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Validation and Acceptability of Double-Blind, Placebo-Controlled Food Challenges in Children

Venter Carina^{1,2}, Maslin Kate^{1,2}, Patil Veeresh², Grundy Jane², Glasbey Gillian², Raza Abid², Vlieg-Boerstra Berber³, and Dean Taraneh^{1,2}.

1. The David Hide Asthma and Allergy Research Centre, St. Mary's Hospital, Newport, Isle of Wight, PO30 5TG, UK
2. School of Health Sciences and Social Work, University of Portsmouth, James Watson West, 2 King Richard 1st Road, Portsmouth, PO1 2FR, UK
3. Emma Children's Hospital, Pediatric Respiratory Medicine and Allergy, Academic Medical Centre, University of Amsterdam, NL

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Correspondence to:

Dr Carina Venter

School of Health Sciences and Social Work

University of Portsmouth

James Watson West

2 King Richard 1st Road

Portsmouth

PO1 2FR

Tel: +44 (0)23 92 844405 (direct)

+44 (0)23 92 844440 (general)

Fax: +44 (0)23 92 844402

carina.venter@port.ac.uk

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To the Editor,

The Double Blind Placebo Controlled Food Challenge (DBPCFC) is considered the gold standard for food allergy diagnosis (1, 2). It is recommended that active and placebo challenge foods for DBPCFCs are sufficiently blinded in terms of smell, flavour and texture. Difficulties arise with children undergoing DBPCFCs as they may refuse to eat the challenge food or struggle to eat the large volumes required to adhere to internationally recommended dosages (2).

Validated recipes for DBPCFCs have been published (3-5) using paired comparison or triangle testing to compare sensory characteristics of active and placebo foods. Only one previous study (5) has looked at the blinding of challenge foods using children as tasting panellists. While the use of adult tasting panellists may improve the quality of blinding, achieving this high level may require compromise in other aspects (e.g. larger portion sizes or use of strong flavourings). The aims of this study were to validate food challenge recipes for DBPCFCs in children and to determine acceptability of recipes and portion sizes.

We invited children aged 5 -15 years from four schools on the Isle of Wight to participate. Children were excluded if they were diagnosed with food allergy or food aversion. Recipes and challenge doses for peanut, wheat, milk and egg were calculated using international guidelines (2). For each allergen, placebo and active test doses were developed with an acceptable portion size, using optimal matrix ingredients and matching of sensory properties (3). Foods were tested in child-friendly formats; baked egg in a lemon cake, peanut in chocolate biscuits, milk in a fruit mousse and wheat in chocolate cake. The blindness of recipes was tested using a triangle test. This is a forced choice procedure, whereby the taster must detect the “odd” sample (i.e. containing the allergen or not) when given three portions of food in a randomised order (6). The foods were also compared in terms of taste, appearance and smell.

To determine whether participants could distinguish the odd sample from the other two, the critical significant number was identified using the formula $[x = (n/3) + 1.64\sqrt{(2n/9)}]$ (7). We considered that they were not able to identify the odd one correctly if $p > 0.05$ (5). A two-tailed binomial exact test with the probability of 0.5 was used to determine whether participants could correctly identify if the “odd sample” chosen by them contained the allergen or not.

We recruited 70 children (34 female, 36 male. Age range 5-15 years). The results of the study are summarised in table 1. For the peanut recipe, 35/64 (55%) correctly identified the odd sample, indicating that the children were able to identify differences in taste, smell and texture ($p < 0.001$). 26 (74%, $p = 0.03$) also correctly identified that this odd sample either contained/did not contain peanut. 79% of children indicated that they liked the taste of the biscuits and could eat two. For milk, 32/60 (53%) correctly identified the odd sample ($p = 0.001$). 15/32 (48%, $p = 1.00$) correctly identified that this odd sample either contained/did not contain milk. 48% indicated that they could eat a whole portion of the mousse. For wheat, 24/66 (36%) correctly identified the odd sample ($p = 0.322$), 7/24 children (32%, $p = 0.134$) correctly identified that this odd sample either contained/did not contain wheat. 85% indicated that they could eat a whole portion. For the baked egg challenge, 24/61 (39%) correctly identified the odd sample ($p = 0.179$). Nine (38%, $p = 0.307$) identified that the odd sample either contained/did not contain egg correctly. 36 (57%) indicated that they could eat a whole portion of the cake.

In summary, we have managed to test four separate recipes: containing peanut, milk, wheat and baked egg. We were able to validate the wheat and baked egg recipes in an acceptable volume. However we were unable to validate the peanut and the milk recipes. Very interestingly, the ability of the children to correctly identify the odd sample as containing the allergen or not, did not correlate in all recipes with their ability to correctly identify the allergen. As expected, participants reported good acceptability for the chocolate biscuits and chocolate cake, with less acceptability for the fruit mousse and the lemon coconut cake.

It has been proposed that adults rather than children should be used for taste testing. Performing food challenges in children can be a challenge in itself and developing and validating food challenge recipes is expensive and labour intensive. If using panels with children, it is important that they can understand the purpose of the test, can concentrate for a sufficient amount of time and most importantly, be able to recognize and describe different kinds of taste and smell of foods (9). This paper therefore highlights an important point; Can children correctly identify the taste of a specific food (e.g. milk)? It has previously been reported that 8-9 year old children are able to correctly identify a taste as sweet, sour or salty when it was the only taste present, but they performed poorer than adults in correctly identifying components when there were two tastes present (8). This is confirmed by other researchers (9) who report that differences between children and

adults are more likely to reveal themselves with complex (i.e. real foods) rather than simple taste stimuli, however neither of these studies specifically tested to food allergens.

A limitation of the study was that the recipes should have been tested in stages, using adults initially, and recipes adapted accordingly. A strength of the study is that the recipes were tested in children, taking into account the international recommended challenge dosages. In conclusion, we found that testing in children with familiar allergenic foods is feasible, although the quality of the blinding may be somehow compromised compared to adults. We were able to validate food challenge recipes for children containing wheat and baked egg. We were unable to validate recipes containing peanut flour and milk. This suggests there may be a sizeable waste of resources when recipes are not blinded and emphasises the difficulties in developing such recipes, particularly for peanut.

Signed: Venter Carina^{1,2}, Maslin Kate^{1,2}, Patil Veeresh², Grundy Jane², Glasbey Gillian², Raza Abid², Vlieg-Boerstra Berber³, and Dean Taraneh^{1,2}.

1. The David Hide Asthma and Allergy Research Centre, St. Mary's Hospital, Newport, Isle of Wight, PO30 5TG, UK
2. School of Health Sciences and Social Work, University of Portsmouth, James Watson West, 2 King Richard 1st Road, Portsmouth, PO1 2FR, UK
3. Emma Children's Hospital, Pediatric Respiratory Medicine and Allergy, Academic Medical Centre, University of Amsterdam, NL

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