



EVALUATION OF SERUM ZINC STATUS IN CHILDREN WITH BRONCHIAL ASTHMA IN NORTH WEST RAJASTHAN

Biochemistry

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ABSTRACT

BACKGROUND: Bronchial asthma (BA) is a chronic inflammatory disease of the respiratory tract. The rise in asthma and allergic disease among children is a matter of worldwide concern. Asthma is a multifactorial disease and its severity varies with the inflammatory grade. Many authors have argued that the changes in diet may have been an important determinant of increased susceptibility to asthma. Free radicals have been proposed to be responsible for the pathogenesis of many diseases because of their harmful effects on the cells and tissues. The enzymes responsible for antioxidant defense have trace elements like zinc.

OBJECTIVE: To evaluate the relation between bronchial asthma and serum zinc level.

PATIENTS AND METHODS: In this case control study, 50 asthma patients and 50 healthy children were enrolled into the study. Serum zinc level in each sample was measured using Atomic Absorption Spectrophotometer (AAS SHIMADZU, modal AA-7000) under standard set protocol. Results were analyzed and appropriate statistical tests of significance were applied. **RESULTS:** This study shows that there were significant difference in the values of serum zinc between asthmatic and control group ($P < 0.0001$). Mean serum zinc level was found significantly low among patients group ($61.05 \pm 5.74 \mu\text{g/dl}$) as compared to the control group ($97.67 \pm 13.64 \mu\text{g/dl}$).

CONCLUSION: Children with bronchial asthma have a major risk of zinc deficiency.

KEYWORDS

Bronchial Asthma (BA), Atomic Absorption Spectrophotometer (AAS), Trace element, Serum Zinc.

INTRODUCTION:

Asthma is the most prevalent chronic respiratory disease among children causing considerable morbidity and mortality. Asthma results from complex interactions among inflammatory cells, their mediators, airway epithelium and smooth muscle, and the nervous system in genetically susceptible individuals.⁽¹⁾

A number of researches have reported that bronchial asthma tends to have higher levels of oxidative stress.⁽²⁾ Studies in recent years indicate the relationship between the serum levels of micro nutrients and antioxidant mechanism in asthma.⁽³⁾

It has been proposed that adequate dietary intake and Zn supplementation may decrease the severity of asthmatic attacks.⁽⁴⁾ Inflammatory diseases can cause an increase in the demand for Zn because of two important reasons, firstly, Zn is essential for producing the thymic hormone thymulin necessary for regulating T-cell development and activation, and secondly, Zn is crucial for the activation of natural killer cells, phagocytic cells and for granulocytes, such as mast cells and eosinophils. As a result, greater demand for Zn by the immune system could be a contributing factor to the Zn deficiency noted in inflammatory diseases. Zinc deficiency itself is detrimental for inflammation as it results in dramatic increases in the number, size and activation state of mast cells.⁽⁵⁾

Our particular interest was to test the hypothesis that a low trace element level is a risk factor for asthmatic symptoms in childhood. In present study, we aimed to assess and compare serum levels of zinc (Zn) in bronchial asthmatic cases and healthy control subjects to define the relation between serum levels of zinc with bronchial asthma in children.

SUBJECTS AND METHODS:

A case-control observational analytic study was carried out in the Department of Biochemistry in collaboration with the Out Patient Department of Pediatrics at S.P. Medical College and attached group of hospitals, Bikaner during a period of three years from the beginning of August 2016 to the end of July 2018.

A total of 100 subjects were divided into two groups. Group I / bronchial asthmatic patients consisted of 50 randomly selected, newly

diagnosed subjects of both the sexes aged between 3 to 15 years with clinically confirmed diagnosis of bronchial asthma (as per Global Initiative for Asthma - GINA guidelines) but not being on any treatment for bronchial asthma. Group II / control group consisted of age and sex matched 50 healthy subjects having similar socio-economic status.

All subjects were interviewed before being clinically examined in the out-patient department based on a questionnaire. The questionnaire contained data on demographic factors, types of habits, detailed clinical history and general physical examination.

Venous blood samples (5ml) were collected from each of the study and control group subjects under aseptic precautions and transferred to pre-labeled, clean, metal free, plain test tubes (having no anticoagulants). These samples were left at room temperature for 20 minutes (allowing to be clotted), centrifuged at 2500 rpm for 15 minutes and stored at -20°C after proper labeling and secure packing for serum zinc level estimation in different batches. Serum level of zinc in each sample was measured using Atomic Absorption Spectroscopy (AAS SHIMADZU, modal AA-7000) under standard set protocol.

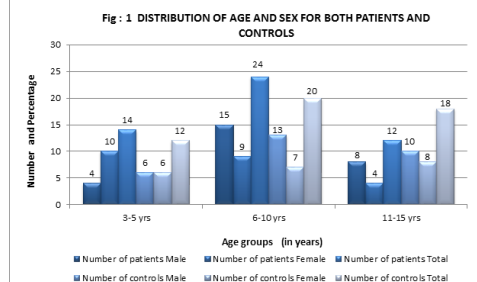
Results were recorded and analyzed using Microsoft Excel 2007 and Biostatistics OPSTAT Software. Quantitative variables were summarized as mean $\pm$ standard deviation. Student's T - test was applied to assess statistical significance.

RESULTS:

As shown in Table 1, present study showed that mean age of bronchial asthma patients ($n=50$) was 8.14 ± 3.65 years and median age was 8 years, age range being 3 to 15 years. 28% of the asthmatic patients (14/50) were between 3-5 years and 48% (24/50) between 6-10 years old, while 24% (12/50) were between 11-15 years age. Out of total (50) patients, 54% (27/50) were males and 46% (23/50) were females (i.e. male/female ratio 1.17/1). There were 71.4% (10/14) female patients among 3-5 years age group while 6-10 and 11-15 years age groups had 37.5% (9/24) and 33.3% (4/12) females respectively, as shown in Figure 2. A corresponding number of the same age groups and sex were selected as a control group ($n=50$)

Table 1: Distribution of age and sex for both patients and controls

Age Group (Years)	Number of patients			Age distribution among total patients (50)	Number of controls			Age distribution among total controls (50)
	Male	Female	Total		Male	Female	Total	
3-5	4 (28.6%)	10 (71.4%)	14 (100%)	14 (28%)	6 (50%)	6 (50%)	12 (100%)	12 (24%)
6-10	15 (62.5%)	9 (37.5%)	24 (100%)	24 (48%)	13 (65%)	7 (35%)	20 (100%)	20 (40%)
11-15	8 (66.7%)	4 (33.3%)	12 (100%)	12 (24%)	10 (55.5%)	8 (44.4%)	18 (100%)	18 (36%)
Total	27 (54%)	23 (46%)	50 (100%)	50 (100%)	29 (58%)	21 (42%)	50 (100%)	50 (100%)

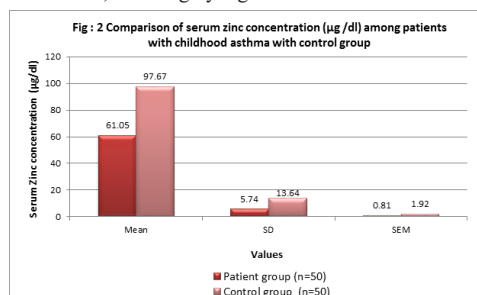


Mean serum zinc values of asthmatics and controls are given in Table 2 along with their standard deviations. On applying student's t-test, highly significant difference in the serum levels of zinc was observed between asthmatic and control group with $P < 0.0001$. Mean serum zinc level was found significantly low among patients group ($61.05 \pm 5.74 \mu\text{g/dl}$) as compared to the control group ($97.67 \pm 13.64 \mu\text{g/dl}$), as shown in Figure 2.

Table: 2 Comparison of serum zinc concentration ($\mu\text{g/dl}$) among patients with childhood asthma with control group

S. No.	Values	Patient group (n=50)	Control group (n=50)
1	Mean	61.05	97.67
2	SD	5.74	13.64
3	SEM	0.81	1.92
4	t	17.31	
5	df	98	
6	p-value*	<0.0001 (HS)	

*Student's T-test; HS = Highly Significant



DISCUSSION:

Many authors have argued that the changes in diet may have been an important determinant of increased susceptibility to asthma.⁽⁶⁾ Free radicals have been proposed to be responsible for the pathogenesis of many diseases because of their harmful effects on the cells and tissues. There are some defense mechanisms to avoid the harmful effects of free radicals. The enzymes responsible for antioxidant defense have trace elements like zinc. Decreased levels of such elements lead to a reduction in antioxidant activity.⁽⁷⁾

The present study had shown that male children were more prone to asthma, 27 (54%) of our patients were males, this result was compatible with other studies like that done by Kakaras & Al-Rabaty⁽⁶⁾ in 2012 (where males were 54%), Mahmood⁽⁸⁾ in 2009 (where the male patients were 70%), Hazim⁽⁹⁾ in 2005 (where 71% of patients were male), Kalyoncu et al⁽¹⁰⁾ in 1999 (73% males) and Hasan⁽¹¹⁾ in 1998 (62% males).

Present study revealed that mean serum concentration of zinc among asthmatic patients was significantly lower than that among the control group individuals. This difference was found to be statistically highly significant ($P < 0.0001$). Similarly other studies have reported that the serum level of zinc in bronchial asthma patients tended to be lower, like Kakarash & Al-Rabaty⁽⁶⁾ in Iraq, Vural et al⁽¹²⁾ in Turkey, Kholy et al⁽¹³⁾

in Egypt. However, the relationship between serum zinc and bronchial asthma still remains controversial as some had reported to have no significant differences like Toro et al⁽¹⁴⁾ in Italy, or even opposite like Satoshi Urushidate et al in Japan.⁽¹⁵⁾

CONCLUSION:

Bronchial asthma in children has a statistical significant association with zinc deficiency.

Zinc supplementation might be suggested in asthmatic patients with hypozincemia, while such a defect could aggregate to the severity of disease. Multicentric studies with larger sample sizes are much required to establish this correlation. Other trace elements must also be studied to find out such associations.

ACKNOWLEDGEMENTS:

Authors are extremely grateful to Principal & Controller, S.P. Medical College, Associated Group of Hospitals, Bikaner and all indoor and outdoor patients making it possible for me to conduct this work in this institution.

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