

Parental perceptions in egg allergy: Does egg challenge make a difference?

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The aim of the study was to determine the effect of an oral egg challenge in egg sensitized children on parental perceptions relating to their child's allergy. A questionnaire was completed by parents for 167 children attending a tertiary paediatric clinic with egg sensitization. The questionnaires included 10 questions concerning parental perceptions of their child's egg allergy. Parental perceptions of those children who had not had an egg challenge ($n = 83$) were compared with those whose children had a positive ($n = 27$) and those with a negative ($n = 57$) egg challenge. A significant difference ($p = \leq 0.02$) was observed between challenge positive (CP) and challenge negative (CN) subjects in reported changes to lifestyle and the fact that more parents in the CN group expected little or no future inconvenience for the child. The responses of parents whose child had undergone an egg challenge differed significantly ($p = \leq 0.005$) from those not challenged with a significant reduction in the following parameters; the effect on out-of-home care arrangements, the perception of being more severe as compared to other common childhood illnesses, whether they found egg allergy to be moderately or very stressful, whether their lifestyle was changed, the expectation of little or no future discomfort for the child and whether others treated the child differently. The performance of an egg challenge was associated with reduced adverse parental concerns. For 6/10 parameters, expectations concerning egg allergy in children who had been challenged were significantly better than those who had never been challenged irrespective of the challenge outcome. The greater certainty provided by the performance of a food challenge may be a positive outcome in both CP and CN children.

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Egg allergic reactions are one of the commonest food allergies in childhood with a prevalence of 1–2% of 2-yr-old infants (1). Egg sensitization, but not necessarily clinical reactivity was found in 0.4% of 7-yr olds (2). There is also a significant proportion of egg sensitized children (approximately 20–30%) attending tertiary hospital-based allergy clinics who fall into the category of having never ingested egg, but having had reactions to other foods and being advised to avoid egg on the basis of RAST or skin test results (3). Egg sensitization frequently resolves with time and egg challenge is commonly performed to document the resolution or to

determine whether a sensitized child is clinically reactive (4, 5).

Significant levels of parental stress and anxiety (6–8) and adverse effects on quality of life (9, 10) have been documented in food allergy. While it has been suggested that the passing of a food challenge may reduce anxiety in the family (11) and a high proportion of parents appear to find the information from a food challenge useful (12), there are no formal studies examining whether food challenges result in reduced parental anxiety or stress and whether these outcomes differ for positive and negative food challenges (12). In this study,

we aimed to determine the effect of an oral egg challenge on parental perceptions relating to their child's food allergy.

Methods

Children who were diagnosed with IgE-mediated egg sensitization were recruited from the allergy data base Children's Hospital at Westmead Allergy Clinic. We enrolled children with a diagnosis of egg allergy or sensitization made by a consultant allergist in 2003 and children who had undergone a formal egg challenge in 2003–07. Children were advised to avoid egg based on an immediate clinical reaction and positive skin-prick tests ($n = 131$) or on the basis of a positive skin-prick test in a child who had never been exposed to egg ($n = 36$).

In 2006/2007, a questionnaire with a parent information sheet and consent form was sent to the parents. A questionnaire was sent to 261 parents. They were asked to complete and return the questionnaire and consent form. They had the option to opt out if they preferred not to participate. Six weeks after the questionnaire was sent, parents who had not responded were contacted by telephone to confirm that they had received the questionnaire. A further questionnaire was sent if required. Another 6 wk later, a reminder letter was sent to parents who had agreed to participate, but had failed to return the questionnaire.

The questionnaire was developed with the input of two paediatric allergist/immunologists (ASK DEC) and a general paediatrician (CWA). It consisted of 46 questions including

demographic data, which covered the clinical features and management of the egg allergy, the impact on family life and issues relating to EpiPen provision.

The 10 questions and possible responses relating to parental perceptions of egg allergy and the impact on family life are listed in Table 1.

Details of initial and subsequent clinical reactions were recorded. Clinical reactions were categorized as grade 1; localized erythema/urticaria, grade 2; generalized urticaria/erythema, angio-oedema and/or gastrointestinal tract symptoms and grade 3; generalized urticaria and/or stridor, wheeze or cardiovascular compromise (3).

Information on dietary advice concerning egg avoidance and the adherence to this advice was obtained. Advice given was categorized into avoiding all food containing egg (avoid all egg), avoiding whole egg, but cooked egg in foods such as biscuits and cakes was permitted (cooked egg permitted), and avoiding any food, which while not known to contain egg, where it was stated that the food may contain traces of egg (avoid traces). Details of adherence were obtained by questionnaire [detailed further elsewhere (13)] and quantified as adhering to the dietary advice all of the time, most of the time, a little bit or not at all. Those considered adherent complied with the given advice all of the time.

Open egg challenges were performed according to the decisions of the consultant allergist/immunologist in charge of the case. The decision to perform a challenge was made by the consultant without knowledge of the patients' partici-

Table 1. Parental perceptions

Questionnaire	Possible responses
1 Does your child's egg allergy affect your out-of-home care arrangements for your child? e.g. childcare, preschool or babysitting?	Yes/no
2 How severe do you feel your child's egg allergy is in comparison to other common childhood illnesses such as fever, otitis media (middle ear infections), bronchitis, diarrhoea?	Less severe/same severity/more severe
3 How difficult is it to manage your child's egg allergy?	Not difficult/little bit difficult/difficult/very difficult
4 How much control do you feel you have over your child's egg allergy?	None/a little/some/a lot
5 How stressful do you find your child's egg allergy?	Not at all stressful/a little stressful/moderately stressful/very stressful
6 How much time do you spend worrying about your child's egg allergy on a weekly basis?	Once a week or less/every 2nd or 3rd day/once a day/more than once/day
7 Has you and your families' lifestyle changed because of your child's egg allergy?	Yes/no
8 In the future, how much inconvenience do you anticipate your child will have due to egg allergy?	Not at all/a little bit/somewhat/a lot
9 Do you find that people treat your child with egg allergy differently than other children because he/she has egg allergy?	Yes/no
10 Do you think other people understand what is needed to care for a child with egg allergy?	Yes/no

pation in the study and prior to the patients being approached to participate. Egg challenge was performed with a modified protocol after Sporik et al. (14). Lightly boiled whole egg commencing with a drop on the buccal mucosa, 1/8, 1/4, 1/2, 1, 2 teaspoons (1 level teaspoon = 5 ml) was administered at 20–30 min intervals to a final dose of 2 level teaspoons (total dose just under 4 teaspoons). One-eighth of a level teaspoon of egg white contains approximately 0.1 g of egg protein. None of the reactions to egg challenge required adrenaline. Subjects who did not react were instructed to continue egg ingestion at home.

Statistical analysis was performed using the GRAPHPAD software quick calcs (GraphPad Software, Inc., La Jolla, CA, USA; <http://www.graphpad.com/quickcalcs/contingency2.cfm>) Fisher's exact test to analyze the significance of association between variables related to parental perceptions and the differing outcomes (no challenge, challenge positive, challenge negative). A two-tailed p-value of <0.05 was considered significant.

The study was approved by the ethics committee at The Children's Hospital at Westmead.

Results

The questionnaire was sent to 261 parents with 199 confirmed that they received. Of these, there were 167 completed questionnaires, a response rate of 83.9% from those known to have received the questionnaire. The questionnaire was completed by mothers in 156 cases, fathers in seven and both in four. There were three categories of patient; those who had never had a challenge ($n = 83$), those who were challenge positive ($n = 27$) and those who were challenge negative ($n = 57$). The subjects were of a similar age at the time of their first reaction to egg and at the time of completing the questionnaire (Table 2).

The answers to the questions relating to parental perceptions and p-values relating to the comparison of the challenge positive and challenge negative are shown in Table 3. The answers in bold for each question were combined and analyzed in a 2×2 contingency table. The challenge negative group reported significantly less change in lifestyle and significantly less expectation of future discomfort and inconvenience for the child. However, in other parameters such as

Table 2. Patient characteristics

	Never challenged $n = 83$	Challenge negative $n = 57$	Challenge positive $n = 27$
Mean age at time of questionnaire (range)	6.1 yr (4.2–9.8)	6.2 yr (2.3–15.0)	7.4 yr (3.3–14.2)
Mean age of first reaction (range)	13.4 months (1–72)	10.7 months (1–27)	13.0 months (2–84)
Mean duration of follow-up since first reaction	5.0 yrs	5.3 yrs	6.1 yrs
Mean age of egg challenge		4.1 yrs	5.4 yrs

Table 3. Parental perceptions in egg challenge positive and egg challenge negative subjects

	*Responses	Challenge negative (resolved allergy) $n = 57$ (%)	Challenge positive (persistent allergy) $n = 27$ (%)	Challenge positive vs. challenge negative (p-value)
Change in out of home care arrangements	Yes	25 (43.9)	15 (55.5)	0.356
Comparative severity	More	18 (31.6)	10 (37)	0.629
Difficulty in managing condition	Difficult	11 (19.3)	4 (14.8)	0.791
	Very difficult	4 (7)	2 (7.4)	
How much control over symptoms	Some	9 (15.8)	8 (29.6)	0.420
	A lot	42 (73.7)	18 (66.7)	
How stressful is the condition	Moderately	11 (19.3)	5 (18.5)	1.000
	Very	6 (10.5)	3 (11.1)	
Time spent worrying	Once a day	5 (8.8)	3 (11.1)	0.179
	More than once/day	6 (10.5)	6 (22.2)	
Lifestyle changed	Yes	21 (36.8)	18 (66.7)	0.018
Discomfort or inconvenience child will experience in future	Not at all	42 (73.7)	4 (14.8)	0.018
	A little bit	8 (14)	13 (48.1)	
Others treat child differently	Yes	21 (36.8)	13 (48.1)	0.350
Other people relate to care difficulties/understand needs of caring for child	Yes	21 (36.8)	13 (48.1)	0.350

*Responses in bold combined and compared in 2×2 table. p-value by Fisher's exact test two-tailed.

Table 4. Characteristics in the never challenged and egg challenged patient groups

	Never challenged n = 83	Challenged n = 84	p-value Fishers exact (two-tailed)
Initial clinical reaction Grade 1 severity	25 (30%)	24 (29%)	0.866
Initial clinical reaction Grade 2 severity	23 (28%)	29 (35%)	0.404
Initial clinical reaction Grade 3 severity	17 (20%)	13 (15%)	0.427
Egg avoidance advised on basis of a positive SPT or RAST to egg with no history of a clinical reaction	18 (22%)	18 (21%)	1.000
One or more reactions subsequent to the initial reaction	29 (35%)	36 (43%)	0.342
Subsequent reaction more severe than initial reaction	5/29 (17%)	8/36 (25%)	0.759
Less severe than initial	11/29 (38%)	10/36 (28%)	0.432
Same as initial	13/29 (45%)	18/36 (50%)	1.000
Dietary advice; avoid all forms of egg all the time	74 (89%)	67 (80%)	0.134
Adhered to dietary advice to avoid all forms of egg all the time	59/74 (80%)	54/67 (80%)	1.00
Epipen prescribed	11 (13%)	24 (29%)	0.022

the number of parents who found the egg allergy moderately or very stressful, there was no difference (30% for each) between the challenge positive and challenge negative groups.

We compared the clinical features of the egg sensitization in those who were challenged with those never challenged (Table 4). There were no significant differences in the severity of the reactions or the incidence of subsequent reactions, the dietary advice given or in adherence to egg restriction. More children in the challenge group had been prescribed an Epipen.

Responses of parents whose child had undergone an egg challenge differed favourably and reached statistical significance from those not challenged (NC) in six of the 10 parameters; the effect on out-of-home care arrangements, the perception of severity as compared to other

common childhood illnesses, whether they found egg allergy to be moderately or very stressful, whether their lifestyle was changed, the expectation of future discomfort for the child and whether others treated the child differently (Table 5).

Discussion

We have documented parental perceptions with regard to egg allergy and whether they differ in challenge positive as compared with challenge negative subjects. There are no published studies of formal quality of life assessments following oral food challenges. Roberts stated that 85% of families felt that information from a food challenge was useful (12) and Perry et al. suggested that passing a food challenge might

Table 5. Parental perceptions in children who had an egg challenge and those who did not

	*Responses	Never challenged n = 83 (%)	Challenged n = 84 (%)	Challenged vs. never challenge (p-value)
Change in out of home care arrangements	Yes	64 (77.1)	40 (47.6)	0.0001
Comparative severity	More	53 (63.8)	28 (33.3)	0.0001
Difficulty in managing condition	Difficult	23	13	0.066
	Very difficult	8 (37.3)	7 (23.8)	
How much control over symptoms	Some	24	17	0.535
	A lot	55 (95.2)	60 (91.6)	
How stressful is the condition	Moderately	31	16	0.005
	Very	12 (51.8)	9 (29.8)	
Time spent worrying	Once a day	11	8	0.174
	More than once/day	17 (33.8)	12 (23.8)	
Lifestyle changed	Yes	67 (78.8)	39 (46.4)	0.0001
Discomfort or inconvenience child will experience in future	Not at all	6	46	0.0001
	A little bit	31 (44.6)	21 (79.8)	
Others treat child differently	Yes	55 (64.7)	34 (40.5)	0.0011
Other people relate to care difficulties/understand needs of caring for child	Yes	32 (38.6)	34 (40.5)	0.874

*Responses in bold combined and compared in 2 × 2 table. p-value by Fisher's exact test.

decrease anxiety significantly (11) although this proposition does not appear to have been more formally examined.

We found that although a negative food challenge was associated with a decrease in reported changes to lifestyle, other parameters were not significantly different, such as those who found the condition moderately or severely stressful. It is perhaps surprising that parental perceptions in those with a negative challenge only differed significantly from those with a positive challenge in two of the 10 parameters. The demonstration to parents either that the child was no longer reactive (negative challenge) or that the child would only develop relatively minor symptoms following egg exposure may have contributed to the lessening of concerns for both possible challenge outcomes. The demonstration to challenge positive subjects that some degree of egg exposure can occur without catastrophic consequences may have eased parental concerns about the risks of inadvertent exposure. Such an interpretation is also consistent with the conclusions of Marklund et al. concerning childhood food allergy that it is the risk of food reactions and measures required avoiding them that are associated with lower quality of life rather than the clinical reactivity induced by food intake (15). However, as we have demonstrated in this study, a number of anxieties may persist or are only marginally changed in challenge negative as compared to challenge positive subjects. In food allergy, steps to alleviate anxiety and uncertainty are not necessarily successful. Thus, Vickers et al. reported that while a comprehensive training package for parents and school staff caring for food allergic children appeared to be successful in relieving the anxieties of the staff, the parents continued to be anxious (16).

The study suggests that food challenges are improving the parental perceptions. We compared the perceptions in those whose children had been challenged with those whose children had not undergone challenge. In this situation, 6/10 perceptions were significantly better in the group who had been challenged and none were worse. There are several possible explanations. First, if parental perceptions were related to the severity of food allergy, the differences between subjects challenged and those NC might be confounded by anxiety of the parents unrelated to challenge status. However, we found that the reactions in the group who were challenged did not differ significantly in severity from those who were NC. Examination of the number of children prescribed Epipens, which may be an additional

marker of parental and or doctor concern, indicates that the never challenged would not be regarded as having a more severe allergy as they had significantly less Epipens prescribed. Second, the decision to challenge was made by the consultant in charge of the case and it is possible that the decision could be influenced by the outcome variables (stress and parental perception of severity) resulting in the children of parents with increased stress or anxiety being less likely to be challenged. In this case, one might expect to see a higher level of dietary stringency of egg avoidance in the never challenged group, which was not observed, and higher levels of avoidance of traces were observed in the challenged than the never challenged group (data not shown). In addition, the adherence to 'avoid all egg all the time' was identical at 80% in the never challenged and challenged groups. However, the study design does not allow this possibility to be totally excluded. A third interpretation is that a significant proportion of parental stress and anxiety concerning food allergy relates to the uncertainties surrounding the diagnosis and possible outcomes and a number of these are resolved by having a challenge. Uncertainties are characteristic of food allergic families(6-8). In support of this interpretation are our previous findings that persistent uncertainty about the seriousness of their child's food allergy and whether they were managing the food allergy with appropriate vigilance were major parental concerns (17). Roberts (12) stated that for many families of food allergic children, the main concerns were uncertainty and lack of information, rather than a fear of the challenge procedure.

Possible criticisms of our study are that an established questionnaire has not been used and that a retrospective design may be subject to recall bias. A disadvantage in using standardized questionnaires is that the contents of the questionnaire may not be as appropriate for the specific issues we were interested to examine. We have utilized questions, which we have found from clinical experience, relevant to patients with atopic disease. Concerning the issue of recall bias whilst this might conceivably affect factual details concerning the cases, the questions relating to parental perceptions related to how the parents felt at the time of completing the questionnaire.

In conclusion, egg allergy has an adverse impact on the family in a number of ways. The performance of an egg challenge tended to reduce parental anxiety or stress. A significant difference was observed between parents of challenge

positive and challenge negative children in reported changes to lifestyle and the fact that more parents in the challenge negative group expected little or no future inconvenience for the child. Some parental perceptions of egg allergy such as the perception of severity as compared to other common childhood illness and whether the parents found egg allergy to be moderately or very stressful were better in patients who had been challenged as compared to never challenged subjects independently of the challenge outcome. It is suggested that the greater certainty provided by the performance of a challenge may be a positive outcome in both challenge positive and challenge negative children.

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