

# Prevalence of egg sensitization in Turkish infants based on skin prick test

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## ABSTRACT

**Aim:** Egg allergy is one of the most frequent allergies in infants. The aim of this study was to determine the frequency of sensitization to egg in infants based on skin prick test results and to evaluate associated allergic conditions by questionnaire.

**Methods:** All infants born between June 2001 and May 2002 were recalled to the hospital according to their dates of birth, and 1015 infants aged between 8-18 months were included in the study. An interview was conducted with each mother and a questionnaire requesting data on food allergy and other allergic diseases was completed during this interview. An egg skin prick test (whole egg) was applied to all infants.

**Results:** Positive skin prick test results were recorded in 19 infants (1.87 %). There was no difference between the prick test-positive and -negative groups with respect to any of the demographic characteristics investigated (gender, age, birth weight,

egg consumption, age of introduction of egg and other solids, breastfeeding). No significant association was demonstrated between sensitization to egg and family history of allergy. Moreover, there was no association between sensitization to egg and occurrence of atopic dermatitis, recurrent wheezing, gastrointestinal symptoms and doctor diagnosis of asthma.

**Conclusion:** The prevalence of egg sensitization based on skin prick test results has been found as 1.87 % among Turkish infants in Istanbul. However, no significant relationship was found between allergic sensitization to egg and occurrence of allergic diseases in this study population.

**Key words:** skin prick test, egg allergy, sensitization, infants, allergic diseases.

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## INTRODUCTION

Although egg is an important dietary protein source for infants, egg allergy is suggested to be one of the most common causes of food hypersensitivity in infants. Some physicians thus recommend not giving egg before the age of one year in order to prevent atopy, and this recommendation is supported by a number of authors<sup>1,2</sup>. Introduction of egg in the infant's diet is recommended after 6 months of age according to nutritional guidelines<sup>3,4</sup>. Prevalence of egg allergy in the 2-year-old population in Norway and Fin-

land has been reported to be between 2 and 7 % based on parental perception<sup>5,6</sup>. In a study conducted in Norway, the point prevalence for the 2.5 years of age group was reported as 1.6 %<sup>7</sup>. In an Australian study based on skin prick test (SPT) positivity, the prevalence was found to be 3.2 %<sup>8</sup>. However, as a valuable protein source, egg is still an important food for infants in developing countries. No prevalence study has been published in Turkey thus far. The aim of this study, which is based on the results of the SPT positivity and information ascertained by questionnaire, was to determine the prevalence of sensitization to egg allergens in infants and the occurrence of associated allergic conditions.

## METHODS

Infants born in Okmeydani Teaching Hospital, Istanbul, between June 2001 and May 2002, were recalled to participate in this study according to their dates of birth. This study is a hospital-based cross-sectional study and does not include long-term observation. Of 1415 infants recalled for the study, 1015 (response rate: 71.7 %) returned to the hospital. At the time of the study, the ages ranged from 8-18 months (median: 12 months). There were 525 boys (51.7 %) and 490 girls (48.3 %). A face-to-face interview was conducted by one of the authors with each mother and a questionnaire seeking data on food allergy and other allergic diseases was completed on the same occasion. After the interview, an egg SPT (whole egg) was applied to all infants. SPT was performed in duplicate with a lancet with 1 mm tip (Mizollen) on the volar surface of the forearm. Standardized allergen extracts from whole egg (code no: 0145, STALLARGENES, France) were employed. Histamine dihydrochloride (10 mg/ml) and diluent served as positive and negative controls, respectively. Skin response was measured 15 minutes later, considering a wheal of 3 mm or larger in the absence of significant reactivity of the diluent control as a positive reaction<sup>9</sup>. Oral food challenge test was not performed.

The study was approved by the ethical review committee of Marmara University, Medical Faculty, Istanbul, Turkey.

Statistical analyses were performed by using the SPSS 10.0 software package program. Chi-square and t-test were used for comparison of demographic data between the groups with positive and negative SPT. Comparison of allergy characteristics between the two groups was performed using Fisher's exact test.

## RESULTS

Of the 1015 infants included, 883 were consuming egg in their diets while 132 had never eaten egg. The questionnaire data was collected and SPT was performed in all infants included. Of the 1015 skin prick-tested infants, only 19 (1.87 %) demonstrated sensitization to egg (whole) allergen. There was no statistically significant difference between egg SPT-positive and SPT-negative infants with respect to egg consumption. Moreover, no significant differences were found between egg SPT-positive and SPT-negative infants with respect to the other demographic characteristics investigated: gender, current age, birth weight, age at introduction to egg or any solid food, and breastfeeding (table I). Similarly, no significant difference was detected between egg SPT-positive and SPT-negative participants with respect to the frequency of allergic disease (asthma, allergic rhinitis or conjunctivitis, atopic dermatitis, gastrointestinal symptoms) in their family members (mother and siblings). Furthermore, percentages of occurrence of any allergic disease including recurrent wheezing, atopic dermatitis and doctor-diagnosed asthma were not significantly different between egg SPT-positive and SPT-negative infants. Frequent gastrointestinal symptoms such as vomiting and diarrhoea with no infectious or metabolic cause were determined in 10.8 % in the egg-sensitized and in 10.5 % in non-sensitized infants, also demonstrating no statistically significant difference (table II).

## DISCUSSION

This cross-sectional study demonstrated that, of 1015 skin prick-tested infants, 1.87 % showed sensitization to egg allergen. SPT with egg allergens is suggested as a simple and inexpensive screening method for detection of sensitization to egg<sup>10-12</sup>. This test provides a rapid method for screening patients for sensitization to specific foods<sup>11</sup>. Although the gold standard for diagnosis of egg allergy is oral food challenge<sup>13,14</sup>, in infants less than 2 years of age, a SPT response to egg with wheal diameters of 8 mm or larger reportedly has a sensitivity of > 95 %<sup>11</sup>. Although positive SPT does not necessarily prove that food is causal, a negative response (specificity < 100 %) is extremely useful for excluding IgE-mediated food allergies (negative predictive value > 95 %)<sup>15</sup>.

Two studies published with a 20-year interval reported similar sensitivity and specificity of SPT with egg allergens. Positive predictive values of SPT for

egg allergy were reported to be 0.61 and 0.92 and negative predictive values 0.82 and 0.50 in those two studies (Sampson, Hill), respectively<sup>16,17</sup>.

The prevalence of egg allergy was found as 1.3 % in young children in the United States<sup>11</sup>. In Norway, based on sensitization to egg and oral challenge, the prevalence was reported to be 1.6 % in the 2.5 years of age group<sup>7</sup>. According to our study, the prevalence of sensitization to egg protein was 1.9 %, but the prevalence of egg allergy cannot be predicted from our results due to the lack of oral challenge test. While the absence of oral food challenges to egg may be considered a limitation of our study, the primary aim was not to evaluate prevalence of egg allergy, but rather to compare development of respiratory allergic disorders in those sensitized to egg during infancy.

Studies have shown that egg allergy develops in the first years of human life and nearly resolves by primary school age<sup>18,19</sup>. Therefore, the prevalence of egg allergy may vary between the ages of 2-6 years<sup>18,19</sup>. On the other hand, it is well known that sensitization to egg protein during infancy is associated with an increased risk of development of respiratory allergic disorders<sup>20,21</sup>.

Since the number of SPT positive infants was only 19 in our study, although the frequency of allergic disease in the infants or their families in SPT-negative infants was not statistically different than the SPT-positive infants, the percentages in the SPT positive group were approximately two times higher than the SPT negative group. Similarly, ratios of recurrent wheezing, diagnosis of asthma and atopic dermatitis were twice as high in SPT positive infants as in SPT negative infants but there was no significant difference statistically between the two groups.

Nickel et al. found a significantly higher frequency of allergy history in the families of 20-month-old infants sensitized to egg compared to those non-sensitized<sup>22</sup>. The same study found that at 3 years of age, the risk of occurrence of asthma, atopic dermatitis and allergic rhinitis increased in those allergic to egg<sup>22</sup>.

In the current study, there was no significant difference in those sensitized and non-sensitized to egg based on time of introduction of egg to the infant's diet. Similarly, Zutavern et al. could not demonstrate any association between early introduction of egg and development of eczema and asthma<sup>23</sup>. In contrast, in the Multicentre Allergy Study, Kulig et al. showed that the presence of egg allergy is associated with an increased rate of occurrence of other allergic diseases<sup>20</sup>. Similarly, Tariq et al. reported that the frequency of eczema, respiratory allergic symp-

**Table I**  
**Demographic characteristics of subjects**

	SPT to egg (–) n = 996	SPT to egg (+) n = 19	p
Male gender (n [%])	516 (51.8)	10 (52.6)	0.701*
Age (Months) (mean ± SD)	13.15 ± 2.67	12.48 ± 2.52	0.49**
Birth weight (g) (mean ± SD)	3343 ± 515	3363 ± 546	0.871**
Number of infants with egg in diet (n [%])	864 (86.7)	19 (100)	0.158*
Introduction of egg (months) (mean ± SD)	6.80 ± 2.45	7.01 ± 2.33	0.723**
Introduction of any food (months) (mean ± SD)	4.11 ± 1.91	4.26 ± 1.91	0.767**
Breastfeeding (n [%])	947 (95.1)	19 (100)	0.322*

\*chi-square test, \*\* t-test.

SPT: Skin prick test.

**Table II**  
**Comparison of the characteristics of egg-sensitized versus non-sensitized infants**

	SPT to egg (–) n = 996 (n %)	SPT to egg (+) n = 19 (n %)	p*
Allergic diseases in family	108 (10.6)	4 (21.1)	0.148
Allergic disease in mother	44 (4.3)	2 (10.5)	0.211
Allergic disease in siblings	43 (4.1)	1 (5.3)	0.572
Any allergic disease	102 (10.0)	4 (21.1)	0.128
Asthma diagnosis	86 (8.5)	4 (21.1)	0.080
Recurrent wheezing	92 (9.2)	4 (21.1)	0.097
Atopic dermatitis	14 (1.4)	1 (5.3)	0.248
Frequent GIS symptoms	108 (10.8)	2 (10.5)	0.864

\*Fisher's exact test.

SPT: Skin prick test.

toms and sensitivity to aeroallergens is higher at 4 years of age in those who had egg allergy in their infancy<sup>21</sup>.

In conclusion, results of this study demonstrated that the prevalence of sensitization to egg protein was 1.87 % among infants in Istanbul. No significant relationship was found between allergic sensitization to egg and the occurrence of allergic diseases such as atopic eczema and respiratory allergic disorders in this study population.

## REFERENCES

- Halmerbauer G, Gartner C, Schierl M et al; SPACE Collaborative Study Team. Study on the Prevention of Allergy in Children in Europe (SPACE): allergic sensitization at 1 year of age in a controlled trial of allergen avoidance from birth. *Pediatr Allergy Immunol* 2003; 14:10-17
- van Odijk J, Hulthen L, Ahisted S, Borres MP. Introduction of food during the infant's first year: a study with emphasis on introduction of gluten and of egg, fish and peanut in allergy-risk families. *Acta Paediatr*. 2004;93:464-70.
- Statement of the Joint Working Group: Canadian Paediatric Society. Dieticians of Canada. Health Canada. Nutrition for Healthy Term Infants. 1998. Available from <http://www.hc-sc.gc.ca/hppb/childhood-youth/cyfh/homepage/nutrition/intro.html> Accessed December, 2002.
- Anon. News in brief: WHO recommends exclusive breast feeding for first six months. *BMJ* 2001;322:1266.
- Eggesbe M, Halvorsen R, Tambs K, Botten G. Prevalence of parentally perceived adverse reactions to food in young children. *Pediatr Allergy Immunol* 1999;10:122-32.
- Kajosaari M. Food allergy in Finnish children aged 1 to 6 years. *Acta Paediatr Scand* 1982;71:815-19.
- Eggesbe M, Botten G, Halvorsen R, Magnus P. The prevalence of allergy to egg: a population-based study in young children. *Allergy* 2001;56:403-11.
- Hill DJ, Hosking CS, Hine RG. Clinical spectrum of food allergy in children in Australia and South Asia: identification and target for treatment. *Ann Med* 1999;31:272-81.
- Aas K, Belin L. Standardization of diagnostic work in allergy. *Int Arch Allergy Appl Immunol*. 1973;45:57-60.
- Williams LR, Bock SA. Skin testing and food challenges for evaluation of food allergy. *Immunol Allergy Clin North Am* 1999;19:3479-93.
- Sampson HA. Update on food allergy. *J Allergy Clin Immunol* 2004;113:805-20.
- Verstege A, Mehl A, Rolinck-Werninghaus C, Staden U, Noconw M, Beyer K, et al. The predictive value of the skin prick test weal size for the outcome of oral food challenges. *Clin Exp Allergy* 2005;35:1220-26.
- Bindsley-Jensen C, Ballmer-Weber BK, Bengtson U, et al. Standardization of food challenges in patients with immediate reactions to foods—position paper from the European Academy of Allergology and Clinical Immunology. *Allergy* 2004;59:690-97.
- Bock SA, Sampson HA, Atkins FM, et al. Double-blind, placebo-controlled food challenge (DBPCFC) as an office procedure: a manual. *J Allergy Clin Immunol*. 1988;82(6):986-97.
- Sicherer SH, Sampson HA. 9. Food allergy. *J Allergy Clin Immunol*. 2006;117(2 Suppl Mini-Primer):S470-5.
- Sampson HA, Albergo M, Durham NC. Comparison of results of skin tests, RAST, and double-blind, placebo-controlled food challenges in children with atopic dermatitis. *J Allergy Clin Immunol* 1984;74:26-33.
- Hill DJ, Heine RG, Hosking CS. The diagnostic value of skin prick testing in children with food allergy. *Pediatr Allergy Immunol* 2004;15:435-441.
- Wood RA. The natural history of food allergy. *Pediatrics* 2003; 111:1631-37.
- Heine RG, Laske N, Hill DJ. The diagnosis and management of allergy. *Curr Allergy Asthma Rep* 2006;6:145-52.
- Kulig M, Niggemann B, Burrow G, Wahn U. Prediction of sensitization to inhalant allergens in childhood: evaluating family history, atopic dermatitis and sensitization to food allergens. The MAS Study Group. Multicentre Allergy Study. *Clin Exp Allergy* 1998;28:1397-403.
- Tariq SM, Matthews SM, Hakim EA, Arshad SH. Egg allergy in infancy predicts respiratory allergic disease by 4 years of age. *Pediatr Allergy Immunol*. 2000;11:162-67.
- Nickel R, Kulig M. Sensitization to hen's egg at the age of twelve months is predictive for allergic sensitization to common indoor and outdoor allergens at the age of three years. *J Allergy Clin Immunol*. 1997;99:613-17.
- Zutavern A, von Mutius E, Haris J et al. The introduction of solids in relation to asthma and eczema. *Arch Dis Child*. 2004; 89:303-8.