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Original Article

The Role of Zinc deficiency in predisposition to Febrile Convulsions in Duhok\ Kurdistan-Iraq

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ABSTRACT

Febrile convulsions which is a common cause of seizure in young children, generally has an excellent prognosis. It is very well known that Zinc does have neurological functions being a necessary component of many metaloenzymes which play a significant role in central nervous system. The aim of this case-control study is to find out if there is a significant relation between serum Zinc level and febrile convulsions in Kurdish children. In the period from June 2012 and June 2013 and in Heevi Pediatric Teaching Hospital in Duhok, North of Iraq, sixty children with febrile seizure and 70 patients with fever without convulsions who aged between 6 months and 6 years underwent serum Zinc estimation. Data were analysed using SPSS 19 to compare serum zinc level between the both groups. One way ANOVA test was used to measure the association of serum Zinc with age, sex and the source of the febrile illness. The mean serum Zinc level of the children with febrile seizures was 54.03 mcg/dl which was significantly lower than the serum zinc level of the control group ($p<0.001$). There was no significant relation between the serum zinc level and each of the age, sex and source of febrile illness. Serum zinc level is significantly lower in Kurdish children with febrile convulsions.

Keywords: Zinc, seizures, febrile

INTRODUCTION

Febrile seizure, a common cause of seizure in young children, generally has an excellent prognosis and is associated with fever. It is age-dependent and is rare before 9 months and 5 years. The peak age of onset is about 14-18 months and the incidence is 3-4% of young children [1] Febrile convulsions happen following both viral and bacterial infections [2,3]. Siblings and parents of patients with febrile convulsions have 4-10% of epilepsy [1]. Low seizure threshold which is genetically determined and fever in association with infections are the most common causes of febrile convulsions. In addition to genetic predisposition and infections, other parameters are also considered in the regards. Febrile convulsions are generally thought to be induced by metabolic changes during the rise-phase of body temperature. Iron insufficiency may play role in the pathogenesis as well. In a prospective study of 150 children, mean ferritin levels are significantly lower in children with febrile convulsions than matched controls with febrile illness but no convulsions [5]. It is hypothesized that hypozincemia indices seizures. Zinc is a necessary component of many metaloenzymes like DNA and RNA polymerases that are important in brain function and development. Low serum zinc levels decreases the concentration of Gama AminoButyric Acid (GABA) and blocks receptors of N-Mthyl-D-Aspartate that induce electrical discharges in brain.

Zinc deficiency is considered as a nutritional problems worldwide today mainly in developing countries. However, there is no reported prevalence of zinc level in Kurdish children. To study the assumed role of Zinc deficiency in febrile seizures, we investigated this relationship in febrile children in Duhok.

MATERIALS AND METHODS

This study was conducted in Heevi Teaching Pediatric Hospital in Duhok, North of Iraq in the period between June 2012 and June 2013. Ethics committee of our university approved the study protocol before the initiation of the study enrolment.

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It is a case-control study where 60 children with their first febrile seizure (case group) were compared with 70 febrile children (control group) based on serum Zinc level. Both groups were matched for age, sex and weight. The inclusion criteria were 1- fever (core temperature > 38 degrees centigrade) 2- age between 6 months and 6 years 3- standard criteria for febrile seizures in case group which occurs for the first time. The patients in both groups were also classified according to the source of febrile illness as respiratory, gastrointestinal or non-specific. From each patient in both groups, 2 ml of peripheral blood was collected, labelled and centrifuged at 2500 rmp under aseptic conditions. Serum samples were then removed and transferred to the biochemistry lab where Zinc level was measured by flame atomic absorption spectrophotometry. The normal serum zinc level using the above technique was 70 mcg/dl. Data were entered and analysed using SPSS 19 for Windows/MAC (PASW1 Statistics GradPack 19). Comparison between cases and controls was made based on age, sex and source of febrile illness using Chi-squared test. Two independent t-test was used to compare the mean serum Zinc level for case and control. One way ANOVA test was used to measure the association of serum zinc with age and source of febrile illness of study participants. All tests were two-sided with 0.05 level of significance.

RESULTS

The mean age of cases was 1.77 years, SD=1.25 years, minimum=6 months, maximum=6 years while the mean age of controls was 2.55 years, SD=1.9 years, minimum= 8months, maximum= 6.5 years. Thirty three cases were male (55%) while 27 were female (45%). In the control group, 42(56%) were male while 33(44%) were female. There is no significant difference between both groups (p>0.05). As shown in Table-1-, there is no significant difference between cases and controls in term of age and the source of febrile illness.

The mean serum Zinc level in cases was 54.03 mcg/dl, SD=19.32 and the mean serum Zinc level in control group was 68.42 mcg/dl, SD=20.93. The P value <0.001 showing significant difference between both groups. This is shown in Figure-1-

Variable	Febrile convulsion	Controls	p-value
Source of febrile illness			
GIT	12 (20)	21 (28.8)	0.39
Respiratory	32 (53.3)	38 (52.1)	
Non-specific	16 (26.7)	14 (19.1)	
Age (years)			
Below 1	14 (24.1)	11 (14.7)	0.10
1-5	34 (58.7)	40 (53.3)	
5 and above	10 (17.2)	24 (32)	

Table-1- Comparison between cases and controls based on age and source of febrile illness

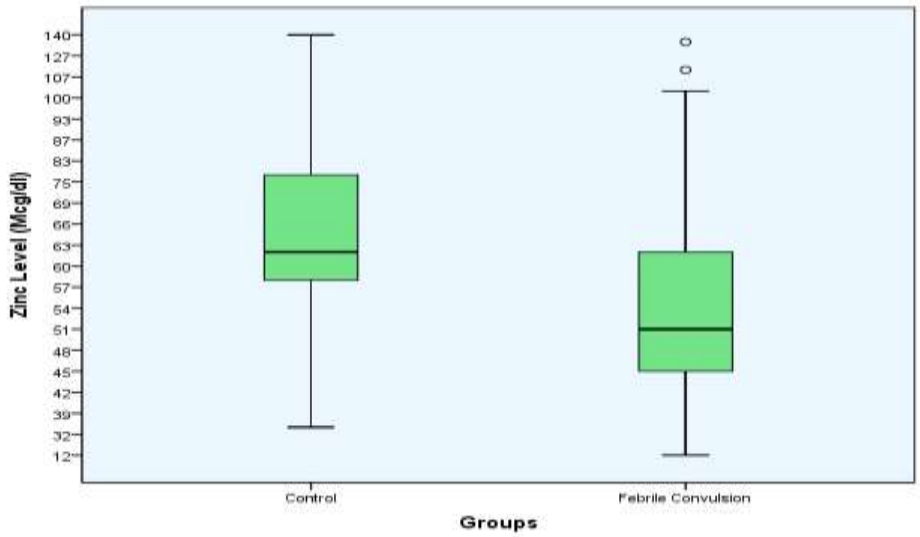

Figure-1- The serum Zinc level in both case and controls

The data analysis showed also no statistical difference in serum Zinc level based on the sex, age and the source of febrile illness as shown in the figures 2, 3 and 4 below.

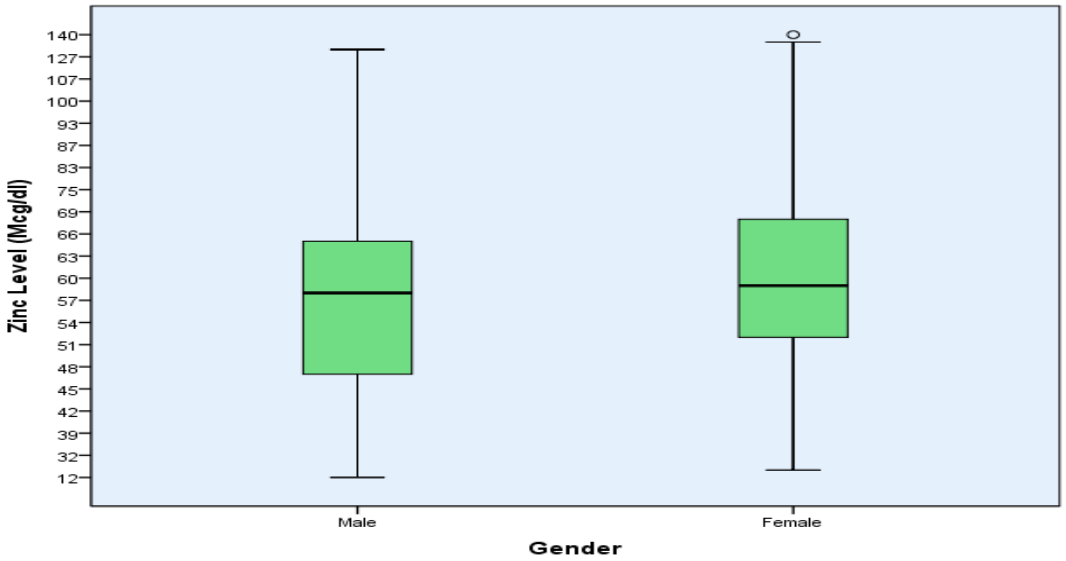

Figure2. Serum zinc levels (mcq/dl) of both male (mean=59.91, SD=18.62) and female(mean=64.81, SD=24.32) groups (p-value-0.18)

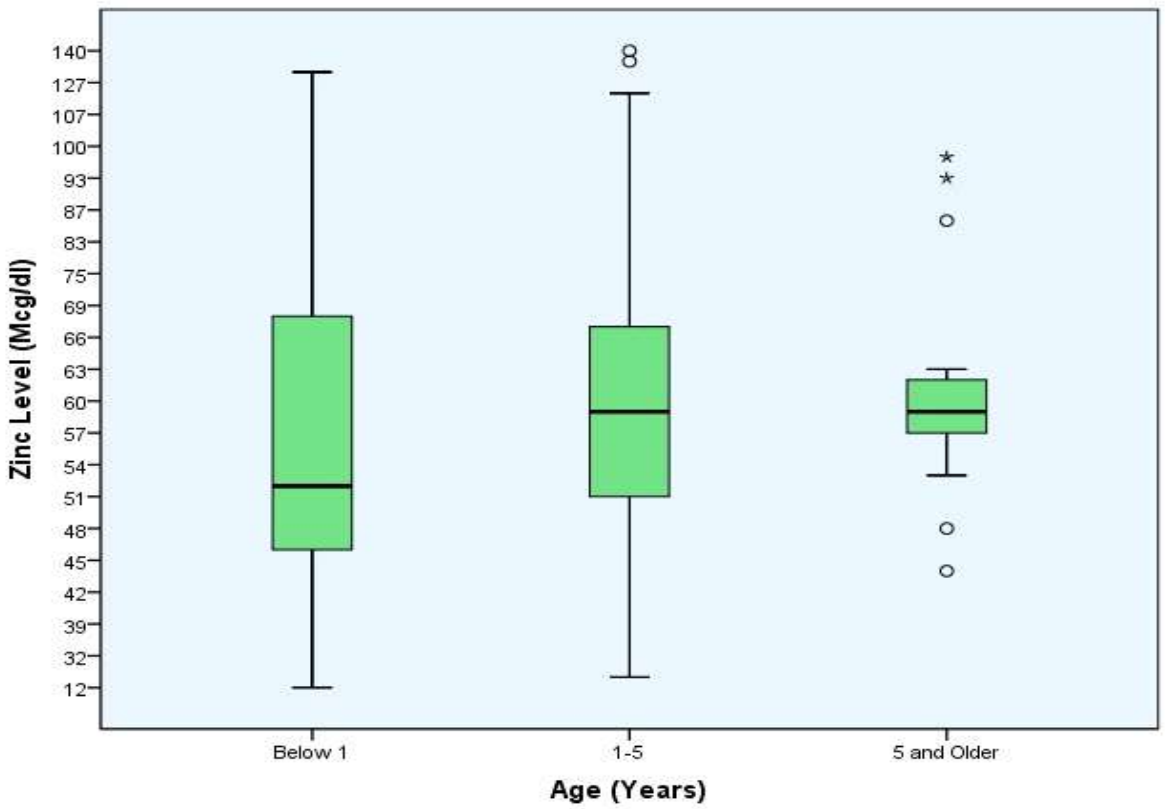

Figure3. Serum zinc levels (mcq/dl) for the age groups: below 1 year (mean=62.36, SD=20.56), 1-5 years (mean=62.83, SD=14.19), and 5 years and older female(mean=62.34, SD=21.44) (p-value-0.99)

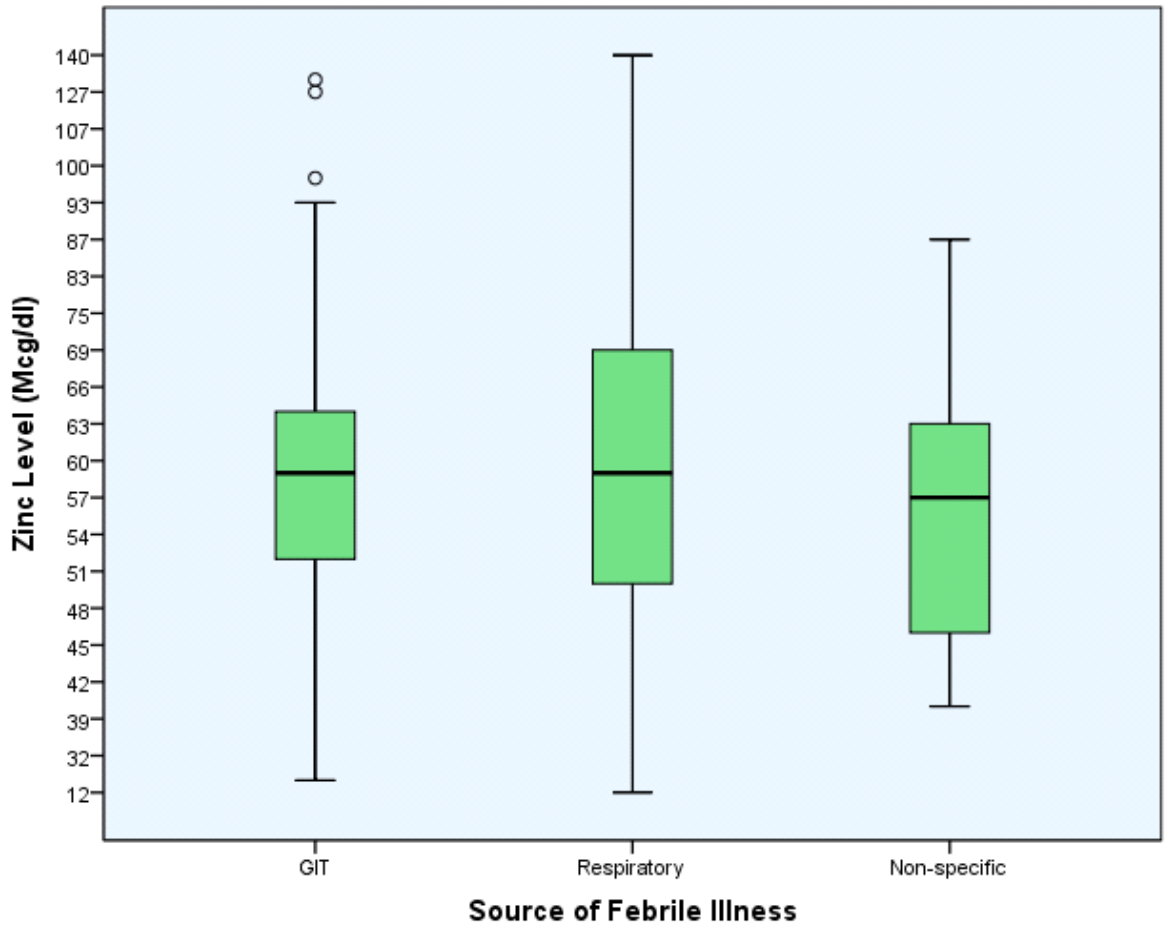

Figure4. Serum zinc levels (mcq/dl) based on the source of febrile illness: GIT (mean=62.15, SD=23.53), respiratory (mean=64.46, SD=23.47), and non-specific (mean=57.23, SD=12.20) (p-value-0.31)

DISCUSSION

Febrile convulsion is the most common type of convulsions during childhood. It is particularly common during early childhood when convulsion threshold is low, tendency for convulsion is higher and fever response is more intense. In this study the mean age of occurrence was 1.77 years which is consistent with other studies[7-10]. The etiology of febrile convulsions is still not understood clearly. Various factors such as age, genetic predisposition, level of fever, cytokines, changes in the level of aminoacids and trace elements, central thermoregulation disorders, delay in CNS maturation and infection are mentioned in its etiopathgenesis [11-14]. The current study shows that serum zinc level is significantly lower in febrile convulsion group as compared to the control group. Regarding the concept that Zinc depression leads to febrile seizures, serum/CSF zinc concentration was found to decrease during infectious diseases in Turkish children [15]. Also the hypothesis proposed by Izumit (hypozincemia during fever triggers febrile seizure) is consistent with our results [16]. In Iran a study showed significant correlation between low serum zinc level and febrile convulsion [17]. A Turkish study carried out on 34 children with febrile convulsion and 58 healthy children revealed that serum Zinc level was significantly lower in cases than control group [18]. Hamed and Abdullah showed that trace elements such as Zinc have a crucial role in the pathogenesis of febrile convulsion [19]. The study of Gunduz et al on 102 children with febrile convulsions showed that serum Zinc level in the afflicted group with febrile seizure was significantly lower [20]. Mishra et al conducted a study on 20 children with febrile convulsion and 48 controls showed also that Zinc level was significantly lower in febrile convulsion group [21]. In Bangladesh, Korea, Indonesia and Nigeria different studies done on children with febrile seizures showed that low serum zinc level predisposes to febrile convulsion [22-27]. Nevertheles; two studies showed no significant difference in serum Zinc level between children

with and without febrile convulsion and this was explained by that acute infection and stress lower the zinc level and zinc is found elevated in recovery tissues [28.29]. In the current study, serum Zinc level doesn't vary by sex and this is consistent with other studies in Bangladesh and Iran [30,31].

CONCLUSION

Serum zinc level is significantly lower in Kurdish children with febrile convulsions as compared with those without febrile convulsions. There is no significant effect of age, sex or the source of febrile illness on serum Zinc level in these children.

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