A Survey on Zinc Status among Chronic Allergic Asthma and in Atopic Phenotype

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Background: Incidence of allergic asthma has increased in the worldwide. Zinc has significant effects on the pathogenesis of bronchial asthma. However, Zinc deficiency caused the enhanced allergy state. Investigations on the recent issue have been less often considered, and only a few studies were found in the literature review. Zinc status particularly has not been known in adult's allergic asthma. The aim of the study was to assess the sera level of zinc in chronic allergic asthma patient with atopic phenotype.

Methods: A total 48 chronic allergic asthma phenotype enrolled among asthmatic population based on the protocol. Skin prick test was applied with six standard extract allergens. Total Immunoglobulin E antibodies and zinc level were measured in sera with the recommendation manufacturer.

Results: The mean age was 32.75±9.86 SD years. Gender distribution was 52% females and 48% males. Mean of total IgE and zinc levels in sera was higher in males than females. 27% of participants had hypozincemia. Hypozincemia subset had a higher mean of total IgE level than a normal zinc level subset. Atopic phenotype was detected in 21% target population. Atopic asthmatic phenotype disclosed hypozincemia status with frequency 23%. Marked differences were observed between zinc and total IgE levels (p=0.04).

Conclusion: The outcome disclosed there was a hypozincemia in the target population and atopic phenotype subset. Hypozincemic allergic asthmatic patients had a higher mean of total IgE level than normal Zinc level subjects. Allergic marker and hypozincemia were marked in the male and female focus population, respectively.

►*Implication for health policy/practice/research/medical education:* Zinc Status among Chronic Allergic Asthma and in Atopic Phenotype

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1. Introduction:

Zinc is a trace element and lack of the body stores. Homeostasis is depended to dietary intake (1). Function of the zinc has been evaluated in the pathogenesis of bronchial asthma in a recent decade. It has the multi-potential role, including; anti-inflammatory effect, antioxidant agent (2), smooth muscle relaxant, cytoprotective effect on the airway (3) and cell mediate immunity responses. However, patients with zinc deficiency can be susceptible to lower respiratory tract infections, opportunist infections and also death (4).

Bronchial asthma is an immunologic disease characterized by chronic airway inflammation, hyper-reactivity of the airways and induced by multifactor stimulations. Corticosteroid compounds are the main arm treatment of asthma. The current knowledge showed that corticosteroid influenced the zinc status (5, 6).

Prevalence of zinc deficiency was 2.4-3% in Iranian adults' population (7). Zinc deficiency reported in 10% of the chronic asthmatic patient in Tehran, capital of Iran (8).

Prevalence of allergic respiratory disease has been raised markedly in around the world over recent decades. In addition, Prevalence of allergic asthma contributes over two third of asthma disease (9). A link between zinc and allergy was observed in recent reports (10-12). A few limited studies are performed on the Zinc status in allergic subjects, and particularly does not evaluate on the adult allergic asthma (2, 3, 13)

The aim of the study was to assess the serum zinc level in chronic allergic asthma and in atopic phenotype.

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2. Materials and Methods:

The study was cross-sectional. It conducted in Shahid Beheshti University of medical sciences (SBUMS), Logman Hakim general teaching hospital, Tehran, Iran.

The study designed in three steps, diagnosed asthma, detection allergic state and atopic phenotype and applying zinc status in their sera.

Sample population sequentially selected from patients who were coming to the chest clinic. A self–administrated questionnaire was completed with following highlights. They included demographic information, asked about asthma symptoms; presence of wheezing at least in last 12 months, cough, dyspnea, medications, background of atopic diseases such as; rhinoconjectivitis, eczema, urticaria. Patients were diagnosed asthma according to American Thoracic Society instruction (14).

Allergic state diagnosed based on allergic marker of IgE in serum. Atopic phenotype was established during the history of allergic symptoms, and at least one positive skin prick test with the panel of aeroallergen (15, 16).

Skin prick test (SPT) was performed with six aeroallergen extracts; Alternaria alternate, Mixed mites, Cockroach Blatella germanica, Grasses, Tree (Blossoming), and feather.

Applying SPT was introduced with guidance of European Academy Of Allergology and Clinical Immunology. Current extracts were placed on the volar surface of the forearm. Through it was incised in vertically with a sharp lancet. We had two controls: histamine as positive and normal saline as negative. After 20 minutes, the test interpreted approving if the mean diameter of reaction allergens were at least 3 millimeters or greater than a diameter of control.

The blood samples were obtained after overnight fast. Cut off point of zinc deficiency was less than 70 mg/dl. Zinc was measured with the colorimetric

method (Greiner diagnostic GmbH-Germany).

Allergic state is defined total IgE level up to 182 Iu/ml (17). It was over 200 Iu/ml in our study and were calculated based on instruction Manufacture's protocol (Padtan Elm, Iran Co Ltd, Enzyme Linked Immunosorbent Assay (ELIZA).

Inclusion criteria encompassed all the following characteristics; Adult, Asthma and allergic state. Subjects with one of the conditions excluded from the study including; using antihistaminic medications at least three days prior SPT, present allergic skin test, lack of consensus for continuous study, smoking habit and known history of parasitic infestation.

Data were collected in SPSS analyzing program, version 18. Frequency presented with percent. Independent samples T test was using comparative means. P value <0.05 was set through entire study.

3. Results:

A total 48 chronic allergic asthma phenotype met the criteria of the study. The mean of participant's age was 32.75±9.86 SD years. It ranged between 15-48 years, Median=30 and Media=48 years. Gender distribution was 52% females and 48% males. Mean of total IgE and zinc levels in sera were higher in males than females. Figure 1 shows sex distribution of total IgE and zinc sera status among allergic asthmatic population.

Global analyzed data of sample study were observed in table 1. No marked correlation was observed between total IgE and zinc levels.

Atopic phenotype (AP) was detected in 21% target population of allergic asthma and equally distributed in both sex. Figure 2 shows total IgE concentrations in atopic and non–atopic subsets. AP subset disclosed hypozincemia status with frequency of 23%. Figure 3 presents status of zinc level in serum of atopic and non-atopic subsets. AP subset established marked raised means of serum zinc and total IgE levels. Figure 4 displays sera totals IgE concentration and zinc levels within atopic and non-atopic subsets.

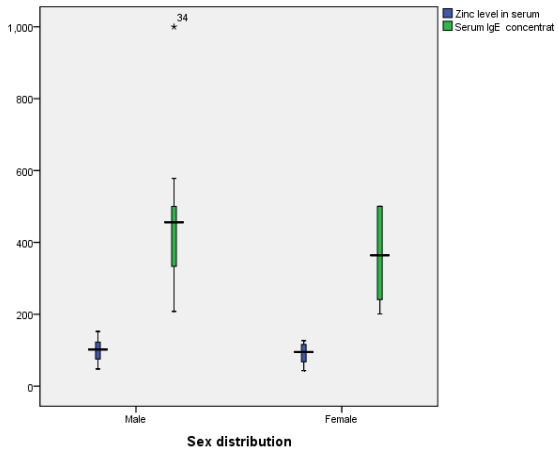

Fig. 1. It shows sex distribution in respect to total immunoglobulin E concentration and serum zinc level.

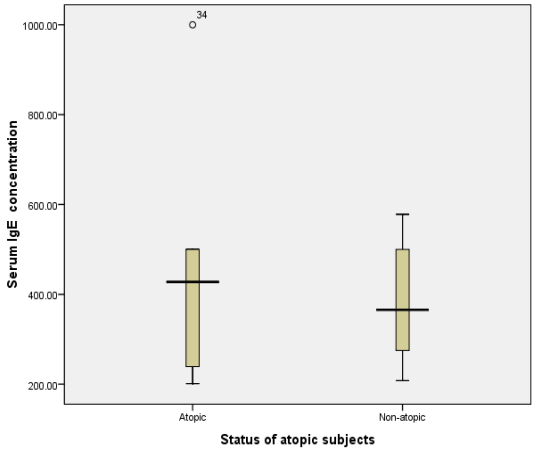

Fig. 2. It reveals status of total IgE concentration in atopic and non-atopic subsets.

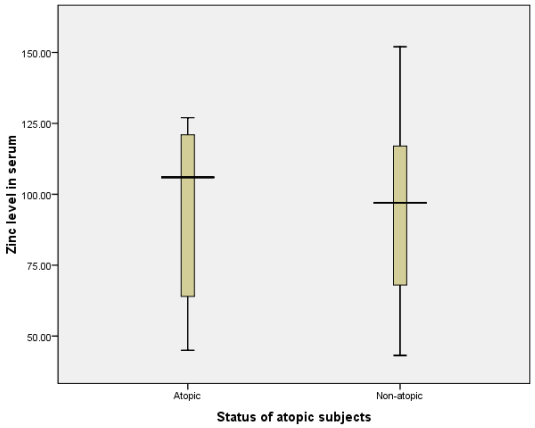

Fig. 3. It reveals status of zinc level in atopic and non- atopic subsets.

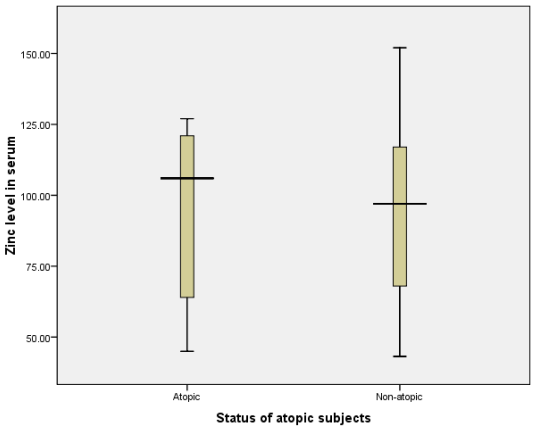

Fig. 4. It reveals status of zinc level in atopic and non- atopic subsets.

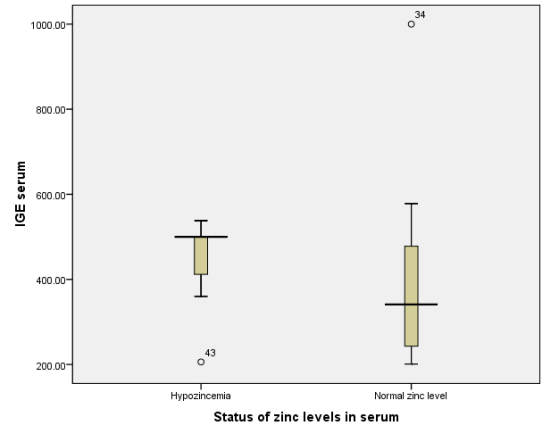

Fig. 5. It presents distribution of total IgE concentration in zinc status subsets.

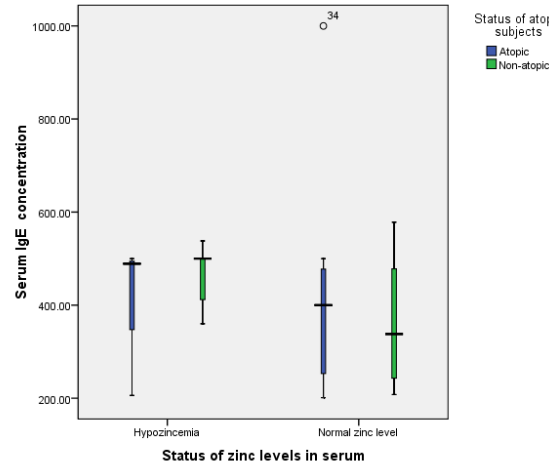

Fig. 6. It demonstrates totals IgE concentration, allergic asthma and atopic distribution subset within zinc status levels.

Mean of PBE was 3.7±1.7 SD percent in the atopic subset.

Hypozincemia observed in 27% subjects of the study, and frequency distribution was 54% in females. Figure 5 reveals distribution of total IgE concentration in zinc status subsets. Hypozincemia subset had a higher mean of total IgE level than a normal zinc level subset. Figure 6 disclosed zinc status distribution respect to Total IgE concentration in allergic asthma and atopic subset. Marked differences were observed between zinc and total IgE levels (p=0.04). Mean of PBE was 3.77±1.48 SD percent in the hypozincemia subset.

There were no relevant differences between hypozincemia and AP subset (p=0.55). No statistically significant differences detected between total IgE level with AP subset (p=0.4).

4. Discussion:

Frequency of hypozincemia was meaningfully among allergic asthmatic selected population. It may be interpreted with following evidence. One of the first reports of zinc status in human was recorded from Middle East, Shiraz, Iran in 1961 (18). Known causal factors are effective on the zinc homeostasis, including; diet and medications. Adequate intake is essential in maintenance of human zinc. Primary dietary sources of zinc consist of animal products such as; meat, dairy food, seafood, plan products; cereal and a nut. Diet has been low in animal protein and rich in phytate associated with the high-up incidence of zinc deficiency in many developing countries and Iran (19). Zinc deficiency in Iran is 42.5% and its incidence is highest so that is a problem in our country (20).

Asthma is chronic inflammatory airway disease with bronchial hyper-responsiveness. Pathogenesis of asthma are multi-factorials. Trace element of zinc plays a role in the asthma disease. It has the cytoprotective effect on the airway, anti-apoptotic, anti- inflammation, antioxidant, cell membrane stabilizer, and cellular growth, effective in prevalence of asthma (21). Decreased dietary intake of

Table 1: It reveals global analyzed data of target population.

Global data of sample study	Mean± SD	Range	Median
Immunoglobulin E antibody Iu/ml	392.25±145.36	201-1000	376.5
Peripheral eosinophilia Percent	3.81±2.42	1-16 %	3%
Serum zinc level mg/dl	93.98±2.82	43-152	98.5

anti-oxidants may be an influence on the raised incidence of asthma (22). However chronic inflammation may be associated with zinc deficiency (23, 24). Moreover, zinc deficiency can be enhanced airway inflammation, pro-survival actions and effective in the outcome of asthma pathogenesis (25).

In the early reports, glucocorticoid as a medication can influence upon the zinc status within the body. Corticosteroids are a novel in the treatment of asthma, leads to decreased zinc level in the asthmatic patients when used in large doses. Zinc concentration returned normal level following cessation therapy (26). In addition, comparative study showed that zinc level in non-steroid treated asthmatic's subjects was significantly more than those on the long term corticosteroid therapy (27, 28). The hypothesis may be suggested that pituitary adrenal axis system maintained circulating zinc and mobilizing body zinc. Another study revealed that corticosteroid therapy post bilateral adrenalectomy led to zinc deficiency (29). Therefore, steroid therapy may be having a direct effect on zinc level in asthmatic patients.

The end point resulting of the study revealed that hypozincemia patients had higher allergic marker of total IgE level than the normal zinc level's subset. A number of studies indicated in western countries that consumption of diets rich in processed foods, deficient in anti-oxidants and mineral cofactors raised incidence of allergic diseases and asthma (30).

Hypozincemia was detected in our study within the atopic phenotype subset of allergic asthmatic patients. It also has linked with raised risk of atopy and allergy (31) through a shift toward T-helper 2 phenotype (32). Allergic disease and asthma are induced by exaggerated T-helper 2 responses in genetically susceptible individuals. However, zinc deficiency may enable a shift prematurely immune function from predominantly activities of cellular T-helper 1 to more T-helper 2 responses. In addition it is possibly inducing allergies (31, 32).

Hypozincemia was higher in the females. It is agreement with a recent report from Iran (20).

5. Conclusion:

The outcome disclosed there was hypozincemia in the target population and atopic phenotype subset. Means of allergic marker were higher within hypozincemia and atopic phenotype subsets. However, distinct differences were observed between zinc and total IgE levels. Allergic marker and hypozincemia were noticeable in the male and female sex focus population, respectively.

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