

## SERUM ZINC LEVEL IN CHRONIC TONSILLITIS

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**ABSTRACT:** A significant number of children suffer from recurrent attacks of upper respiratory tract infection. The factors that contribute are varied and primarily revolve around the immune system. Zinc plays a key role in the integrity of our immune system. To study its effects and contribution in the genesis of chronic infections a prospective study was undertaken with specific relevance to chronic tonsillitis. The results of our study are presented here. Serum zinc level was found to be significantly low in patients who had chronic tonsillitis.

**KEYWORDS:** Serum Zinc, Chronic tonsillitis, Immunity.

**INTRODUCTION:** Zinc was initially found to be an essential element for the growth of plants and animals more than 100 years ago when scientists were seeking to discover the basic requirements for growth, and deliberately reduced or eliminated zinc from the food of plants, microbes, and animals. In all cases growth was radically reduced, and in some experiments the effects were lethal<sup>[1]</sup>. Although these studies attracted much attention for their basic significance, it was assumed that implications for human health were minimal, since zinc was thought to be widely available in nature. However, in the 1960's, this view suddenly changed, when human zinc deficiency was reported for the first time and a new field opened up.

In the years since the original discovery of how zinc influences the immune system, many groups have studied zinc and other links between nutrition and immunity<sup>[2]</sup>. Indeed there is growing evidence that nutrients have actually evolved as co-factors in development and maintenance of immune response and that nutrients directly affect both immediate and long term defense against infections<sup>[3]</sup>. The course of infections as diverse as measles and HIV may be directly affected by nutrient deficiency.

Zinc has a unique role in thymus dependent "T" cell mediated immune response. In addition to combining with thymic hormone to form the biologically active thymic hormone molecule, even a mild reduction of circulating zinc levels is associated with reduced T cell production of certain critical proteins called cytokines which regulate immune response and act as growth factors for the immune system<sup>[4]</sup>.

**AIM OF THE STUDY:** The aim of this study was to compare the estimated serum zinc level in the diseased group with that of estimated serum zinc level in age and sex matched controls.

### MATERIAL AND METHODS

#### SUBJECT SAMPLING:

**Case group:** Patients who attended the outpatient department of E.N.T., with chronic tonsillitis were selected for this study. 37 cases (20 males and 16 females) in the age group of 6-28 years with a mean age of 14.81 years were included in this group.

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**Criteria for Inclusion:** 5 or more attacks of sore throat or acute tonsillitis per year for more than 2 consecutive years. 3 or more attacks of sore throat or acute tonsillitis per year for more than 3 consecutive years. Clinically; St. John's criteria consisting of flushing over anterior pillar, Irwin Moore sign positive and presence of enlarged non-tender Jugulo digastric lymph nodes.

**Criteria for Exclusion:** Patients with diabetes, Immunodeficiency disorders, History of any micronutrient supplement containing zinc in the recent past.

**Control group:** The control group consisted of 37 age and sex matched healthy individuals (age range 6–28 years with mean age of 15.32 years, 21 males and 16 females) with normal physical examination and laboratory findings. None of them had a history of recurrent or recent infection. This group included medical students, school-going children, nursing students and college students.

## DATA COLLECTION:

**Clinical history:** Detailed history was obtained from each subject, which included – number of attacks of tonsillitis in a year, duration, history of previous attacks of tonsillitis and other illnesses. Treatment history (regarding micronutrients supplementation), history of any immunosuppressive conditions.

**Clinical Examination:** Each subject underwent thorough Ear nose and Throat examination, neck examination for enlarged Jugulodigastric lymph nodes, along with complete general physical and systemic examination. Control subjects also underwent complete Ear, Nose, Throat and neck examination. The tonsils and oropharynx was examined for any active infection. Controls having on-going infection were excluded from the study.

**COLLECTION OF BLOOD SAMPLES:** Subjects who met the criteria were then included in the study and their serum zinc level was estimated. 2 ml of venous blood was drawn from the cubital vein, collected in a plain metal free glass bottles. The blood samples were allowed to coagulate for 2 hours and after centrifugation at 5000 RPM for 10 min the serum was separated.

**ESTIMATION OF SERUM ZINC:** Serum zinc estimation as done by Photospectroscopic method.

**RESULTS AND OBSERVATIONS:** 37 patients with chronic tonsillitis and corresponding 37 age and gender matched controls were included in the study. The following were the observations of the study:

## 1. AGE DISTRIBUTION

Group	Mean Age (Yrs)	Standard Deviation	Standard Error	Total Cases (N)
Study group	14.81	6.3151	1.0382	37
Control group	15.32	6.7703	1.1130	37

Student **t** test (t) = - 0.337      p = 0.737

The mean age of the study group was 14.81 yrs. and that of the control group was 15.33 yrs. There was no statistical difference in the mean age of the two groups (p = 0.737).

## 2. GENDER DISTRIBUTION

Group	Study group	control group
Male	20 (54%)	21 (56%)
Female	17 (46%)	16 (44%)
Total Cases (N)	37	37

Chi square  $\chi^2$  = 0.2776      p = 0.615

There were 20 (54%) males and 17 (46%) females in the study group. In the control group there were 21(56%) males and 16 (44%) females. Statistically there was no difference in the composition of the two groups (p = 0.615).

## 3. INFLUENCE OF GENDER ON SERUM ZINC LEVELS

The following tables show the mean serum zinc levels among males and females in the study group and the control group.

### 3.1 STUDY GROUP

Sex	Mean serum zinc $\mu$ g/100ml	Standard Deviation	Standard Error	No. of cases
Male	68.5500	19.0522	4.2602	20
Female	66.8635	15.7324	3.8157	17

t = 0.290      p = 0.773      Total cases: 37

The mean serum zinc levels among males in the study group was 68.55  $\mu$ g/100ml and for females it was 66.86  $\mu$ g/100ml. Statistically there was no difference in mean serum zinc levels among males and females (p = 0.773).

## 3.2 CONTROL GROUP

Sex	Mean serum zinc $\mu$ g/100ml	Standard Deviation	Standard Error	No. of cases
Male	114.71	20.7854	4.5357	21
Female	115.59	21.4533	5.3637	16

$t = 0.1253$        $p = 0.901$       Total cases: 37

The mean serum zinc levels among males in the control group was 114.71  $\mu$ g/100ml and for females it was 115.59  $\mu$ g/100ml. Statistically there was no difference in mean serum zinc levels among males and females ( $p = 0.901$ ).

## 4. INFLUENCE OF AGE ON SERUM ZINC LEVELS

The following tables show the mean serum zinc levels among various age group in the study group and the control group.

### 4.1 STUDY GROUP

Age Group (Yrs.)	Mean serum zinc $\mu$ g/100ml	Standard Deviation	No. of cases
5 to 9	57.68	15.2545	9
10 to 14	75.16	14.3744	13
15 to 19	65.3	12.1945	4
20 to 24	66.93	21.6366	8
25 to 30	71.56	23.6678	3
<b>Total</b>	<b>67.77</b>	<b>17.387</b>	<b>37</b>

One way analysis  $F = 1.479$        $p = 0.232$

### 4.2 CONTROL GROUP

Age Group (Yrs)	Mean serum zinc $\mu$ g/100ml	Standard Deviation	No. of cases
5 to 9	115.68	26.7738	10
10 to 14	109.87	19.5001	8
15 to 19	114.84	23.6892	7
20 to 24	120.65	19.1036	6
25 to 30	115.83	12.7125	6
<b>Total</b>	<b>115.09</b>	<b>20.7655</b>	<b>37</b>

One way analysis  $F = 0.217$        $p = 0.927$

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5 year age intervals were considered for the study group as well as the control group. Statistical analyses for comparison of serum zinc levels among the various age group in the study group did not reveal any significant difference ( $p = 0.232$ ). Similarly statistical analysis for comparison of serum zinc levels among the various age groups in the control group did not reveal any significant difference ( $p = 0.927$ ). Thus it is evident from table 3.1, 3.2, 4.1 and 4.2 that age and sex does not significantly affect the serum zinc levels in both the study group and the control group.

## 5. COMPARISON OF MEAN SERUM ZINC LEVELS BETWEEN THE STUDY GROUP AND THE CONTROL GROUP

Table 5.1 displays the mean serum zinc levels of the study group and the control group. Table 5.2 shows the various tests of significance used to compare the values between the two groups.

### 5.1 TABLE COMPARING THE MEAN SERUM ZINC LEVELS OF THE STUDY GROUP AND THE CONTROL GROUP

Group	Mean serum zinc $\mu$ g/100ml	Standard Deviation	Standard Error	No. of cases (N)
Study group	67.7751	17.3870	2.8584	37
Control group	115.0973	20.7655	3.4138	37

### 5.2 TESTS OF SIGNIFICANCE

Tests of Significance	Values
Mann Whitney U Test	32.500
Z Value	- 7.049
p Value	<0.0001

The mean serum zinc level among the study group is significantly lower than the mean serum zinc level of the control group ( $p < 0.0001$  which is statistically highly significant).

### The following are the Results of the study

- There was no statistically significant difference in the age or gender composition between the study group and the control group i.e. the study group and the control group were well matched for age and gender composition.
- There was no statistical difference in the mean serum zinc levels when compared to either gender or age of both the study group and the control group i.e. age and gender does not significantly influence the mean serum zinc levels.

- C) There was a high statistically significant difference in the mean serum zinc levels between the study group and the control group. The mean serum zinc of the study group was significantly lower compared to the mean serum zinc levels of the control group.

## DISCUSSION:

**Sinha and Gabrieli**<sup>[5]</sup> analyzed serum zinc levels in 200 apparently healthy volunteers (100 males, 100 females) to establish their normal range. The serum zinc data obtained were analyzed for sex, race, and age. They found the values for zinc were 70 to 180 µgm /100ml, with a mean of 120±22 µgm/100ml. Men had a mean of 121±18 µgm/100ml and women 118±21 µgm/100ml. same trend was observed for age and race distribution also. They concluded that no statistical difference in mean values of serum zinc was observed between sex, race and age group.

Similar observation was made by **Bondestam M. et al**<sup>[6]</sup> in their study on serum zinc levels in children with undue susceptibility to infections. They observed that although their patients were generally younger than the controls, a comparison of the two groups was considered valid, since it has been well documented that the element being analyzed is not age-dependent beyond the first few weeks of life.

Estimation of serum zinc in our study had a normal reference laboratory range of 90 – 110 µg/100ml. It was observed in our study that there was no significant difference in the mean serum zinc level between males and females in the study group and control group. Study group: Males 68.55 µg/100ml, females 66.86 µg/100ml, Control group: Males 114.71µg/100ml, females 115.59 µg/100ml. Among the various age groups in the study group and control group there was no statistical difference in the mean serum zinc levels. **Inference:** It is evident from the observations of various studies and from our study that age and sex does not significantly influence the serum zinc levels.

**Onerci M. et al**<sup>[7]</sup> conducted a study on trace elements in children with chronic tonsillitis and recurrent tonsillitis to determine the relationship between serum levels of Zinc and chronic tonsillitis. 37 children (age range 3-14 yrs, Boys 16 and girls 21) were evaluated for zinc, copper and magnesium levels. The values were compared with that of control group consisting of 28 age and gender matched healthy children with normal physical examination and laboratory findings. None of them had a history of recurrent or recent infection. The mean serum zinc level in the study group was 78.05µg/100ml. Although in six patients the serum zinc level (ranged from 64 to 68 µg/100ml) was slightly lower than the normal limit (70 – 150µg/100ml), the serum value of the other 31 patient was with in normal range. However when compared to the control group (mean serum zinc level 88.93 µg/100ml), the mean serum zinc level was significantly lower in the patients group ( $p<0.0007$ ). The author concludes that this alteration in trace element status causes or fosters recurrent and chronic tonsillitis is not clear.

Our study accord with the conclusion that there is a significant difference in serum zinc levels between the study group and control group. But there are two variations observed.

- a) The normal range in the study conducted by **Onerci et al.** is between 70-150 µg/100ml, where as it is 90-110 µg/100ml, in our case, when this difference in taken into consideration, there is better correlation between the two studies.

- b) The study group in **Onerci et al** consisted of patients who had chronic tonsillitis but during the time of study there was no on-going infection. This could explain the higher values obtained among the study group. Whereas our study was conducted on patients with on-going infection, thus serum zinc levels were significantly lower than the normal lower limit of 90 µg/100ml.

**Bondestan M. et al** <sup>[6]</sup> in their study on children with undue susceptibility to infections observed that the children with undue susceptibility to infection had significantly lower mean levels of serum zinc ( $p < 0.001$ ) than the controls. Study group had a mean serum zinc level of 88 µg/100ml, while that of controls was 110 µg/100ml. Our study revealed a mean serum zinc level of 67.73 µg/100ml among the study group and control group had a mean of 115.09 µg/100ml. Thus this study correlates well with other authors finding that there is a significant reduction in serum zinc levels in patients with recurrent infection compared to matched controls.

Duchateau et al.,<sup>[8]</sup> Chandra and Au,<sup>[9]</sup> Pekarek et al.<sup>[10]</sup> Prasad A S,<sup>[11]</sup> Beck et al.<sup>[12]</sup> and Sazawal et al.<sup>[13]</sup> studied various parameters in Immune function in either experimentally induced zinc deficient individuals or malnourished individual with zinc deficient. All the authors have observed significant low levels of zinc in the study group compared to normal controls; this was associated with atrophy of lymphoid tissue, reduced lymphocyte count and reduced CD4: CD8 ratio. Decreased lymphocytic proliferation and reduced cytotoxic activity was also found in zinc deficient status. The authors concluded that low serum zinc level depresses various subsets of immunity and predisposes the individual to recurrent infections. Some of the authors hypothesized that since zinc deficiency increases the susceptibility of an individual to infection, oral zinc supplementation may improve the immune status and thus reduces the frequency of infection<sup>[14]</sup>.

**CONCLUSION:** The critical nature of zinc interaction with immune components, particularly the T-cell in the development of defense against potential pathogens continues to be at the cutting edge of current research on how nutrients affect immune response. These studies show that zinc is essential for normal human immune function, deficiency of which can lead to lowered immunity and recurrent infections. Our study emphasizes the findings of lower serum zinc levels in patients susceptible to chronic recurrent tonsillitis.

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