

Birch Pollen Allergy in Children

Role of Milk Feeding during the First Birch Season of Life

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The effect of exclusive breast-feeding throughout the first birch pollen season of life was examined in 59 children compared to 67 children on cow milk formula and to 27 children weaned to cow milk-based formula during their first birch season. The infants were about 3 months of age in their first birch season, and allergy to birch pollen was evaluated at 5 years of age by history and prick and provocation tests. Breast-feeding throughout the first birch season did not prevent birch pollen allergy; a similar birch allergy prevalence of about 10% was found in children initially fed on human or cow milk. Instead, weaning to cow milk-based formula during the first birch season seemed to protect from subsequent development of birch pollen allergy. Analogous results were obtained regarding allergy to grass pollen. This unexpected finding may be related to the immunological stress on the young infant provided by introduction of cow milk proteins at an early age.

Key words: birch pollen; breast milk; cow milk; milk formulas; pollen allergy.

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It has been stated that the very first birch pollen season of life is of importance as regards the development of subsequent respiratory allergy to birch pollen (2, 11), although there also are reports to the contrary (7, 10, 12). The neonatal respiratory epithelium may be unable or less able to defend against entrance of pollen antigens as compared to older infants or children, based on findings that children born in spring have more birch allergy than those born in autumn (2) and, furthermore, that the highest prevalences of birch allergy have been found among people born in years with profuse birch pollen seasons (3).

The role of human milk in the prevention of respiratory allergy is so far uncertain, although there is evidence that prolonged breast-feeding protects from food allergy and atopic eczema (9, 14). Blair (4) found that breast-feeding for at least 8 weeks improved the long-term prognosis of childhood asthma in a 20-year follow-up. The purpose of the present study was to find out whether exclusive breast-feeding

throughout the first birch pollen season of life would protect from subsequent birch pollen allergy in a prospective follow-up from birth to 5 years of age.

SUBJECTS AND METHODS

Initially, 256 healthy newborn full-term infants, born at the Helsinki University Central Hospital during the first 3 months of 1975, were selected for the study on voluntary basis. The only criteria were that the baby was healthy and had a birthweight of at least 3000 g. The infants were seen on seven occasions during the first year of life (at 0.5, 1, 2, 4, 6, 9 and 12 months of age) at the Children's Hospital as outpatients by the same physician (U.M.S.) for a careful history taking, physical examination, and dietary instructions. A total of 237 children completed the first-year follow-up. At 3 years 178 and at 5 years 153 children were re-examined (by M.K.). At every visit a careful history was

taken both orally and by questionnaire, and a physical examination was performed.

Dietary instructions

All infants followed a strict dietary program during the first year of life. The mothers were encouraged to breast-feed for as long as possible. When the mothers no longer had enough milk the infants were weaned either to a commercial cow milk-based formula or to a home-prepared cow milk formula (14). In most cases the weaning was gradual, partial breast-feeding continuing for a couple of months. Solid foods were started at 3.5 months of age according to a strict protocol which was similar for all infants (14). The diet was free after the age of 1 year.

The first birch pollen season

Birch pollen is the most significant pollen allergen in Finland and was therefore chosen for the study. Grasses also play a role, as well as mugwort in the late summer and autumn. Ragweed does not occur in Finland.

The pollen season of deciduous trees last in southern Finland from April 15 to May 31. Birch (*Betula*) is the most important of these trees. Alder (*Alnus*) and willow (*Salix*) are also noteworthy and deserve mention especially because of cross-reactions with birch allergen (1, 17). Aspen (*Populus*) and hazel (*Corylus*) are less important.

The first birch pollen season was the same for all children in the study. All were born during the same 3 months' period in the same year and had a mean age of 3.0 (range 1.5–4.5) months on May 15, 1975. All the children were from the Uusimaa region, most of them from the neighbouring towns of Helsinki, Espoo and Vantaa. These towns are approximately similarly urbanized, with a similar supply of birch pollen.

In 1975 the peak of the birch pollen counts in the Helsinki areas occurred on May 8, with 1444 pollen grains/m³ of air. This represents a "normal" birch pollen season. In the following years -76, -77, -78, and -79 the maximum birch pollen counts were 336, 2217, and 387 grains/

m³, observed on May 12, 14, 18 and 26, respectively. The pollen samples were collected with a Hirst Burkard sampler for outdoor air by Dr. Pentti Sorsa, Ph.D., Botanical Institute, University of Helsinki.

Study groups for birch allergy evaluation

B = *Breast milk group* ($n = 59$; 31 boys and 28 girls). Infants whose only source of milk throughout the first birch pollen season, at least up to June 1, 1975, was breast milk.

W = *Weaning group* ($n = 27$; 12 boys and 15 girls). Infants who were weaned to the cow milk-based formula during the birch pollen season, i.e., the formula was started between April 15 and May 31, 1975.

C = *Cow milk group* ($n = 67$; 35 boys and 32 girls). Infants for whom the cow milk-based formula was started before the beginning of the birch pollen season, i.e., before April 15, 1975.

The study groups did not differ in atopic heredity (defined as atopic symptoms or signs in one parent or sibling). The groups were also comparable regarding the occurrence of food allergy (defined by history of skin eruption or heavy vomiting after ingestion of certain foods at home) and atopic eczema. The age of the study groups was similar, as was the geographical origin of the children. Also the sex distribution was similar. No differences could be noticed in the exposure to other allergens; domestic animals were found similarly in all study groups, and the introduction age to solid foods was strictly the same in all children.

Grass pollen allergy

We wanted to see whether corresponding results would be found in grass allergy as in birch allergy, the main topic. The grass pollen season lasts in southern Finland from June 15 to August 15, and among the most common species are *Phleum*, *Festuca*, *Alopecurus*, *Poa*, *Dactylis*, *Lolium*, and *Holcus*, all of them cross-reacting with each other.

Table 1

Birch pollen allergy in children evaluated at 5 years of age in respect to the milk-feeding regimen during the first birch pollen season of life. B = Breast milk group, W = weaning group, and C = cow milk group (see text). Suspected birch allergy means positive prick test only, or positive history only

	B (n = 59)		W (n = 27)		C (n = 67)	
Seasonal symptoms	7	(12 %)*	0	(0 %)	10	(15 %)**
Positive prick test	9	(15 %)	1	(4 %)	10	(15 %)
<i>Verified birch allergy</i>						
a) seasonal symptoms and positive prick	6		0		5	
b) seasonal symptoms, positive prick and challenge	4		0		4	
c) positive prick and challenge	5		0		6	
Total (a, b or c)	7	(12 %)*	0	(0 %)	7	(10 %)*
<i>Suspected or verified birch allergy, total</i>	10	(17 %)*	1	(4 %)	15	(22 %)**

* $P < 0.10$ compared to group W.

** $P < 0.05$ compared to group W.

Table 2

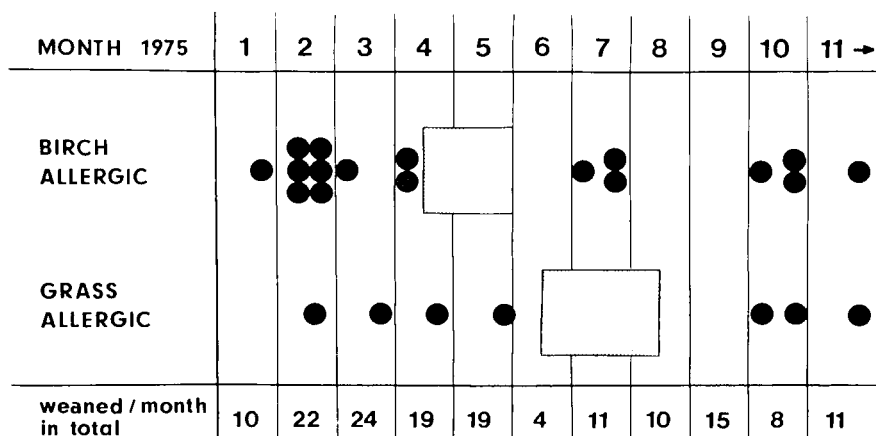
Grass pollen allergy in children evaluated at 5 years of age in respect to the milk-feeding regimen during the first grass pollen season of life. B₁ = breast milk group, W₁ = weaning group, and C₁ = cow milk group (see text). Suspected grass allergy means positive prick test only, or positive history only

	B ₁ (n = 42)		W ₁ (n = 15)		C ₁ (n = 96)	
Seasonal symptoms	3	(7 %)	0	(0 %)	4	(4 %)
Positive prick test	5	(12 %)	2	(13 %)	9	(9 %)
<i>Verified grass allergy (Seasonal symptoms and positive prick)</i>						
	3	(7 %)	0	(0 %)	4	(4 %)
<i>Suspected or verified grass allergy, total</i>	5	(12 %)	2	(13 %)	9	(9 %)

Study groups for grass allergy evaluation

B₁ = Breast milk group (n = 42). Infants whose only source of milk was breast milk throughout the first grass pollen season of life, up to August 15, 1975.

W₁ = Weaning group (n = 15). Infants who were weaned to the cow milk-based formula during the grass pollen season between June 15 and August 15, 1975.



The calendar month of weaning to cow milk-based formula of children with symptomatic allergy to birch pollen ($n = 17$) or grass pollen ($n = 7$) evaluated at 5 years of age. Shaded areas indicate the pollen seasons in southern Finland. Birch season: April 15 to May 31; grass season: June 15 to August 15. Solid circles indicate individual children.

C_1 = Cow milk group ($n = 96$). Infants for whom the cow milk-based formula was started before the beginning of the grass pollen season, i.e., before June 15, 1975.

Symptoms of respiratory pollen allergy

Symptoms of respiratory pollen allergy were defined as 1) seasonal conjunctival redness, itching and tearing, and/or 2) seasonal nasal obstruction, rhinorrhea, congestion, and recurrent sneezing, and/or 3) seasonal wheezing attacks, during the respective pollen season in 1 or more years. The information was obtained by a careful history taken from the mothers.

Laboratory methods

Skin prick tests were performed at 5 years of age with allergen extracts from Allergologisk Laboratorium (Copenhagen, Denmark): 1 HEP (histamine equivalent prick) birch (*Betula verrucosa*) pollen, 1 HEP timothy (*Phleum pratense*) pollen, and 1:100 (w/v) meadow fescue (*Festuca elatior*) pollen. A wheal diameter of at least half of that given by a prick test with histamine 5.43 mmol (solution of 1 g/l of histamine dihydrochloride) was defined as a positive reaction.

Children with positive prick tests to birch pollen were given also conjunctival, and when

negative, nasal provocation test with birch pollen extracts.

Statistical methods

The chi-square test was used in the statistical analyses.

RESULTS

The breast milk group (B) and the cow milk group (C) did not differ in the occurrence of birch pollen allergy at 5 years of age. Verified birch pollen allergy was found in these groups in 12% and 10%, and suspected or verified birch pollen allergy in a total of 17% and 22%, respectively (Table 1).

Unexpectedly, in the weaning group (W) there was no child with verified or symptomatic birch pollen allergy and only one with a positive prick test. The significances of the differences when compared to groups B and C varied between $P < 0.10$ and $P < 0.05$ (Table 1).

The finding was similar with regard to allergy to grass pollen. Verified grass allergy occurred in 7% in group B_1 and in 4% in group C_1 , but not at all in group W_1 (Table 2).

For the children with symptomatic pollen allergy at 5 years of age the calendar month of weaning to cow milk-based formula is examined separately for the birch allergic and the grass allergic children (Fig. 1). No child weaned during a specific pollen season developed symptomatic allergy to that type of pollen prior to 5 years of age. There were three infants breast-fed through the birch pollen season and weaned during the grass season. These infants later developed birch allergy but not grass allergy (Fig. 1). On the other hand, two other infants weaned during the birch season and fed on cow milk formula during the following grass season developed grass allergy but not birch allergy (Fig. 1). The finding is logical, although hard to evaluate statistically.

We also checked that group W did not contain fewer atopic children than the other groups. In groups B, W and C, evaluated from birth to 5 years of age, atopic eczema had occurred in 24%, 30% and 34%, respectively, and a history of food allergy in 29%, 37% and 36%, respectively.

DISCUSSION

The results indicate that exclusive breast-feeding throughout the first birch pollen season of life does not protect from subsequent development of allergy to birch pollen; similar prevalences of birch allergy were found in the breast milk and cow milk groups at 5 years of age.

Prolonged breast-feeding is prophylactic for atopic disease as regards eczema and food allergy (14), presumably because human milk protects the gastrointestinal tract from the entrance of foreign antigens. The present data suggest that the respiratory tract does not have similar protection. Furthermore, the gastrointestinal tract might not be of major importance as an invasion route for pollen antigens, because human milk protects against food allergy but not pollen allergy. It is also possible that the very first pollen season of life is not of so great importance in the development of pollen allergy as has been claimed (2, 11).

Although our original aim to find protection from pollen allergy by breast-feeding had a negative result, the data unexpectedly suggested another finding: symptomatic or verified birch pollen allergy did not occur in children who were weaned during their first birch season to cow milk-based formula.

We primarily questioned whether the finding could be true. The statistical significances of the differences were marginal (Table 1), since the weaning group was relatively small, and the prevalences of birch allergy in groups B and C were not high. Possibility of bias was searched for very carefully, but there was no indication of what could have influenced the results. The study groups did not differ in age, sex, atopic heredity, geographical area of living (supply of pollen), or exposure to other allergens (solid food introduction, domestic animals). The study was blind; the physician (M.K.) who examined the children at 5 years of age and took the history from the mothers, did not know about the initial milk feeding, nor did the allergy-trained nurse who performed the prick tests. We are aware that birch allergy can also appear after 5 years of age. Long-term follow-up is needed to see whether the suggested effect of weaning during pollen season will be of preventive or only a postponing nature.

In order to find additional support for the potential benefit of weaning during the first pollen season of life, we examined whether a similar phenomenon could be found regarding grass allergy. New study groups B₁, W₁ and C₁ were selected and evaluated for grass allergy. The finding was similar: no child weaned during the grass pollen season had developed symptomatic grass allergy. Furthermore, there were three children with symptomatic allergy to birch but not grass, weaned during the grass season, and two children allergic to grass but not to birch, weaned during the birch season (Fig. 1). Weaning during the respective pollen season seemed to prevent symptomatic pollen allergy, but not totally the prick-positivity alone. The results for grass allergy, although not statistically significant as such, supported the birch allergy findings. Accordingly, weaning to cow milk-based formula during the first

birch pollen season of life might indeed play a role in the prevention of subsequent birch pollen allergy.

The mechanism by which weaning during the pollen season could protect from an atopic allergy to pollen is obscure and probably complicated. We know that the introduction of a cow milk-based formula provides a certain immunological stress for the young infant. The synthesis of both IgA and IgE is accelerated after weaning (13, 15). Several kinds of milk antibodies with or without clinical significance are synthesized (6, 8, 16). Possibly there is not much immunological capacity left for the production of reaginic antibodies to the pollen allergens. Cow milk may also have effects on the respiratory tract epithelium (5, 16), and changes in permeability might perhaps also occur.

In summary, we conclude that exclusive breast-feeding throughout the first birch pollen season of life does not protect against the development of a subsequent allergy to birch pollen. Instead, introduction of cow milk formula during the first pollen season might, by an unknown mechanism, play a protective role.

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