

ORIGINAL ARTICLE

The parent-reported prevalence and management of peanut and nut allergy in school children in the Australian Capital Territory

Marjan Kljakovic,¹ Paul Gatenby,¹ Carolyn Hawkins,¹ Robyn G Attewell,³ Karen Ciszek,² Gitta Kratochvil,¹ Alayne Moreira¹ and Anne-Louise Ponsonby^{4,5}

¹Australian National University Medical School, ²ACT Community Health, Australian Capital Territory, ³Biometrics Operations, Covance Pty Ltd, ⁴Murdoch Childrens Research Institute, Victoria, ⁵Menzies Research Institute, University of Tasmania, Tasmania, Australia

Aim: To describe parent-reported prevalence and management of peanut and nut allergy in school entrant children.

Method: A population-based, cross-sectional study in the Australian National Capital.

Results: Out of 3851 children, parents reported 127 had a strong allergic reaction to peanuts and 19 to other nuts ever. Nut allergy ever prevalence was 3.8% (95% confidence interval 3.2–4.4%), and of peanut allergy ever 3.3% (2.8–3.9%).

Children with nut allergy were more likely to have a general practitioner (odds ratio 2.64, 1.16–6.03), hay fever (3.78, 2.67–5.36), eczema (4.54, 3.15–6.56) and wheeze in the last 12 months (3.19, 2.22–4.59) and have been breastfed (2.68, 1.26–5.77) than those who did not.

At follow up of 109 children with parent-reported allergy (75% response), 70% had diagnostic test-confirmed sensitisation, 32% had been prescribed an adrenalin autoinjector (6% had used one) and 46% were not eating peanut. Increasing severity of reported symptoms following consumption of peanut was associated with an increasing likelihood of recommended management. Based on parent report, the projected estimated diagnostic test-confirmed prevalence of peanut sensitisation was 2.4% (1.9%, 3.0%) for the entire sample.

Conclusion: Among a highly representative sample of children at school entry, 1 in 30 parents reported their child to have a strong allergic reaction to nuts and over 1 in 50 are estimated to have diagnostic test-confirmed peanut sensitisation, based on parent report.

Key words: adrenalin autoinjector; allergy; anaphylaxis; general practice; management adherence; nut; peanut.

Peanut sensitisation and allergy in childhood appears to be increasing in prevalence.^{1,2} Previous studies on nut allergy have been conducted in high-risk groups and population-based data are rare. Understanding how nut allergy is managed is important because it affects many children in the community,¹ it appears to be a growing problem and there is a real potential for life-threatening anaphylactic reactions.³ Peanut accounts for two-thirds of all fatal food-induced anaphylaxis.⁴ As a result of this, authorities in Australia are under pressure to develop risk management strategies. For example, parental pressure has led

to peanut-free schools. Despite this, there has been no research describing the community management strategies for peanut allergy in Australia.

The management of allergy and anaphylaxis to peanut is outlined in the Australasian Society of Clinical Immunology and Allergy guidelines⁵ where parents are encouraged to take their child to a doctor to confirm a diagnosis of peanut allergy and have an anaphylaxis action plan in place.

The aims of this study were to describe the prevalence of reported peanut and other nut allergy in the Australian Capital Territory (ACT), the characteristics of children with reported nut allergy and the association between reported nut allergy and other atopic disease at primary school. Secondly, the follow-up study aimed to assess how parent-reported nut allergy is managed in the community.

Method

Sample frame

All new entrants to primary schools with parent-reported nut allergy were selected from those who took part in the ACT Kindergarten Health Screen in 2005. The Health Screen Questionnaire (HSQ) has been described elsewhere.⁶ Parents are asked to report on a variety of health issues in their child and response rates range from 85% to 89%. Data are collected on the child's demographics and four possible atopic outcomes as

Key Points

- 1 The prevalence of parent-reported peanut allergy in school entry children was 3.3%.
- 2 There were strong associations between reported peanut and nut allergy with other atopic disease, breastfeeding and having a current general practitioner.
- 3 Increasing severity of reported symptoms following consumption of peanut was associated with an increasing likelihood of recommended management and an action plan.

Correspondence: Professor Marjan Kljakovic, Australian National University Medical School, PO Box 11 Woden, ACT 2606, Australia. Fax: +61 2 62444105; email: marjan.kljakovic@anu.edu.au

Accepted for publication 22 July 2008.

listed in Table 2. In 2005, one question was added: 'Has your child ever had a strong allergic reaction to peanuts/peanut products, and/or other nuts/nut products?'. A positive response was termed as parent-reported peanut allergy.

Follow-up Nut Allergy Questionnaire

The parents were mailed an NAQ 1 year later and asked about their child's peanut or other nut food allergies and management. Two months after the initial mail out, non-respondents were contacted by phone. Children of whom parents reported that a skin prick test or a blood radioallergosorbent immunoassay test had been conducted were classified as having diagnostic test-confirmed sensitisation. Clinical peanut allergy as a response to ingested peanut antigen was not determined.

Analysis

The prevalence of peanut/other nut allergy reported in the HSQ was estimated with binomial-based 95% confidence intervals (CIs). Children with and without reported nut allergies were compared regarding their demographic characteristics and other factors potentially relevant to atopic disease such as prematurity, breastfeeding and exposure to smoking using chi-square tests⁷ or multiple logistic regression models⁸ with adjustment for age and sex. Parents who did not answer the nut allergy questions about their child in the HSQ were included in the denominator when calculating the prevalence rate, but were excluded from comparison analyses. The NAQ recorded how parents described their child's symptoms. The category of severe allergy symptoms was defined as collapse/or a hospital emergency visit, asthma or wheeze. The category of moderate symptoms was defined as all other symptoms. The severity of symptoms was compared with parental report of nut consumption and standard nut allergy management practices using chi-square tests.⁷ We used the results from the NAQ to adjust the parent-reported nut allergy rate derived from the HSQ.

All analyses were done using SPSS (version 13.0; SPSS Inc, Chicago, IL, USA).

The ACT Department of Health Research Ethics Committee approved this study.

Results

Prevalence of reported nut allergy and associated factors

In 2005, the HSQ was delivered to all 110 primary schools in the ACT. Parents of 3851 children completed the HSQ (85% response out of 4327). Parents reported that 127 children had allergy to peanuts ever and 69 to other nuts ever. Because 50 children were reported with allergy to both, the overall prevalence of reported nut allergy was estimated as 146/3851 or 3.8% (95% confidence interval 3.2–4.4%) and the prevalence of reported peanut allergy was 3.3% (95% CI: 2.7–3.9%). The 112 (2.9%) children whose parents left the nut allergy questions blank were assumed to have no reported nut allergy.

Table 1 shows more children who had a usual general practitioner (GP) or with a history of breastfeeding reported a strong allergic reaction to nuts compared with those who were not. Furthermore, children who were reported to have a strong allergic reaction had been breastfed for a longer time period compared with children who had not reported a reaction (mean (SD) months ceased breastfeeding 13 (8) vs. 10 (7) months, $P < 0.001$ *t*-test). Table 2 shows that the parents who reported a strong allergic reaction to nuts were also more likely to report all four possible atopic disorders in their child.

Follow-up study

In 2006, 109 parents responded (75% response out of 146) to the follow-up NAQ, 15 parents declined and 22 were not contactable. Importantly, these 109 children did not differ with the non-responding peanut and nut allergy children ($n = 37$) with regard to Caucasian origin, term birth, breastfed or a history of atopy, except that more children who had a usual GP responded than those who did not have a GP (98% vs. 89%, Fisher's exact $P = 0.04$).

Ninety-nine parents (91%) reported their child had a nut allergy, 89 for peanuts and 10 for other nut allergy. There were 11 children for whom the parents denied their child had an allergy to any nut even though there had been a positive response in the HSQ the previous year. In three of these children, the parents believed their child had 'outgrown their allergy'.

Eighty-eight children (81%) were observed by their parents to have symptoms in response to consuming peanuts. Table 3 shows the range of reported symptoms where 43 parents observed one symptom in their child and 45 parents observed two or more symptoms. In 21 children (19%), parents had not observed their child to have symptoms in response to consuming peanut and 13 of these children were currently consuming peanut.

Fifty children (46%) could not eat any quantity of peanut-containing foods without inducing an allergic reaction. In 42 children (39%), parents reported varying amounts of food could be consumed. Fewer parents reported a large amount of peanut could be consumed compared a trace amount before their child experienced symptoms (46% vs. 94%, $\chi^2 = 8.86$ $P = 0.0029$). In 17 children (16%), parents were unsure for of the quantity of peanut containing foods that could be consumed.

Thirty-five children (32%) had been issued an adrenalin autoinjector prescription and six children (6%) had actually used one to treat an anaphylactic reaction (one child had used another child's autoinjector). Among the 74 children who had not been prescribed an adrenalin autoinjector, two children had access to an autoinjector from others in their household. A high proportion of children given an autoinjector had a written allergy plan in place (94%; 33/35).

Twenty-nine children had oral antihistamines available, among which 14 children in addition were prescribed an adrenalin autoinjector. Parents also gave other treatment to 24 children who included: 18 children given multivitamins, four children given fish oil, one child given a laxative, and one child a paracetamol.

Table 1 Odds ratios for reported nut allergy and characteristics of kindergarten children in the Health Screening Questionnaire 2005 (*n* = 3739)

Characteristic of child	Reported nut allergy ('Ever had strong allergic reaction to peanuts or other nuts?')				Odds ratio* (95% CI)
	Total	No 3593	Yes 146	Total 3739†	
Sex of child	Male	1801	79	1880	1.17 (0.84, 1.63)
Age at health screen	5 years	3179	127	3306	1.12 (0.69, 1.81)
Child born in Australia	Yes	3368	137	3505	1.02 (0.51, 2.03)
	Unknown	5		5	
Aboriginal or Torres Strait Islander descent	Yes	79	4	83	1.24 (0.45, 3.44)
	Unknown	16		16	
Child has a usual general practitioner	Yes	3203	139	3342	2.64 (1.16, 6.03)
	Unknown	26	1	27	
Child born over 3 weeks premature	Yes	197	6	203	0.73 (0.32, 1.68)
	Unknown	8		8	
Child was breastfed	Yes	3150	138	3288	2.68 (1.25, 5.77)
	Unknown	17	1	18	
Smokers living the child's home	Yes	858	26	884	0.71 (0.46, 1.09)
	Unknown	369	18	387	
Anyone smoking in the child's home‡	Yes	228	4	232	2.05 (0.70, 6.04)
	No	630	22	652	
	Total	858	26	884	

*Adjusted for age and sex where appropriate (separate logistic regression for each characteristic) and estimated for males versus females and presence of each characteristic (yes vs. no). †Excludes children with missing data on the nut allergy questions. ‡This is a subset analysis of children in the homes of smokers. CI, confidence interval.

Table 2 Odds ratios for reported nut allergy and positive responses to questions on symptoms and disease in kindergarten children in the Health Screening Questionnaire 2005 (*n* = 3684)

Response to health screen question: Has your child . . .	Reported nut allergy				Odds Ratio* (95% CI)
	Total	No 3542	Yes 142	Total 3684†	
Ever had asthma?	Yes	619	53	672	2.79 (1.96, 3.97)
Ever had hay fever?	Yes	531	57	588	3.78 (2.67, 5.36)
Ever had eczema?	Yes	1219	100	1319	4.54 (3.15, 6.56)
Had wheezing or whistling in the chest in the last 12 months?	Yes	472	47	519	3.19 (2.22, 4.59)

*Adjusted for age and sex (separate logistic regression for each question). †Excludes children with missing data for nut allergy, age and atopy questions. CI, confidence interval.

The schools for 102 children (94%) were aware of the child's allergy (one school had given a child an adrenalin autoinjector injection). Eighty-three parents (76%) were aware of any management procedures that the child's school had put into place in order to manage their child's allergy.

There were 39 children (36%) who had experienced an allergic reaction outside the home. The people acting in response to this reaction were 21 parents, eight child-care workers/teachers, six grandparents, three friends and one doctor. Their actions were: 19 children were administered oral antihistamine, seven children were asked to watch and wait for the reaction to

subside, six children visited the hospital, four children used an adrenalin autoinjector injection, two children were induced to vomit and one child had calamine lotion applied.

Two-thirds of parents (66%, 72/109) expressed concern about their child's food allergy. Fewer children currently consumed nuts among parents who expressed concern compared with parents who did not express concern (26% vs. 50%, $\chi^2 = 29.899$, $P = 0.001$). Parents whose child had been prescribed an adrenalin autoinjector were more concerned about their child's allergy than those parents whose child who had not received a prescription (44% vs. 12% $\chi^2 = 23.414$ $P = 0.001$). Parents were

Table 3 Symptoms and management observed by parents in the follow-up Nut Allergy Questionnaire (*n* = 109)

	<i>n</i> (%)
Symptoms observed by parents*	
Hives on skin	50 (46)
Swelling around the mouth, lips or eyes	40 (37)
Asthma or wheeze	33 (30)
Abdominal pain	21 (19)
Collapse/hospital emergency visit	21 (19)
Vomiting	16 (15)
'Hay fever'†	5 (5)
No symptoms observed	21 (19)
Allergy management observed by parents	
Who made the diagnosis?	
Specialist	77 (71)
General practitioner	13 (12)
Parent observation	8 (7)
No comment	11 (10)
Diagnostic test confirmation	
Skin prick test	55 (50)
Allergen-specific blood test‡	10 (9)
Both tests	11 (10)
No test performed	33 (30)
Action plan	
Prescribed EpiPen**	35 (32)
Oral antihistamine available§	29 (27)
School aware of action plan	102 (94)

*Child could have more than one symptom. †Words used by parents to describe nasal symptoms. ‡Radioallergosorbent (RAST) immunoassay blood test. §These were most likely bought over the counter.

**CSL Ltd, Parkville, Australia.

also more concerned if the child had been issued a management plan (40% vs. 15% $\chi^2 = 10.920$ $P = 0.004$). There was no difference level of concern for who made the diagnosis, whether a diagnostic test was ordered, if the child had an allergic reaction outside the home or if the parents were aware of any allergy management procedures in the school.

Table 4 shows that the more severe the symptoms of an allergic reaction to nuts observed by parents, the more likely they were to comply with the recommended management of nut allergy.

Nut allergy prevalence rate estimate adjustment

The follow-up study results were used to adjust the parent-reported nut allergy rate derived from the HSQ. If nut allergy was redefined as 'diagnostic test confirmed nut allergy only' and thus restricted only to those children who had skin prick or radioallergosorbent immunoassay test testing (70%) and weighted to account for the greater likelihood that this 70% came from a sample with a greater proportion of usual GP care (98%) than the entire school entry population sample (89%) (and accordingly may be more likely to have diagnostic testing), then the reported prevalence of diagnostic test-confirmed nut allergy was 2.4% ($=3.8 \times 0.7 \times 89/98$) (95% CI 1.9, 3.0).

Discussion

The rate of parent-reported nut allergy for 5-year-old children in the ACT to any nut and peanut was 3.8% and 3.3%, respectively, with an estimated 2.4% of school entrants having diagnostic test-confirmed allergy. Children with reported nut allergy were more likely to have been breastfed or have a current GP than those with no reported allergy. Further, children with reported nut allergy have had a twofold increased risk of reported hay fever, eczema, asthma or recent wheeze.

Other studies using parental and self-report of nut allergy have found lower prevalence rates in children of 0.34–1.5%^{1,9–11,12–16} than our estimates. A previous South Australian study of school children found a prevalence rate to peanut allergy of 0.35%.¹² Increases in peanut sensitisation over time^{1,2,15} could partly explain the higher prevalence report in our study.

Our study found that breastfeeding history and duration were associated with parents reporting a strong allergic reaction to peanut and nuts. This is consistent with two prospective cohorts with odds ratios for breastfeeding and peanut allergy of over three.^{1,14} However, observational studies cannot fully account for the possible over-representation of 'at risk' children among those breastfed because of a lack of randomisation between the breastfed and non-breastfed groups. That is, the extended breastfeeding may only be linked with peanut allergy because a mother chose to respond to a family history of allergy or early signs of child eczema by breastfeeding for an extended time.

The previously established link between nut allergy and other atopic disease was also demonstrated in this study.^{1,14,16–19} Here, the strongest association was between eczema, and reported peanut and nut allergy was found with an odds ratio of exceeding four. Although this may reflect a common antecedent factor such as genetic disposition, the findings from other studies indicate that other mechanisms could be involved. For example, eczema could increase peanut allergy risk through the use of creams containing peanut oil to reduce eczema symptoms.¹⁴ Further, it is possible that more intensive diagnostic test assessment of children with eczema or atopic disease may have led to a greater detection of peanut sensitisation among such children.

The follow-up study found that most children had been to a doctor to receive a diagnosis of peanut allergy and have an anaphylaxis action plan in place at home and school as is recommended by the Australasian Society of Clinical Immunology and Allergy 2004 guidelines.⁵ Increasing severity of parent-reported symptoms and increasing parental concern about their child's allergy was associated with an increasing likelihood of specialist management.

In our study, teachers encountered only 6% of all children's nut allergy reactions. Many people took various actions such as inducing vomiting or waiting for symptoms to subside. Two Australian studies show that first aid management of anaphylaxis in schools is inadequate.^{4,12} Our study found the adrenalin autoinjector was used rarely in the community.

A strength of this study is that the data describe the prevalence, associated factors and management in a community representative sample of children. Parents may have interpreted the words 'strong reaction' in the screening question to mean

Table 4 Severity of symptoms observed by parents in child compared with parental concern about nutallergy, child's history of nut consumption and management of nutallergy reported in the Nut Allergy Questionnaire, 2006 (n = 109)

	Severity of allergy symptoms observed by parents			P value*
	None n = 21	Moderate n = 46	Severe n = 42	
Parent concerned about food allergy	9 (43%)	30 (65%)	33 (79%)	0.001
Nut consumption				
Child had consumed nuts in past	13 (62%)	43 (93%)	40 (95%)	0.001
Child currently consumes nuts	14 (67%)	21 (46%)	7 (17%)	0.001
Management of nut allergy				
Child seen by specialist	9 (43%)	31 (67%)	34 (81%)	0.001
Diagnostic tests performed	9 (43%)	33 (72%)	35 (83%)	0.001
EpiPen prescription issued	3 (14%)	10 (22%)	20 (48%)	0.002
School aware of action plan	16 (76%)	44 (96%)	42 (100%)	0.001

*P value for Pearsons chi-squared test.

either a reaction to a diagnostic test or a clinical reaction. Misclassification was evident between the 2005 and 2006 surveys because 10% of parents gave inconsistent reports. Some of these children would have outgrown their nut allergy and others may have had reduced levels of sensitisation to peanut.^{20–22} Objective data are not available, but other studies have indicated that questionnaire response alone indicates the number of children likely to clinically react to peanut.¹⁶ A false positive rate – allergy to peanut listed on questionnaire but not proven on challenge – is less than 20%.²³ Our estimate of diagnostic test-confirmed peanut and nut allergy (2.4%) is conservative, in that the question asked about strong allergic reactions to nuts, with missing responses classified as negative.

In conclusion, among a highly representative sample of school entrants, 1 in 30 parents reported their child to have a strong reaction to peanut and nuts and over 1 in 50 children were estimated to have diagnostic test-confirmed peanut allergy. Peanut and nut allergy in children was associated with having been breastfed, eczema, other possible atopic disease and having a GP. The follow-up study found most children had seen a doctor to receive a diagnosis and had an anaphylaxis action plan in place. Increasing severity of reported symptoms following consumption of peanut was associated with an increasing likelihood of recommended management.

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