

**STABILITY OF PARENT-REPORTED FOOD ALLERGY IN SIX AND SEVEN-YEAR-OLD CHILDREN: FIRST FIVE YEARS OF THE FINNISH ALLERGY PROGRAMME**

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Syventävien opintojen kirjallinen työ

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JÄRVENPÄÄ JOHANNA: STABILITY OF PARENT-REPORTED FOOD ALLERGY IN SIX AND SEVEN-YEAR-OLD CHILDREN: FIRST FIVE YEARS OF THE FINNISH ALLERGY PROGRAMME

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Tutkimuksen tarkoituksena oli kartoittaa ruoka-aineallergioiden määrä ja laatu peruskoulun syksyllä 2013 aloittaneilla lapsilla ja verrata, onko vanhempien raportoimien ruoka-allergioiden yleisyys vähentynyt Kansallisen allergia-ohjelman aloittamisen jälkeen. Kyseessä oli seurantatutkimus, joten tutkimus tehtiin samalla tavalla kuin vastaava vuonna 2009 ennen Kansallista allergiaohjelmaa tehty (julkaistu vuonna 2011) Parent-reported food allergy requiring an avoidance diet in children starting elementary school -tutkimus.

Kouluterveydenhoitajat täyttivät allergiakyselylomakkeen tehdessään terveystarkastusta peruskoulun aloittavalle lapselle. Kriteerinä vanhempien raportoimille allergioille oli, että lapsen tuli välttää ruoka-aineita koulussa.

Tutkimukseen saatiin mukaan 1653 lasta, joista 6,1 prosentilla oli jokin ruoka-aineallergia. Lapsista 2,5 prosenttia olivat allergisia perusruoka-aineille (maito, kananmuna tai vehnä). Vuonna 2009 perusruoka-aineallergisia lapsia oli 2,7 prosenttia. Hedelmä- ja juuresallergiat vähenivät 5,8 prosentista 3,2 prosenttiin. Pähkinäallergiat taas vähenivät 3,1 prosentista 1,8 prosenttiin.

Perusruoka-aineallergioiden määrä pysyi siis lähes samalla tasolla, sen sijaan pähkinä-, hedelmä- ja vihannesallergiat vähenivät Kansallisen allergiaohjelman ensimmäisen viiden vuoden aikana.

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## **Abstract**

**Aim:** The Finnish national allergy programme was introduced in 2008 to decrease the burden of allergy in the population. This study, carried out in 2013, evaluated the prevalence of parent-reported food allergies, treated with an avoidance diet until early school age, and discussed the rates in relation to those found in an identical study in 2009.

**Methods:** School health nurses used a structured questionnaire to interview the parents of 1,653 children aged of six or seven in the first year of elementary school. The criterion for a parent-reported food allergy was that the parents considered it necessary for their child to follow an avoidance diet at school.

**Results:** In 2013, 6.1% of the children were allergic to at least one food and 2.5% of the children were allergic to basic foods, such as cows' milk, eggs and wheat, compared to 2.7% in 2009. A significant decrease was seen in allergies to nuts, fruits and vegetables.

**Conclusion:** Parent-reported allergies to basic foods, such as cow`s milk, eggs and wheat, remained rather stable in first-graders of elementary schools during the first five years of the Finnish national allergy programme, but allergies to nuts, fruits and vegetables decreased.

**Key words:** Diet, food allergy, milk allergy, nut allergy, avoidance diet

**Key notes:**

- The Finnish national allergy programme was introduced in 2008 to decrease the burden of allergy in the population.
- This 2013 study evaluated the prevalence of parent-reported food allergies in six and seven-year-old children and compared them to an identical study in 2009.
- Allergies to basic foods were similar (2.7% versus 2.5%,) in both years, but allergies to nuts, fruits and vegetables decreased during the first five years of the programme.

## **Introduction**

The Finnish national allergy programme, which was introduced in 2008 and will run until 2018, aims to reduce the burden of allergies both at individual and societal levels (1). The idea of the programme is to increase both immunological and psychological tolerance and to change attitudes to support health instead of disease in the case of mild allergy. The current dogma of allergen avoidance has not proved effective in decreasing allergy epidemics (2). For example, the national programme suggests that food allergy diets should be critically re-evaluated and stopped if possible. The keys to implementing the allergy programme have been allergy experts networking with primary care doctors, nurses and pharmacists and campaigning to increase allergy awareness and knowledge among the general public. The programme was published in the Finnish Medical Journal in April 2008 (1) and then launched on a regional basis across Finland. It included 150 educational sessions, attended by more than 9,000 multi-disciplinary professionals between 2008 and 2012 (3). In 2009, we evaluated the prevalence of parent-reported food allergies requiring avoidance diet among children starting elementary school in Tampere, a city with 220,000 inhabitants in West-Central Finland (4). The results reflected the frequency of parent-reported food allergies at the start of the implementation of the national allergy programme. More than 2.5% of the 1,542 first-graders reported allergies to basic foods such as milk, eggs or grains, requiring avoidance diets (4). Fruit or vegetable allergies were reported to affect 5.8% of the children (4).

In 2013, we performed an identical study to the 2009 study among the current first-graders. The purpose of the present study was to evaluate the prevalence of parent-reported food allergy requiring an avoidance diet, and to discuss the results in relation to the levels at the time the national allergy programme was launched.

## **Subjects and methods**

In August 2013, 1,970 children born in 2006 started elementary school in Tampere, the third largest city of Finland, with 220 000 inhabitants. There are 40 schools in the city and the numbers of first-graders varied between eight and 90 per school, with 29 school health nurses being responsible for the pupils. The school health nurses interviewed and examined 1,563 first-graders who were six to seven-years-of-age, between May and December 2013, with the 830 boys and 823 girls representing 83.9% of that year's first-grade intake. The need to follow an avoidance diet due to food allergies, coeliac disease and lactose intolerance was evaluated as part of the examination. The parents had completed a routine health questionnaire in advance and the school health nurses checked this information, interviewed the parents and children and completed the structured study questionnaire, including questions on ongoing avoidance diets due to diagnosed food allergies. The study questionnaire contained questions on whether the child's diet included milk, eggs, soy, fish and grains (wheat, rye, oat, barley) or cereals. Milk, eggs and grains are considered basic children's foods in Finland. Separate questions were asked about the use of milk, low-lactose milk and lactose-free milk. If the child was not able to use milk but was able to use low-lactose or lactose-free milk or milk products, they were classified as lactose intolerant. Cows' milk allergy was only considered if the child was unable to use any milk products at all. If the child avoided grains and cereals, the parents were asked whether the child had been diagnosed with coeliac disease and separate questions were asked about whether the child could eat wheat, rye, oat and barley. Children were classified as having a grain allergy if they could not tolerate one or more grains and did not have coeliac disease. If the child did not eat eggs, but could tolerate egg protein in food, they were not classified as having an egg allergy. Multi-allergy was defined as an allergy to milk, wheat and any other grain. The school health nurses were told to only record allergies to milk, eggs,

soy, fish, grains and cereals, if those allergies had been diagnosed by a physician, but no time or age limits for this diagnosis were specified.

In addition, we included a list of 32 fruits, vegetables, legumes (including beans, peas and lentils), nuts and spices that may cross-react with pollens into the questionnaire and the school health nurses were asked to underline any foods that the child could not consume.



## **Statistics**

The data were analysed using SPSS Statistics 20.0 software. The results are expressed as percentage distributions with 95% confidence intervals (95% CI). Pearson's chi-square test and Fisher's exact test were used in the statistical analyses of the data.

## **Ethics**

Because the children's personal data were not registered, the study was carried out with the permission of the Director of Social and Primary Health Care Services of the city of Tampere. Oral consent was obtained from the parents before they were interviewed by the school health nurses.

## Results

In the present study, carried out in 2013, 101 (6.1%) children reported an allergy to at least one food (Table 1). There were no significant differences between boys and girls. Allergies to basic foods were reported by 2.5% of the children (95% CI 1.9-3.4%), compared with 2.7% in 2009 (Table S1), and 0.3% (0.1-0.7%) of the children had multiple allergies. Of these, 22 children (1.3%) reported a cow`s milk allergy (1.5% in 2009), 24 children (1.5%) reported an allergy to eggs (1.1% in 2009) and 16 children (1.0%) reported a grain allergy (1.0% in 2009) (Table S1).

In 2013, 53 (3.2%, 95%CI 2.5-4.2%) children reported allergies to fruits or vegetables (5.8% in 2009), 30 children (1.8%, 95%CI 1.3-2.6%) to nuts (3.1% in 2009), 14 (0.8%) children to legumes (0.7% in 2009), and nine (0.5%) children to spices (0.6% in 2009) (Table S1).

Coeliac disease was only diagnosed in three (0.2%) children and all of them were girls. In all, 144 (8.7%) children - 75 boys and 69 girls - reported partial or total lactose intolerance. The prevalence of total lactose intolerance was 4.7%, affecting 39 boys and 39 girls.

A third (33%) of the 42 children with allergies to basic foods - cow`s milk, eggs or grains - reported allergies to fruits or vegetables, and 21% reported allergies to nuts, 19% to soy, and 12% to fish. In all, 101 children (6.1%) were allergic to non-basic foods; 41.6% of them were allergic to basic foods and 58.4% were not allergic to basic foods.

## Discussion

A total of 84% of the children starting elementary school in Tampere, a city of about 220,000 inhabitants, took part in the study and 2.5% had parent-reported allergies to basic foods that required a special avoidance diet. The 2009 study was carried out before the national allergy programme (4), which was launched during 2008, had time to make an impact, as the early stages focussed on training the medical staff to implement the programme. The aim of the programme was to increase both immunological and psychological tolerance to mild allergy (1) and the present study, carried out in late 2013 reflects the influence of the first five years of the 10-year programme. The allergies to basic foods were rather similar in 2013 (2.5%) and 2009 (2.7%) (4), with about 1.3% being allergic to milk, 1.5% to eggs, 1.0% to grains, and 0.3% having multiple allergies to milk, wheat and some other grain.

The 10-year national allergy programme aims to reduce the burden of allergies, both at individual and societal levels (1,3). In the case of food allergy, it suggests that on-going avoidance diets should be critically re-evaluated and stopped if possible. Increasing evidence suggests that hyposensitisation is an effective and safe treatment for food allergies (5,6). Regular use of the food in question seems essential to the maintenance of tolerance (6), and mild symptoms must be endured. Evidently, a possible reason that our study found negative results in relation to basic foods allergies is that avoidance diets that had started in early childhood had continued unnecessarily until school age.

A review published in 2014 updated the data on food allergy over the past three years (7) and this showed that, on average, food allergies affect 8% of children. In the US, 8% of 38,480 children of all ages had parent-reported food allergies, with 2.4% reporting allergies to multiple foods and about 3% reporting severe reactions (8). Between the ages of six and 10, there was a prevalence of 7.6% for all food allergies and the most common allergens were peanuts (1.9%), milk (1.5%), tree

nuts (1.1%), eggs (0.8%) and wheat (0.4%) (8). In Canada, 7.1% of 2,198 children of all ages had parent-reported food allergies, with the most common allergens being cows' milk (2.2%), peanuts (1.8%), tree nuts (1.7%), eggs (1.2%) and wheat (0.45%) (9). However, the prevalence of these allergies were not reported by age. In an Italian study, the parents reported food allergy symptoms in 9.9% of 463 children at five to 10-years-of-age (10), with cows' milk (3.4%), eggs (2.3%), tomatoes (1.5%), peanuts (1.1%) and chocolate (0.9%) being the most common allergens (10). The figures for these American and Italian children aged from five to ten years are higher than our figures for six to seven-year-old Finnish children in their first grade (8,10).

Childhood allergies to nuts and fish are usually persistent, but allergies to milk, eggs, wheat and other grains typically resolve during childhood. However, the resolution rates have slowed down during recent years (7). No data on resolution rates are available from Finland, but this trend has been universal in western countries and may partly explain the higher than expected food allergy prevalence figures of the present study.

The allergies to fruits and vegetables were less common in 2013 (3.2%) than in 2009 (5.8%) (4), but are still higher than in many other studies (8,9). In Italy, for example, 1.5 % of school children reported allergies to fruits and less than 1% reported allergies to vegetables (10). The allergies to certain fruits and vegetables are associated with birch allergy, and there is no reason to assume that the prevalence of birch allergy has decreased in Finland. In Northern Sweden, the prevalence of allergic sensitisation to birch pollen in seven to eight-year-old children increased from 7.9% to 13.12% between 1996 and 2006 and the figure for any allergen increased from 20.6% to 29.9% over the same period (11). The observed decrease in parent-reported fruit and vegetable allergy may result from children increasing their endurance of mild symptoms and from healthcare professionals paying less attention to avoidance diets in children with seasonal rhinitis, in line with the national allergy programme.

In the present study, allergies to nuts were lower in 2013 (1.8%) than in 2009 (3.1%) (4). This could partly be explained by the introduction of challenge tests to nuts after 2009 and excluding peanuts and hazelnuts from the skin prick test panel for young children in our hospital. There is a risk of over-diagnosis if the diagnoses are based on skin prick testing (12). The use of nuts has increased in Sweden (13) and evidently it has also increased in Finland. In the UK, peanut allergies doubled from 2000 to 2005 (14) and in the US they tripled from 1999 to 2007 (15). Importantly, nuts still cause half of the severe allergic reactions to foods (7). In line with the Swedish observations (13,16), nuts were the most important dietary cause of severe anaphylactic reactions recorded in the Finnish Anaphylaxis Register, maintained by the Skin and Allergy Hospital, Helsinki, Finland, and these notifications increased three-fold between 2009 and 2013.

There are four main strengths in the present study. First, the study was identical to the study performed in 2009, enabling us to compare food allergies before and five years after the introduction of the national allergy programme. Second, we were able to recruit 83.9% of the children starting elementary school in the town by scheduling the survey as part of the routine health examination carried out by the school health nurses. Third, the study population was at an optimal age of about seven years, which is a good time to evaluate the transience versus persistence of food allergies. At that age, transient early-childhood food allergies have mostly recovered and allergies to those fruits and vegetables, which are associated with pollen allergies, have mostly become symptomatic. Fourth, the presence of lactose intolerance was charted and children who were not able to use milk but were able to use low-lactose milk or milk products were not included in the milk allergy group. Self-reported lactose intolerance is so common (8.7%) that its careful separation from milk allergy is necessary in questionnaire-based studies.

The main shortcoming of the study was that the data only consisted of parent-reported information. This bias was diminished, but not totally eliminated, by the advice that school health nurses should only register allergies that had been diagnosed by a physician. This kind of design is mandatory,

because 30% of parent-reported food allergies were not diagnosed by a physician in a population-based American study (17). Our study was only performed in one town, although it covered more than 1,500 first-graders of elementary schools, which is a clear limitation of the study.

The goals of the Finnish allergy programme which started in 2008 and will run until 2018, are to change both public attitudes and healthcare practices. Although the findings of a lower prevalence of allergies to nuts and to fruits and vegetables are promising, a period of five years seems to be too short to achieve any major effects. On the other hand, the stability of parent-reported food allergy may be a positive sign that the programme is proving effective, because a Swedish study has suggested that allergic sensitisation may continue to increase in the child population (11), and currently, the spontaneous resolution of childhood food allergy seems to take longer than earlier (7).

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**Table 1. Food allergies in 2013 by gender in the 1,653 children starting elementary school.**

<b>Allergen/allergies</b>	<b>Boys n=830 (%)</b>	<b>Girls n=823 (%)</b>	<b>All n=1,653 (%)</b>
Cows' milk	8 (1.0)	14 (1.7)	22 (1.3) [0.9–2.0]**
Eggs	12 (1.4)	12 (1.5)	24 (1.5) [1.0–2.1]
Grains	6 (0.7)	10 (1.2)	16 (1.0) [0.6–1.6]
Wheat	5 (0.6)	7 (0.9)	12 (0.7) [0.4–1.3]
Rye	4 (0.5)	8 (1.0)	12 (0.7) [0.4–1.3]
Barley	5 (0.6)	8 (1.0)	13 (0.8) [0.5–1.4]
Oat	3 (0.4)	3 (0.4)	6 (0.4) [0.2–0.8]
Multi-allergy	2 (0.2)	3 (0.4)	5 (0.3) [0.1–0.7]
Basic food allergies	17 (2.0)	25 (3.0)	42 (2.5) [1.9–3.4]
Soy	1 (0.1)	7 (0.9)*	8 (0.5) [0.2–1.0]
Fish	7 (0.8)	5 (0.6)	12 (0.7) [0.4–1.3]
Legumes	6 (0.7)	8 (1.0)	14 (0.8) [0.5–1.4]
Nuts	14 (1.7)	16 (1.9)	30 (1.8) [1.3–2.6]
Spices	5 (0.6)	4 (0.5)	9 (0.5) [0.3–1.0]
Fruits and vegetables	29 (3.5)	24 (2.9)	53 (3.2) [2.5–4.2]

\*p = 0.038; no other significant differences between boys and girls

\*\* 95% confidence interval

#### **Electronic supplementary material**

**Table S1. Parent-reported food allergies in first-graders aged six to seven who started elementary school in 2009 and 2013.**

<b>Allergen</b>	<b>In 2009 (Ref. 4)</b>	<b>In 2013 (Present study)</b>
Basic foods	2.7% [1.9-3.5]	2.5% [1.9–3.4]***
Cow milk	1.5% [0.9-2.1]	1.3% [0.9–2.0]
Eggs	1.1% [0.6-1.6]	1.5% [1.0–2.1]
Grain	1.0% [0.5-1.5]	1.0% [0.6–1.6]
Nuts	3.1% [2.2-4.0]	1.8% [1.3–2.6]
Fruits and vegetables	5.8% [4.7-7.0]	3.2% [2.5–4.2]
Fish	0.8% [0.4-1.3]	0.7% [0.4–1.3]

\*\*\* 95% confidence interval