

Comparison of serum zinc level between adult males with febrile urinary tract infection & healthy males

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Abstract

Background: Urinary Tract Infection (UTI) is one of the most common cause of hospital admission in adult males. Zinc is the second most abundant mineral in the body involved in the cell growth, cell division and regulation of immune system activity. In studies, zinc administration has been effective in improving gastroenteritis in adults. However, rare studies have been conducted on this subject. The present study aimed to compare the serum zinc level between males with febrile Urinary Tract infection & healthy males as control.

Objective: This study was performed to compare serum zinc level between males with febrile UTI and healthy males.

Method: In this case-control study, serum zinc levels for 50 adult males of more than 50 years of age with urinary tract infections were compared with the serum zinc levels of the same number of healthy males in the control group who were matched in terms of location and age. Using SPSS ver. 18, univariate analysis was performed through t-test, correlation coefficient; and multivariate analysis was carried out through multiple regression tests. Significant level was considered as less than 0.05.

Results: There was a weak correlation between age and serum zinc level ($r=-0.203$, $p=0.043$). Mean serum zinc level of the test group and the control group were $74.31 (\pm 15.01)$ and $94.41 (\pm 9.12)$ microgram/deciliter ($p=0.001$), respectively. The group with UTIs had lower zinc levels than the control group ($p=0.010$, $R^2=0.366$).

Conclusion: According to the results of this study, serum zinc levels of people with urinary tract infections were lower than that in the control group. It seems that zinc levels are a risk factor for urinary tract infections.

Keywords: Gastroenteritis, leukocytosis, hospitalization, micronutrients

Introduction

Urinary tract infection (UTI) is a contagion among men and women but the incidence is found high among women due to their biological conditions ^[1]. In the urino-genital system, the output from kidneys is eliminated and wastes are filtered in urinary tracts. The urinary tract has an upper and lower part. This filter tube of human system often gets affected by bacterial, fungal and viral infections. However, the bacterial infection is predominant than the other two microbes ^[2]. UTI infection exhibits a variety of symptoms including mild burning in micturition, bacteremia, sepsis and even death ^[3]. It is reported that UTI is affecting both genders ^[4]. UTI infection is global and in U.S more than 150 million cases are reported every

year and the economic burden is more than 6 billion ^[5]. About 40% women and 12% of men suffers with UTI infection at least one time in their lifetime ^[6].

Zinc is a micronutrient, and its deficiency can increase the risk of infectious diseases ^[7]. Zinc is involved in the regulation of the host immune system, and its moderate deficiency leads to the dysfunction of the immune system. Zinc is necessary for the development and activity of T lymphocytes, and its deficiency leads to decreased levels of cellular immunity ^[8]. The bacterial poisoning caused by zinc can be a defense mechanism used by macrophages to clear the infection ^[9]. Zinc deficiency is associated with bad outcomes in response to bacterial infections and sepsis ^[10].

So due to the important role of zinc in the immune system and prevention of some infection in older adults and scarcity of studies on this subject, we decided to conduct a study comparing the Serum Zinc level between adult males with febrile Urinary Tract infection & healthy males. If zinc deficiency is a risk factor for UTI, it is possible that taking Zinc supplements in adult males help in preventing further complications.

Methods

This case control study was performed from Sept 2021 to Feb 2022, after obtaining Ethical clearance from LNMC & JK Hospital vide no. LNMC&RC/Dean/2019/Ethics/066 dtd. 28.11.2019.

The study participants were 50 adult males of more than 50 years of age with febrile UTI of middle socio economic status with symptoms of UTI and positive urine culture, who were referred to JK Hospital Medical OPD and 50 healthy males of same age and socio economic status with the absence of UTI symptoms or history of past UTI who have come to OPD for routine test or accompanied the patients who have consented to participate in the study as controls.

Diagnosis of UTI was confirmed by positive urine culture and the clinical symptoms like dysuria, urgency to urinate, supra-pubic pain or flank pain and fever and/or chills with WBC more than 10/hpf in centrifuged urine smear.

Inclusion criteria

Adult males with febrile UTI who have come to medical OPD.

Exclusion criteria

Subjects suffering from any other co-morbidity, dialysis patients, immune-compromised patients and who have consumed zinc in past one year.

Blood samples (5 cc) were taken from the subjects who met the inclusion criteria. In the laboratory, after centrifugation the serum was isolated from the sample and transferred to micro-tubes by sampler with acid washed tips and kept at -21°C temperature until the zinc level was measured by BT 3000 auto analyzer device (made in Italy) and the Bio rex kit (made in the UK).

The subjects in the control group underwent the same procedure and the tests were performed by same laboratory.

Statistical analysis

After entering the collected data into SPSS ver. 18, charts and tables were used to describe the variables. A Chi-square test and Fisher test were used to compare qualitative variables

between the two groups; moreover, the t test and Pearson correlation coefficient were used to compare quantitative values. Then, multiple linear regression was used to determine factors affecting serum zinc levels. The significance level was set at 0.05.

Results

The mean age of the participants in the test group and the control groups was 53.24 (± 15.4) and 52.40 (± 15.22) years, respectively ($p=0.854$). The mean serum zinc levels of the participants from urban and rural areas were 86.72 (± 15.23) and 86.71 (± 18.3) microgram/deciliter, respectively ($p=0.995$). There was a weak correlation between age and serum zinc level ($r=-0.203$, $p=0.043$). Mean serum zinc level of the test group and the control group was 74.31 (± 15.01) and 94.41 (± 9.12) microgram/deciliter ($p=0.001$), respectively. The results of multiple linear regression (Table 1) shows that the level of zinc reduced with age; in addition, the group with UTIs had lower zinc levels than the control group ($p=0.010$, $R^2=0.366$). Decreased serum zinc levels was related to increased age and urinary infections after adjusting for other variables.

Table 1: Relationship between serum zinc level and other variables after adjusting for other factors using a regression model.

Model	Non-standard coefficients		Standard coefficients	P Value	95% CI for B	
	Beta coefficient	Std. Error	Beta coefficient		Lower bound	Upper bound
Constant coefficients	106.82	5.89		<0.001	93.80	120.22
Age (years)	-0.196	0.073	-0.213	0.010	-0.34	-0.04
Location (Urban, Rural)	-0.382	4.11	-0.005	0.928	-9.01	8.22
Group (UTI infection/control)	-20.21	2.85	-0.576	0.001	-25.55	-14.50

Discussion

The present study aimed to compare serum zinc level between adult males with the febrile UTI and the healthy males. A few studies have examined the association between serum zinc level and UTI in adult males, which proves the importance and value of this study.

In this study it was found that UTI cases had significantly lower serum zinc levels than control groups, this difference was also observed after adjusting for age and location. Consistent with our results Fariba Zabehe *et al.* [11] Noorbuksh *et al.* [12] reported that serum zinc level was significantly lower in UTI infection in children but it is in contrast to study done by Aaron R. Johnson *et al.* [13] who reported that zinc supplementation at high levels results in increased hospitalization for urinary complications as compared to placebo.

The results of our study showed that serum zinc levels decreased with age and it was observed in both groups, which indicates a reverse relationship between age and serum zinc level. Given the fact that with aging there is an increase in the incidence of UTIs, it can be hypothesized that, in addition to various causes for the increased incidence of UTIs in old age, zinc deficiency can also be regarded as one of the reasons.

Hancock *et al.* [14] indicated that the antimicrobial and anti-biofilm effects of zinc on urinary tract pathogens, *E. coli*, and *Klebsiella* was investigated; it was observed that the divalent zinc was able to inhibit the mechanisms of biofilm formation by the studied organisms in order to apply its antimicrobial mechanism. Therefore, it might be concluded that UTI infections may be due to the formation of biofilm in the urinary tract or stones in the urinary system.

Christy VR *et al.* [15] studied the epidemiology of urinary tract infection in south India and reported that patients with complaint of suspected UTI are more in females (1029) than males (795). But culture test revealed a different statistics. The percentage of culture positive males

is 37.23% and female patients are 37.99% which indicates that the prevalence of UTI in males and females are more or less equal.

Zinc is an important micronutrient, which plays a crucial role in cellular growth and differentiation through the synthesis of proteins and nucleic acids. It is a key cofactor for around 200 enzymes [16]. Zinc deficiency can bring impaired immunity, as it is important for the development and function of T lymphocytes. Furthermore, this micronutrient has a role in the production of cytokines, including interleukin-2, interferon- γ , and tumour necrosis factor- α [17-18].

In patients with UTIs, oxidative stress is increased and antioxidant levels is decreased [19]. Markers of oxidative stress such as malondialdehyde in UTIs is increased; whereas, serum cations such as Cu, Ca, and Zn are decreased [20]. The above-mentioned conclusions are consistent with the results of our study. The administration of antibiotics together with an appropriate level of serum zinc could result in a synergistic ability to eradicate organisms in the urinary system.

This study had some limitations. We have taken limited number of participants in the two groups and no diet history was taken, also could not follow patients with low level of serum zinc.

Conclusion

According to this study, UTIs are associated with low serum zinc levels. Due to very small number of studies in this field it is not possible to express a definite opinion about the effect of zinc deficiency on increasing the risk of UTI in adult males. Therefore it is recommended to conduct a clinical trial on the effect of zinc supplementation on the patients suffering from UTI to determine the effect either in prevention or the treatment of the disease.

List of abbreviations

UTI-Urinary Tract Infection.

OPD-Out Patients Department.

Author's contribution

Payasvi Sachdeva, Soniya Saxena & Sheloj Joshi drafted the manuscript. Payasvi Sachdeva & Sheloj Joshi edited and finalized the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The author's declare no conflict of interest, Financial or otherwise.

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