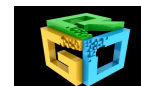


Research Article



A CORRELATION STUDY BETWEEN SERUM ZINC AND PLASMA TOTAL CHOLESTEROL, HIGH DENSITY AND LOW DENSITY LIPOPROTEIN CHOLESTEROL IN THYROID DYSFUNCTION

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ABSTRACT

Diseases of thyroid gland can affect nearly every function of our body. Thyroid hormone binding transcription factors, which are essential for modulation of gene expression, contain zinc bound to cysteine residues and also thyroid hormones influence zinc metabolism by affecting zinc absorption and excretion. Zinc is required for enzymes involved in lipid synthesis and lipoprotein excretion. Zinc is also known to have lipid lowering action. Effect of alteration of zinc on total cholesterol, high density lipoprotein cholesterol and low density lipoprotein cholesterol is still not clear with variable views. 61 subjects were divided into three groups of 19 hyperthyroid, 20 hypothyroid and 22 euthyroid who visited Kasturba Hospital, Manipal. The serum zinc correlated strongly negative and significantly with total cholesterol ($r = -0.564$), high density lipoprotein ($r = -0.548$) and low density lipoprotein cholesterol ($r = -0.566$) in hyperthyroid group. But the correlation in hypothyroid and euthyroid group differed and was not significant. Our study demonstrated a significant relationship and hence effect of serum zinc on total cholesterol, high density lipoprotein and low density lipoprotein cholesterol in hyperthyroid subjects but not on other groups. Elevated levels of total cholesterol and low density lipoprotein cholesterol may be proatherogenic and increase the risk of cardio vascular diseases hence zinc can be an important supplement during treatment of dyslipidaemia in thyroid abnormalities.

Keywords: Thyroid, Thyroid dysfunction, Zinc, Dyslipidaemia, Cardio vascular diseases, Total cholesterol

INTRODUCTION

Aim

To compare and correlate the plasma levels of zinc with that of serum high density lipoprotein cholesterol, total cholesterol and low density lipoprotein cholesterol levels in subjects with thyroid abnormalities. To study the effect and importance of zinc supplementation for dyslipidaemia in subjects with thyroid abnormalities.

Introduction

Thyroid disorders are the most common among all endocrine diseases in India¹. On the basis of countrywide study and other related studies, it can now be estimated that total burden of significant thyroid diseases in the country is approximately 42 million². The thyroid is a gland that controls key functions of our body. Diseases of thyroid gland can affect nearly every function of our body. Many micronutrients are associated with various biochemical function of which zinc is one of the most important. Zinc is essential for many biochemical processes and also for cell proliferation. Serum zinc has been regarded as one of the indices of zinc status. Thyroid hormones influence zinc metabolism by affecting zinc absorption and excretion. Also thyroid hormone binding transcription factors, which are essential for modulation of gene expression, contain zinc bound to cysteine residues³. Additionally it was reported that reduced thyroid function was strongly related to low serum zinc level⁴. But controversy exist regarding thyroid dysfunction and serum zinc levels as few authors report that

hypothyroidism is associated with elevated serum zinc levels and hyperthyroidism with that of low serum zinc level⁵. Thyroid hormones are essential in lipid metabolism as they stimulate both lipogenesis and degradation of lipids, hence dyslipidaemia is commonly seen in thyroid dysfunction. Hypothyroidism is associated with elevated low density lipoprotein cholesterol (LDL-C) and total cholesterol (TC). Levels of high density lipoprotein cholesterol (HDL-C) are usually unchanged or elevated in hypothyroidism and reduced in hyperthyroidism. Effect of alteration of serum zinc levels on plasma lipids is still controversial as low serum zinc was reported to be associated with low TC, TG and HDL-C but no change on LDL-C but few authors have reported elevated levels of TC, TG and HDL-C in subjects with low serum zinc levels^{6,7,8}.

MATERIALS AND METHODS

We evaluated 61 subjects of which 19 were hyperthyroid, 20 were hypothyroid and 22 were euthyroid controls who would regularly visit Kasturba Hospital, Manipal. Hyperthyroid and hypothyroid patients were selected on the basis of serum thyroid stimulating hormone (TSH). TSH values between 0.30 mIU and 5.00 mIU (both inclusive) were taken to be within normal limits. TSH > 5.00 mIU were considered as hypothyroid and TSH < 0.30 mIU were considered as hyperthyroid. All the subjects were age and sex matched having excluded smokers, alcoholics, and subjects on lipid lowering agents, OCP users, pregnant females, diabetics, jaundiced patients and those diagnosed with thyroid carcinoma. The ethical clearance



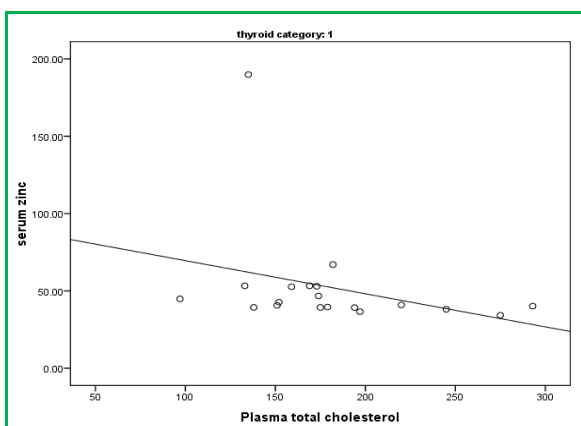
was duly obtained from the ethical review committee for the study.

Biochemical parameters

The various biochemical parameters were determined by auto analyzer by enzymatic methods like CHOD – PAP method for TC⁹ and enzymatic method for HDL-C¹⁰. LDL-C was determined by modified Friedwald's formula. Serum zinc levels were estimated colorimetrically using kit method.

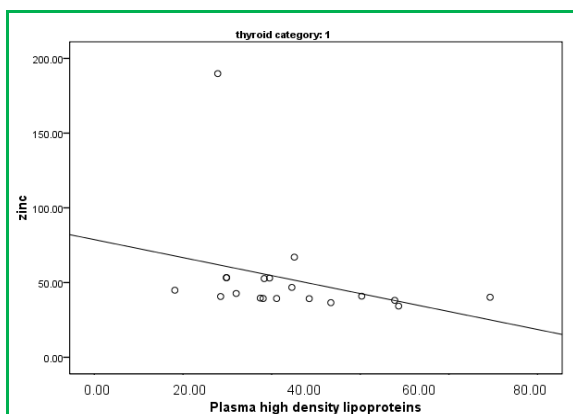
RESULTS

Full descriptive analysis of available data was performed using statistical package for social sciences (SPSS) version 17. The correlation analysis was done to test any possible correlation between plasma zinc, HDL, LDL and TC. The correlation between plasma zinc and TC was found to be significant [**p < .05**] with strong negative strength of correlation [**r = -0.564**] in hyperthyroid group [Graph 1].



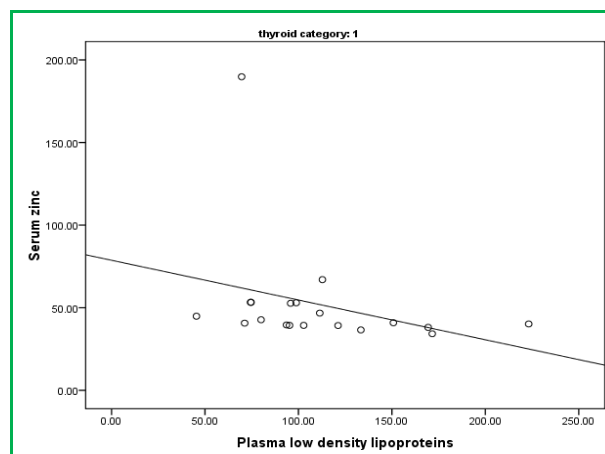
Graph 1: plasma total cholesterol

The correlation between TC and zinc was not significant with weak negative correlation in hypothyroid [**r = -0.239**] and euthyroid [**r = -0.034**]. The correlation between plasma zinc and HDL was found to be significant [**p < .05**] with strong negative strength of correlation [**r = -0.548**] in hyperthyroid group [Graph 2] but it was not significant with weak positive strength of correlation [**r = 0.192**] in euthyroid group and weak negative strength of correlation [**r = -0.267**] in hypothyroid group.



Graph 2: plasma HDL

The correlation between plasma zinc and LDL was significant [**p < 0.05**] with strong negative strength of correlation [**r = -0.566**] in hyperthyroid group [Graph 3] but was not significant with weak negative correlation in euthyroid [**r = -0.016**] and hypothyroid [**r = -0.265**]. Each small square represents a single observation and the best fit line has been drawn. From the graphs (1, 2 and 3) it is clearly visible that the correlation between serum zinc and TC, HDL-C and LDL-C is negative based on the best fit line.



Graph 3: plasma LDL

DISCUSSION AND CONCLUSION

Zinc is an essential trace metal for catalytic activities of many enzymes involved in metabolism in body¹¹. Zinc effects on thyroid hormones are complex and include both synthesis and mode of action. Thyroid hormone binding transcription factors, which are essential for modulation of gene expression, contain zinc bound to cysteine residues. Nevertheless effects of zinc on thyroid hormones or vice versa is still not clear. Dyslipidaemia is commonly associated with thyroid dysfunction^{12, 13}. Zinc is required for enzymes involved in lipid synthesis and lipoprotein excretion. Zinc is also known to have lipid lowering action¹⁴. But effects of zinc on total cholesterol, HDL-C, LDL-C are still controversial with contrasting results and opinion^{15, 16}.

In our study we studied a relatively large group and demonstrated correlation between zinc and total cholesterol, HDL-C, LDL-C. Our study demonstrated that the relationship between zinc and TC differs in the three studied group. The effect of zinc on TC in hyperthyroid group was significant with strong negative correlation. Similar findings have been demonstrated in few other studies^{17, 18}. But the relationship of zinc to TC in euthyroid and hypothyroid group was not significant.

It has been reported that decreased serum zinc leads to decreased TC due to selective decline in HDL-C⁶, but few authors have reported low serum zinc is associated with increased risk of cardio vascular diseases due to elevated TC, LDL levels^{19, 20, 21}. In hyperthyroid group the effect of zinc on HDL was significant with strong negative correlation as compared to euthyroid and hypothyroid

group where it differed in having weak strength of correlation.

It is known that most cholesterol is carried in LDL-C. Previous studies have reported that zinc depletion per se produced no significant alteration in levels of LDL-C⁶. In our study the effect of zinc on LDL-C was significant with strong correlation in hyperthyroid group but not so significant in hypothyroid and euthyroid group.

In correlation study involving plasma zinc, TC, HDL, LDL cholesterol in patients with thyroid abnormalities, it was observed that HDL-C, TC and LDL-C had strong negative correlation with plasma zinc in hyperthyroid group but not so much on euthyroid or hypothyroid group. It can be stated that levels of plasma zinc had significant effect on levels of lipid parameters in patients with thyroid abnormalities especially in hyperthyroidism but it differed in hypothyroid group. Alteration in zinc levels can play a significant role in increasing the risk of proatherogenic events and cardio vascular diseases in patients with thyroid abnormalities. Hence zinc supplementation may also be essential in treatment of dyslipidaemia in thyroid dysfunction.

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