Paediatrica Indonesiana

VOLUME 55 July • 2015 NUMBER 4

Original Article

Skin prick test reactivity in atopic children and their number of siblings

Beatrix Siregar, Lily Irsa, Supriatmo, Sjabaroeddin Loebis, Rita Evalina

Abstract

Background Some studies have shown that low birth order is a risk factor for developing atopy, although these results remain inconclusive. Those studies put forth the hygiene hypothesis, which states that early childhood infections in siblings may protect against atopy. Hence, an inverse relationship between family numbers and atopy was found. Atopy may be diagnosed from a history of atopy in an individual or his family, and can be confirmed by specific IgE for allergens or positive skin prick tests.

Objective To assess for an association between skin prick test reactivity in atopic children and their number of siblings.

Methods A cross-sectional study was conducted in May to June 2010 in elementary school children at the Kampung Baru District, Medan Regency, North Sumatera. Subjects were divided into two groups. Group I had children with < 3 siblings and group II had children with ≥ 3 siblings. Skin prick tests were done in 7 to 10-year-old children with a history of asthma, allergic rhinitis and atopic dermatitis. Skin prick test reactivity results were analyzed by Chi-square test.

Results A total of 192 subjects were enrolled in this study, with 96 subjects in each group. Positive skin prick tests were significantly higher in subjects with <3 siblings than in those with ≥3 siblings (75% and 53.1%, respectively; P=0.003).

Conclusion Atopic children with <3 siblings had more positive skin prick tests than children with ≥3 siblings. **[Paediatr Indones. 2015;55:189-93]**.

Keywords: *skin prick test, number of siblings, atopy, children*

The average family size in developed countries has decreased over the past century. In New Zealand there was an average of 2.5 children per family, which decreased to 1.95 children per family in 1996.[1] The incidence of asthma in children was 1.4-11.4%, and in the United States it is 8-13%, with a 50% increase from 1964 to 1980.[2] The prevalence of atopic dermatitis in the community is 1-3%.[3]

Low birth order has been hypothesized to be a risk factor for the development of atopic disease, although results remain conflicting. The hygiene hypothesis proposes that early childhood infections from siblings may protect against the acquisition of atopy.[1] Atopy may be diagnosed from the history of atopy of an individual or his family, and confirmed by specific IgE for allergens or positive skin prick tests.[4] Skin prick tests (SPT) can be done in a short time and are appropriate for use in children.[5]

This study was presented at *Kongres Nasional Ilmu Kesehatan Anak (KONIKA) XV*/The 15th Child Health National Congress, Manado, July 11-13, 2011.

From the Department of Child Health, University of North Sumatera Medical School/H. Adam Malik Hospital, Medan, Indonesia

Reprint requests to: Beatrix Siregar, Department of Child Health, University of North Sumatera Medical School/H. Adam Malik Hospital, Jl. Bunga Lau No.17 Medan, 20136. Tel +6261 8361721 – 8365663. Fax +6261 8361721, E-mail: trixa_30@yahoo.com.

The aim of this study was to assess for an association between skin prick test reactivity in atopic children and their number of siblings.

Methods

We conducted a cross-sectional study from May to June 2010 in elementary school children at the Kampung Baru District, Medan Regency, North Sumatera. Study protocols were explained to children and parents. Parents provided informed consents prior to enrollment of their children.

This study was approved by the Ethics Committee of the North Sumatra University Medical School. Questionnaires were completed by parents. We used trace cards from the *Allergy-Immunology IDAI Working Group of Indonesian Pediatric Society* to detect any atopic risks. Subjects were aged 7-10 years with a history of asthma, rhinitis allergy, and atopic dermatitis. Subjects underwent SPT of seven allergens including house dust mites, house dust, cotton, feather, cat dander, cockroach, and fungi. Allergens were produced by the Departemen of Pharmacy, Dr. Soetomo Hospital, Surabaya. Positive and negative controls were 1% histamine and 0.9% NaCl, respectively. The SPTs were performed on the volar forearm area with blood lancet at a 45° angle to the forearm. Sensitization was assessed 15-20 minutes after skin puncture and considered to be positive in the case of a red wheal ≥3 mm in diameter, or negative in the case of a red wheal <3 mm in diameter. Overall SPT results were considered to be positive if at least one allergen was positive. They were enrolled by consecutive sampling, then divided into two groups. Group I had children with < 3 siblings while group II had children with ≥ 3 siblings. Skin prick test reactivity was compared in the two groups.

Data processing was done with *SPSS software version 14.0* and analyzed by Chi-square test to assess for an association between skin prick test reactivity in atopic children and their number of siblings. Results were considered to be statistically significant for P values < 0.05.

Results

We screened 910 children by questionnaires and found 210 children with a history of atopy. The subjects were selected consecutively from those 210 children. Subjects were divided into two groups of 96 children each, those with < 3 siblings and those with ≥ 3 siblings.

Table 1. shows that both groups had more females than males, and a mean age of 9 years. For groups I and II, mean weights were 24 kg and 25 kg, respectively, and mean heights were 1.21 m and 1.28 m, respectively.

Chi-square test revealed that children with < 3 siblings had significantly more positive skin prick tests than children with ≥ 3 siblings (P=0.03) (**Table 2**).

Table 1. Baseline characteristics of subjects

Characteristics	Number of siblings < 3 Group I n=96	Number of siblings ≥ 3 Group II n=96
Gender, n (%)		
Male	43 (44.8)	41 (42.7)
Female	53 (55.2)	55 (57.3)
Mean age (SD), years	9.1 (0.91)	9.2 (0.99)
Mean weight (SD), kg	24.4 (4.60)	24.9 (7.17)
Mean height (SD), cm	120.6 (29.19)	127.2 (8.95)

Table 2. The association between number of siblings and skin prick test reactivity

Groups	Skin prick test		P value
	Positive n (%)	Negative n (%)	
Group I (number of siblings < 3)	72 (75)	24 (25)	0.003
Group II (number of siblings ≥ 3)	51 (53.1)	45 (46.9)	

Table 3 shows significant relationship between birth order and skin prick test (P=0.0001), in which first child had a higher risk of increased skin test reactivity. **Table 4** shows that a history of exclusive breastfeeding and pet ownership influenced skin prick test reactivity. A history of exclusive breastfeeding followed by decreased risk of atopy that can be seen in decreased skin test reactivity, meanwhile pet ownership increased atopy risk as the reactivity of SPT was increase.

Table 5 shows that only house dust mites had a significant relationship with number of siblings, where

Table 3. The association between birth order and skin prick test reactivity

Birth order	Skin prick test		P value
	Positive N=123 n(%)	Negative N=69 n(%)	
First	21 (17.1)	44 (63.8)	0.0001
Second	60 (48.8)	23 (33.3)	
Third	18 (14.6)	1 (0.8)	
Fourth	14 (11.4)	1 (0.8)	
Fifth	6 (4.9)	0 (0)	
Sixth	2 (1.6)	0 (0)	
Seventh	1 (0.8)	0 (0)	
Tenth	1 (0.8)	0 (0)	

Table 4. Factors which influence skin prick test reactivity

Variables	Skin prick test		P value
	Positive N=123	Negative N=69	
History of DPT vaccination, n(%)			
Yes	75 (39.1)	43 (22.4)	0.977
No	48 (25)	26 (13.5)	
Pet ownership (cat or dog), n(%)			
Yes	101(52.6)	27 (14.1)	0.0001
No	22 (11.4)	42 (21.9)	
History of exclusive breastfeeding, n(%)			
Yes	62 (32.3)	20 (10.4)	0.006
No	61 (31.8)	49 (25.5)	
Cigarette smoke exposure, n(%)			
Yes	72 (37.5)	41 (21.3)	1.000
No	51 (26.6)	28 (14.6)	

Table 5. Distribution of skin prick test results by type of allergen

Type of allergen	Group I n=96	Group II n=96	P value
House dust mite, n (%)			
Positive	38 (66.7)	19 (33.3)	0.004*
Negative	58 (43)	77 (57)	
Dust mite, n (%)			
Positive	17 (56.7)	13 (43.3)	0.551
Negative	79 (48.8)	83 (51.2)	
Cockroach, n (%)			
Positive	12 (36.4)	21 (63.6)	0.126
Negative	84 (52.8)	75 (47.2)	
Pollen, n (%)			
Positive	10 (52.6)	9 (47.4)	1.000
Negative	86 (49.7)	87 (50.3)	
Mold, n (%)			
Positive	6 (54.5)	5 (45.5)	1.000
Negative	90 (49.7)	91 (50.3)	
Chicken dander, n (%)			
Positive	4 (50)	4 (50)	1.000
Negative	92 (50)	92 (50)	
Cat dander, n (%)			
Positive	7 (36.8)	12 (63.2)	0.334
Negative	89 (51.4)	84 (48.6)	

atopic children who had less siblings reacted more to house dust mites compared to those who had ≥ 3 siblings (P=0.004).

Discussion

We found a significant association between positive skin prick test reactivity and fewer number of siblings. Positive skin prick tests were observed in 75% of children with <3 siblings, compared to 53.1% of those who had more siblings. A similar German study reported that declining family size may in part contribute to the increased prevalence of atopic diseases.[6] Our results support the idea of a protective effect of older siblings for prevention of atopy.

We also found a significant association between birth order and skin prick test reactivity (P = 0.0001). A British study reported that 19.6% of their subjects had a positive reaction to aeroallergens, but the lowest sensitization was found in third-born children who had the lowest umbilical cord IgE.[7] Our findings agree that higher birth order decreased allergic sensitization, as seen from the skin prick test results.

We found a significant relationship between pet ownership (dog or cat) and positive skin prick test reactivity (P=0.0001). A study in New Zealand with 1,037 subjects on whom skin prick tests were performed found that there was a synergistic interaction between cat and dog exposure which was associated with a lower risk of developing atopy in childhood and young adulthood.[8] Our study contrasts to this study in New Zealand which showed that pet ownership (dog,cat) was related to a lower risk of atopy.

Our study found a significant relationship between negative skin prick test results and a history of exclusive breastfeeding (P= 0.006). A Swedish prospective study found that exclusive breastfeeding had a preventive effect on the early development of allergic disease, such as asthma, atopic dermatitis, and suspected allergic rhinitis, up to 2 years of age.[9] However, a study on 200 newborns in Finland found that prolonging strictly exclusive breastfeeding for ≥ 9 months was associated with increased atopic dermatitis and food hypersensitivity symptoms in childhood.[10] Our results were in agreement with the Swedish study, but only examined the effect of breastfeeding for 6 months, not longer durations.

Of subjects exposed to cigarette smoke, 63.7% had positive skin prick tests, but there was no significant relationship (P= 1.000). A Brazilian study on 183 children aged 4-9 years who underwent skin prick tests found that the presence of respiratory infections and asthma attacks were not associated with smoking parents, but were associated with a parental history of atopy.[11] A study on tobacco smoke exposure and wheezing disorders in Austrian preschool children found that prenatal environmental tobacco smoke exposure was a risk factor for wheezing and asthma in their subjects.[12] In contrast, we found that tobacco smoke exposure did not play a role in atopic disease. A history of parental atopy was also asked in this study, but we did not examine the relationship of history of atopy and tobacco smoke exposure to atopic disease in children. We also did not evaluate the length of time exposed to tobacco smoke, so we could not assess for an association between time of exposure and atopic disease.

Skin prick tests were performed on children aged 7 to 10 years. Sensitivity was interpreted 15-20 minutes after the skin puncture. There is no lower limit for allergen skin prick testing and the test is valid from 4 months of age.[13] Aeroallergens tested in this study were house dust mite, dust mite, pollen, chicken dander, cat dander, cockroach, and mold, as well as positive and negative controls. Out of the seven allergens, only house dust mites had a significant positive relationship with the number of siblings, where atopic children who had less siblings reacted more to house mites allergen compared to those who had ≥ 3 siblings (P=0.004). Skin prick test is an appropriate diagnostic method to detect IgE sensitization by aeroallergens, food, animal, and drugs. Skin prick test is the best technique and has the most predictive results among skin tests. This test also has good safety, sensitivity and the results can be trusted.[14] The reason to use aeroallergen in the study is aeroallergen has high negative predictive value. The side effect of skin prick test does not find, so this test is safe to be done.

In conclusion, there are significantly more positive skin tests in atopic children with < 3 siblings compared to those with ≥3 siblings.

Conflict of interest

None declared.

References

1. McRae WM. Asthma, allergy and the hygiene hypothesis. NZFP. 2002;29:31-7.
2. Santosa H. Asma bronchial. In: Akib AA, Munasir Z, Kurniati N, editors. Buku ajar alergi- imunologi anak. 2nd ed. Jakarta: Ikatan Dokter Anak Indonesia; 2008. p. 252-65.
3. Santosa H. Dermatitis atopik. In: Akib AA, Munasir Z, Kurniati N, editors. Buku ajar alergi- imunologi anak. 2nd ed. Jakarta: Ikatan Dokter Anak Indonesia; 2008. p. 234-44.
4. Arshad SH, Tariq SM, Matthews S, Hakim E. Sensitization to common allergens and its association with allergic disorders at age 4 years: a whole population birth cohort study. Pediatrics. 2001;108:e33.
5. Munasir Z. Pemeriksaan penunjang klinis: uji kulit terhadap alergen. In: Akib AAP, Munasir Z, Kurniati N, editors. Buku ajar alergi imunologi anak. 2nd ed. Jakarta: Ikatan Dokter Anak Indonesia; 2008. p. 443-5.
6. von Mutius E, Martinez FD, Fritzsch C, Nicolai T, Reitmeir P, Thiemann HH. Skin test reactivity and number of siblings. BMJ. 1994;308:692-5.
7. Karmaus W, Arshad H, Mattes J. Does the sibling effect have its origin in utero? Investigating birth order, cord blood immunoglobulin E concentration, and allergic sensitization at age 4 years. Am J Epidemiol. 2001;154:909-15.
8. Mandhane PJ, Sears MR, Poulton R, Greene JM, Lou WY, Taylor DR, et al. Cats and dogs and the risk of atopy in childhood and adulthood. J Allergy Clin Immunol. 2009;124:745-50.
9. Kull I, Wickman M, Lilja G, Nordvall SL, Pershagen G. Breast feeding and allergic diseases in infants-a prospective birth cohort study. Arch Dis Child. 2002;87:478-81.
10. Pesonen M, Kallio MJ, Ranki A, Siimes MA. Prolonged exclusive breastfeeding is associated with increased atopic dermatitis: a prospective follow-up study of unselected healthy newborns from birth to age 20 years. Clin Exp Allergy. 2006;36:1011-8.
11. Ribeiro SA, Furuyama T, Schenkman S, Jardim JR. Atopy, passive smoking, respiratory infections and asthma among children from kindergarten and elementary school. Sao Paolo Med J. 2002;120:109-12.
12. Horak E, Morass B, Ulmer H. Association between environmental tobacco smoke exposure and wheezing disorders in Austrian preschool children. Swiss Med Wkly. 2007;137:608-13.
13. Morris A, Potter P, Lockey R. ALLSA position statement: allergen skin-prick testing. Curr Allergy Clin Immunol. 2006;19:22-5.
14. Bock SA. Diagnostic evaluation. Pediatrics. 2003;111:1638-44.