surks MI and Ocempo E. "Subclinical thyroid diseases". American Journal of Medicine. 1996;100:217-223.
7. Kreisman SH and Hennessey JV." Consistent reversible elevations of serum creatinine levels in severe hypothyroidism". Archives of Internal Medicine.1999;159:79-82.
8. Giordano N, Santacroce C, Matii G, Geraci S, Amendola A and Gennari C. "Hyperuricemia and gout in thyroid endocrine disorder". Rheumatol.2001;19:661-5.
9. Nishi Y, kawate R, and Usui T."Zinc metabolism in thyroid disease." Postgraduate Medical Journal.980;56:833-837.
10. Ambooken B, Binitha MP, and Sarita S." Zinc Deficiency Associated with Hypothyroidism, An Overlooked Cause of Severe Alopecia." Int J Tricology.2013; Jan-Mar 5(1):40-42.
11. Sibel E, Arigo FG Cicero, Oya C, Gutbuz E."Relationship between serum zinc levels, thyroid hormones and thyroid volume following successful iodine supplementation." 2010;9(3):263-268.