

VITAMIN C STATUS IN ALLERGIC CHILDREN

Reza Tirang Neyestani, M.Sc., Mahmoud Djalali, D.Sc., Ali Keshavarz, Ph.D.^{*},
Abolhasan Farhoodi, M.D.^{**}, Mohammad Gharagozlou, M.D.^{**} and
Zahra Poor-Pak, Ph.D.^{*}

*From the Department of Biochemistry and Nutrition, Faculty of Medicine, Hamedan
University of Medical Sciences, Hamedan,*

^{*} *Department of Nutrition and Biochemistry, Faculty of Public Health and Institute of
Public Health Research, Tehran University of Medical Sciences, Tehran,*

^{**} *Department of Allergy and Clinical Immunology, Children's Medical Center Hospital,
Tehran, I.R.Iran.*

ABSTRACT

This study was undertaken to assess vitamin C status in allergic children. Twenty-six allergic patients and 46 apparently healthy controls aged 7-16 years of both sexes were introduced. All patients were diagnosed being allergic based on their histories, physical examinations and laboratory findings. Blood samples were obtained between 09.00-11.00 to determine total serum immunoglobulin E, histamine, plasma vitamin C and complete blood cell count. Stool examinations and urinealysis were also done. Although total serum immunoglobulin E levels were significantly higher in patients than in controls, the serum histamine and plasma vitamin C levels showed no significant difference between the two groups. Surprisingly, patients with allergic dermatitis and food allergy had significantly lower plasma vitamin C levels than patients with asthma and rhinitis. Also, female patients tended to have higher plasma vitamin C but lower total serum immunoglobulin E levels compared to the male patients but none of these differences were significant. Healthy boys, on the other hand, had significantly higher plasma vitamin C than healthy girls. Our findings did not confirm the previous reports which showed decreased plasma vitamin C levels in allergic patients. We concluded that the plasma vitamin C levels in different allergies might be influenced by such factors, such as sex, type and the stage of allergic disease, besides those affecting intake.

Key words: Nutritional Status, Vitamin C, Allergy

INTRODUCTION

Despite general health improvements in the population, the prevalence of allergy and asthma has risen in recent years(1). During the period of 1980-1987, physician-diagnosed asthma in the United States increased by 43% (from 35 to 50 cases/100 people) in people aged < 20 y. Small but significant increases were also observed in middle-aged and older people (2).

Diet and environmental pollutants are among suspected causes of the increased prevalence of asthma in the population. The realization that oxidants and mutagens are commonly encountered in food and are endogenously produced has led to an increased interest in antioxidants (3).

Ascorbic acid or vitamin C has been the center of various discussions and its use in asthma and allergy has also been studied repeatedly since 1803, when Reisseissen noted "convulsive" asthma in patients with scurvy (4). Vitamin C appears to be the most abundant antioxidant substance in the extracellular fluid lining of the lung (5) and it appears to function both as a water soluble scavenger and as a regenerating agent for vitamin E (6). Asthmatic patients have been reported to have lower plasma vitamin E (6) and vitamin C concentrations than healthy controls (7). This finding, however, has been criticized by some authors (4). Decreased plasma vitamin C levels in allergic patients, compared to healthy controls, may indicate increased utilization and hence increased need for the vitamin in allergic state. The aim of this study was to investigate this possibility.

MATERIALS AND METHODS

1. Study design

This was a cross-sectional, observational controlled study conducted from January 21 to July 6, 1998 at the Department of Allergy and Clinical Immunology, Children's Medical Center Hospital, Tehran, Iran.

2. Study population

Twenty-six patients and 46 apparently healthy children aged 6-17 years of both sexes were introduced into the study. The sample size was estimated using other investigators' findings (7) and the equation proposed for sample size estimation

when $\alpha=0.05$ and $B=0.20$ (8). All patients were diagnosed as allergic (asthma, rhinitis, dermatitis or food allergy) by an expert in allergy taking into account the clinical and laboratory findings. They were all healthy from other point of view. The control group was randomly selected from the children of four primary and intermediary schools in Central Tehran. They were apparently healthy, based on their health records, and had no history of allergy. Both patient and control groups had been taking no medications, including vitamin and mineral supplements, at least from one week before blood sampling.

3. Sample collection

Blood samples were taken between 09.00-11.00 to determine total serum immunoglobulin E (IgE), serum histamine, plasma vitamin C and complete blood cell count (CBC). Blood samples of patients were collected at the same time of the sampling for routine tests so there was no need for repeated venipuncture. Stool and urine samples were also collected and examined to exclude those with parasitic and urinary tract infections.

4. Laboratory analysis

i) Plasma vitamin C. Briefly, the plasma of freshly-drawn blood was separated after centrifugation at 3500 rpm for 10 minutes. The proteins of plasma were precipitated by adding cold (4°C) 5% trichloroacetic acid. After centrifugation at 3500 rpm for 10 minutes, the supernatant was kept at -80°C for vitamin C assay with 2,4 dinitrophenyl hydrazine (2,4 DNPH) in less than 2 weeks (9).

ii) Serum IgE was determined using ELISA technique (IFCI CLONE SYSTEMS S.P.A., Via Magnanelli, 2- CasaLecchio Di Reno, Bologna).

iii) Serum histamine was determined using RIA technique (Immunotech Acoultier Co. 130 Ave. de Latire de Tassigny, 1300 g, Marseille, France).

RESULTS AND DISCUSSION

The results are shown in Tables 1 and 2. Plasma vitamin C levels showed no significant difference between two groups. Although in patient group, plasma vitamin C levels were insignificantly higher

in females than in males, the healthy boys had significantly higher plasma vitamin C levels than healthy girls ($P=0.001$). Our findings, therefore, confirmed the sexual difference in plasma vitamin C levels reported by other investigators (10).

Interestingly, patients with dermatitis or food allergy had significantly lower plasma vitamin C than those with asthma, or intake in the two former groups since they were usually on occasionally self-prescribed, hypoallergenic diets. This was confirmed by our 24h recall data (not shown).

Table 1. Comparison of serum IgE and histamine and plasma vitamin C between allergic and healthy children

Measure	Patients	Controls
IgE (IU/ml)	302 ± 58.3^a	68.5 ± 15.7^b
Histamine (nM)	25.2 ± 5.3^a	21.7 ± 4.1^a
Vitamin C (mg/ml)	11.05 ± 1.5^a	11.22 ± 0.84^a

$N_1=27$ (14 boys and 13 girls)

$N_2=47$ (23 boys and 24 girls)

Measures are $X \pm SEM$.

Measures in row not sharing a common superscript are significantly different ($P<0.001$).

Table 2. Comparison of serum IgE, histamine and plasma vitamin C between allergic children with different pathologies

Measure	Asthma	Rhinitis	Dermatitis	Food Allergy
IgE (IU/ml)	299.3 ± 59.9^a	$428.8^a 214^a$	248.9 ± 147^a	48.3 ± 29.1^a
Histamine (nM)	28.5 ± 3.7^a	33.3 ± 9.7^a	13.5 ± 7.7^a	19 ± 4.8^a
Vitamin C (mg/ml)	13.9 ± 2.2^a	11.9 ± 3.8^a	7.9 ± 1.6^b	7.6 ± 1.6^b

$N_1=14$, $N_2=4$, $N_3=4$, $N_4=4$

Measures are $X \pm SEM$.

Measures in row not sharing a common superscript are significantly different ($P<0.04$).

Expectedly, total serum IgE levels were significantly higher in patients than in controls ($P<0.001$). Patients with asthma or rhinitis had insignificantly higher serum IgE than those with dermatitis or food allergy. This might be due to the nature of allergens which are usually continually encountered in asthma and rhinitis (aeroallergens) while in dermatitis and food allergy they usually originate from diet and therefore are more easily avoided.

Total serum histamine levels also showed no significant difference between patients and controls. The reason could be the rapid inactivation of released histamine by the two major catabolizing enzymes, diamine oxidase and histamine methyl transferase (11).

It should be noted that almost all the patients that had been studied were apparently in good health at the time of admission and blood sampling, i.e. they were in the period between allergic attacks (inter-attack period). It was, therefore, likely that different results would have been gained if sampling had been done during allergic attacks (intra-attack period).

Table 3. Comparison of serum IgE and histamine and plasma vitamin C between healthy controls

Measure	Boys	Girls
IgE (IU/ml)	83.6 ± 30.4^a	54.6 ± 11.0^a
Histamine (nM)	30.6 ± 4.1^a	37.8 ± 3.6^a
Vitamin C (mg/ml)	13.7 ± 1.5^a	8.9 ± 0.64^b

$N_1=23$, $N_2=24$

Measures are $X \pm SEM$.

Measures not sharing a common superscript are significantly different ($P=0.001$)

Our findings did not confirm the previous report of decreased plasma vitamin C levels in allergic patients. We concluded that plasma vitamin C levels in allergies might be influenced by such factors, such as sex, type and stage of allergic disease, besides those affecting intake.

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