Correlation of Serum zinc with TSH in hyperthyroidism

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ABSTRACT

Aims and Objectives: Trace elements may have a role in progression of hyperthyroidism. We planned to estimate the serum zinc, copper and ceruloplasmin in hyperthyroids. Materials and Methods: 41 hyperthyroid patients and 32 control subjects were taken for the study. Serum T4, TSH, zinc, copper and ceruloplasmin were estimated in them. T4 and TSH were estimated by ELISA method. Zinc and copper were estimated by colorimetric method. Serum ceruloplasmin were estimated by Ravins method. Results: Significant decrease of TSH (p<0.0001) and zinc (p<0.0001) were found in hyperthyroids in comparison to controls. Serum copper and ceruloplasmin were significantly elevated (p<0.0001) in them. Significant positive correlation between TSH and zinc was observed in case group. Conclusion: Zinc deficiency may contribute to the worsening of hyperthyroidism. Zinc supplementation may improve the condition.

Key words: Hyperthyroidism, TSH, Serum zinc, Serum copper, Ceruloplasmin

INTRODUCTION

Commonest endocrine disorders of world are the thyroid diseases. Population study estimated about 108 million people in India are suffering from endocrine and metabolic diseases of which thyroid abnormalities contribute about 42 millions.¹ Hyperthyroidism may results from generalised thyroid gland over activity or due to some other causes.² However clinical, physiological and biochemical alterations occur when tissues are exposed to increased concentrations of thyroid hormones.³ Different studies also supported that functional abnormalities of hyperthyroidism virtually affects many organ systems.⁴

An epidemiological study in cochin have shown that subclinical and overt hyperthyroidism were present in 1.6% and 1.3% of subjects in community.⁵ In another hospital based study at Puducherry, 0.6% and 1.2% of female subjects were observed as hyperthyroids.⁶

Optimal health maintenance demands an adequate supply of macronutrients, micronutrients and trace elements.⁷ Trace elements influence hormones on different aspects, namely hormone secretion, binding at target tissues and actions.⁸ With the known effect of zinc (Zn) on hypothalamus and pituitary, it appears a major role in the synthesis of thyrotropin releasing hormone (TRH).⁹,¹⁰ It also shows its necessity in the activity of 5” deiodenase.¹¹ Studies already documented the alteration of Zn status in hypothyroidism.¹²,¹³ Significantly low Zn levels were found by Kucharzews-ki et al in patients with thyroid cancer.¹⁴ In another study low Zn and high copper (Cu) levels were observed in thyroid cancer patients.¹⁵ The alteration of Zn, Cu and manganese were observed in erythrocytes and brain tissues of rats in induced iodine deficiency.¹⁶ Plasma Cu is mostly bound to ceruloplasmin (CP) and only a small fraction is bound to albumin.¹⁷ Furthermore, increased (S) CP levels were observed in hyperthyroidism were established by some authors.¹⁸ Following the above observations, the present study aimed to explore the changes in the serum levels of Zn, Cu and CP in hyperthyroid patients and any correlations exist between them.

MATERIALS AND METHODS

The study was done in the Biochemistry department of Calcutta National Medical College. It is a Cross sectional,
observational study without any type of intervention. The duration of study was two months (1.7.2014 to 31.8.2014).

Selection of cases and controls- A total of 41 hyperthyroid (16 males and 25 females, aged 25 to 50 years) patients were selected for the study. Written informed consent was taken from them. 32 age and sex matched controls were also selected, with consent, from apparently healthy persons who were not suffering from any diseases.

Inclusion criteria
Selection was done according to method of convenience. All patients for estimation of thyroid status according to the advice of physicians and Surgeons of different departments of the institution.

Exclusion criteria
a) Patients suffering from any other endocrine disorders like diabetes mellitus
b) Any other disease or drugs which may cause alteration of Zn, Cu or CP levels
c) Antenatal mothers and psychiatry patients
d) Smokers and tobacco chewers.

Methods for analysis of test parameters: The assessment of cases and controls was done under 3 headings, history, clinical examination, and biochemical assay. For biochemical assay, 5 ml of blood from the subjects was collected aseptically using standard protocols. The serum was separated by centrifugation (3000 rpm for 5 min) immediately and analysis was done.

Estimation of T4 was done by Competitive ELISA. (Aspen Laboratories Pvt Ltd).
Estimation of TSH was done by Sandwich Elisa (Aspen Laboratories Pvt Ltd).
Serum zinc is measured by colorimetric method.(Crest Biosystems).
Serum copper is measured by colorimetric method.(Crest Biosystems).
Serum ceruloplasmin is measured by Ravin`s method.

Ethics
Before commencement of the work, Ethical Permission was obtained from the Institutional Ethics Committee, according to the Helsinki Declaration. Written informed consent was taken from cases and control subjects.

Statistical analysis
Statistical analysis was done by SPSS 20 Software. Individual parameters are compared in between control and hyperthyroid group by unpaired students t-test. Correlation coefficient was done by pearsons correlation 2 tailed. P value was considered significant when <0.05.

RESULTS
Results of our study have clearly shown that mean serum TSH & Zn values were significantly low (P<0.001) in hyperthyroid patients than controls (Table 1) and mean serum Cu & CP was significantly high (P<0.001) in case group when compared to controls (Table 1). Our results also have shown significant positive correlation between TSH and Zn levels (Table 2).

DISCUSSION
The current study has shown significant decrease of serum Zn levels in hyperthyroidism. Our result is in agreement with the results of some previous studies. Maes et al showed that (S) Zn and albumin were significantly decreased in hyperthyroid patients. The probable explanation is that the albumin is the major transporter of Zn in plasma. They also suggested that the lower (S) Zn level in hyperthyroidism may be secondary to the sequestration of metallothioneins in liver, which may be a response of increased production of interleukin-6 (IL-6) produced during inflammation. Furthermore, Varga et al found the decrease of RBC Zn content may be a reflection of reduced (S) Zn in hyperthyroidism. Influence of TSH may also contribute the alteration of (S) Zn in

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control (n=32)</th>
<th>Case (n=41)</th>
<th>P value</th>
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<tbody>
<tr>
<td>TSH</td>
<td>3.0381±0.037534</td>
<td>0.2049±0.02410</td>
<td>0.0001</td>
</tr>
<tr>
<td>T&lt;sub&gt;4&lt;/sub&gt;</td>
<td>5.9375±1.11416</td>
<td>21.1220±6.83731</td>
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<tr>
<td>Zinc</td>
<td>90.5938±2.29810</td>
<td>48.9268±3.48848</td>
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<td>Copper</td>
<td>109.0313±7.68528</td>
<td>163.5366±2.70275</td>
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<tr>
<td>Ceruloplasmin</td>
<td>31.9375±3.08939</td>
<td>50.4878±3.17901</td>
<td>0.0001</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Group variable</th>
<th>TSHd Pearson correlation</th>
<th>Znd Pearson correlation</th>
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<tbody>
<tr>
<td>TSHd Pearson correlation</td>
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<td>0.314*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Znd Pearson correlation</td>
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*Correlation is significant at the 0.05 level (2-tailed)
human thyroid tissue. In our study we have found a significant positive correlation between (S) TSH and (S) Zn concentrations among hyperthyroids.

Cousins R et al observed the interleukin 1 (IL-1) produced a transient decrease of (S) Zn and increase (S) CP. They also found the infection, cellular injury and inflammation may stimulate the IL-1 production which results the increased metallothionein content in liver. In agreement with this, we found the rise of (S) CP in hyperthyroids.

We observed significant rise of cu concentration in hyperthyroids when compared to controls. Our study is in agreement with the findings of Aihara K et al. Most of the plasma cu is bound to CP and only a small portion is bound to plasma albumin. Hence rise of (S) cu may be a result of increased CP in hyperthyroids. Plasma CP level was also reported to be increased in patients with hyperthyroidism. A possible explanation is that the CP is one of the acute phase reactant that increases in response to inflammation. Although our study have shown the significant alteration of Zn, Cu, and CP in hyperthyroids in comparison to controls, significant positive correlation was observed between (S) TSH and Zn. Based on the observations of our study, we can hypothesize that Zn reduction may contribute in development or progression of hyperthyroidism. These results may help the physicians to think and plan about Zn supplement in hyperthyroids.

CONCLUSION

The results of our study have shown the significant alteration of Zn, Cu and CP in hyperthyroid patients. Furthermore we also observed a significant positive correlation between TSH and Zn. Zinc reduction may be a contributor of worsening of hyperthyroidism. Zinc supplementation may improve the condition.

REFERENCES

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Authors Contribution:
SS (Sinha) and AD - Designed the study and wrote the protocol. SS (Sinha) - Performed the statistical analysis. KK - wrote the 1st draft of manuscript. Authors SB and SS (Sen) - Managed the analysis of study and literature search. All authors read and approved the final manuscript.

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