

**Contact allergens in
food ingredients and
additives: atopy and the
hapten-atopy hypothesis**

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Food protein allergy is overwhelmingly seen in atopic patients (1). However, we have recently found that

atopic eczema patients have a reduced incidence of contact allergy to contact allergens/haptens, which are used in both skin products and in food (skin + gut + exposure) but have a normal incidence of contact allergy to allergens/haptens used in only skin products (skin + gut – exposure), suggesting that atopics are more efficient at orally tolerising haptens/contact allergens (McFadden JP, White J M L, Kimber I, unpublished data). This has led us to speculate that allergens/haptens in foods, food additives and antibiotics may compete with proteins for oral tolerance, which may lead to breakdown of normal protein tolerance methods and predispose to development of atopy (the hapten-atopy hypothesis). We have therefore looked at food additives and ingredients of examples of processed food to look for the presence of recorded haptens/contact allergens.

Methods

Published EU permitted food additives ('E numbers') and listed ingredients of examples of processed food were checked for recorded cases of allergic contact dermatitis using 4 main text references from *Contact Dermatitis* and an internet medical reference resource (www.ncbi.nlm.nih.gov/sites/entrez/). The 3 examples of processed food were formula milk, processed meat products/meals and children's lollipop/chew bags, 5 products from each were randomly selected.

Results

E numbers- the number of haptens/suspected haptens found in each category were: colours 14/44 (31.8%); preservatives 18/39 (46.2%); antioxidants 8/15 (53.3%), sweeteners 0/13 (0%), emulsifiers 10/61 (16.4%), and others 14/145 (9.7%).

Processed foods

Formula milk. Median number haptens per formula milk = 10 with a range of 9–12 (e.g. ascorbic acid, choline chloride, tocopherol, pantothenic acid, copper sulfate, thiamine, pyridoxine hydrochloride, potassium iodide, vitamin K, sodium selenite, lactic acid, retinyl palmitate, cyanocobalamin, and potassium chloride).

Processed meat. Median number hapten per pack = 3 with a range of 0–6 (e.g. carmine, spearmint oil, sodium metabisulfite, spice extract, nutmeg oil, garlic, and onion powder).

Children's lollipop/chew bags. Median number haptens = 7 per bag with a range of 4–9 (e.g. gum arabic, citric acid, fumaric acid, quinoline yellow, sunset yellow, indigo carmine, beeswax, carnauba wax, curcumin, glyceryl monostearate, and lactic acid).

Discussion

Chemicals with potential to act as haptens are present in significant numbers in subgroups of 'E number' food additives (except sweeteners) and in all examples chosen of processed food. Our recent finding (McFadden JP, White J M L, Kimber I, unpublished data) that atopic dermatitis patients have reduced incidence of contact allergy to chemicals/haptens with 'skin + gut +' exposure could possibly be explained by confounding factors, as it was a retrospective unselected patch test population, or as a secondary phenomenon to atopic dermatitis. The alternative explanation is that atopic dermatitis patients are 'super-efficient' at orally tolerising haptens and that this process is in competition or antagonistic to oral tolerance of food proteins. This may also affect the generalised immune system predisposing to atopy.

It is of interest to note that the significant rise in atopy noted over the last 40 years coincides with a period where processed food with artificially high chemical content is a staple of most diets in industrialized countries and use of oral antibiotics, which behave as haptens in the gut.

Many of the dietary haptens found are rare or infrequent contact sensitizers. Some haptens may just be weak sensitizers, or some of the rare reports may be false positive. Others may not be routinely used on the skin and exposure leading to sensitization was unusual e.g. choline chloride (2) and potassium chloride (3). Sodium metabisulfite is not an allergen in animal models but clinically in humans can cause sensitization (4). Dietary haptens may not elicit cutaneous reactions commonly if oral tolerising signals are at work. Other possible effects of processed food and modern diets, which may have an effect on oral tol-

erance of food proteins (e.g. change in acidity, low-protein content) are outside the scope of this brief review.

References

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