

REVIEW ARTICLE

Allergy to peanut oil – clinically relevant?

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Abstract

The increasing prevalence of food allergies (especially allergy to peanuts) has led to a discussion of how safe topical preparations containing peanut oil are with respect to allergy.

The major allergens from peanuts are proteins that have been characterized at a molecular level and cloned. Clinical signs of peanut allergy symptoms can be observed on the skin (urticaria), or in the gastrointestinal and/or respiratory tract culminating in cardiovascular symptoms and anaphylactic reactions. In most cases, symptoms are elicited by oral uptake; rarely, a contact urticaria has been described. In vegetable oils, the contents of protein differ depending on the production process: crude oils contain approximately 100 times more proteins than refined oils. This has clear-cut implications for allergic individuals. Quantitative data are available regarding elicitation of symptoms in allergic individuals with a threshold dose of 0.1–1 mg peanut allergen in oral provocation tests. There are anecdotal reports of adverse reactions after topical use of peanut oils. In one epidemiological trial, an association between topical use of skin care products containing peanut oil and the development of peanut allergy was observed; however, the data reflect a retrospective analysis without specifying skin care products containing peanut oil and also without analysing the quantity of topicals used. In contrast, oral tolerance was prevented and allergic sensitization was enhanced in a mouse model using high concentrations of peanut protein. So far, no reliable data are available regarding doses required to induce sensitization against peanut allergen via the epidermal route. A possible induction of sensitization against peanut proteins through contact with the skin via skin care products and the respective protein concentrations is a matter of speculation. Patients with atopic diseases, namely eczema, need appropriate skin care because of the disturbed skin barrier function. The benefit of avoiding damage to skin barrier functions of atopic individuals by the use of peanut protein-containing skin care products seems to outweigh possible risks of sensitization and/or allergy induction against substances contained in those products containing refined peanut oil.

Introduction

The increasing prevalence of allergies worldwide represents a major health problem for modern societies.^{1,2} Over the past decades, allergists and dermatologists have worked together with the authorities to minimize the allergologic risks from products used in daily life, such as food, cosmetics

and skin care products. Declaration and labelling of ingredients are nowadays common to prevent risks for sensitized persons. Therefore, only a precise diagnosis by allergologic testing makes the avoidance of specific triggers possible.²

Food allergy in children has increased in prevalence during the last years. In 2003, Lack *et al.* published new

data of a prospective study on peanut allergy in children.³ Similar data have been observed in Germany.⁴ Animal models showed enhanced allergic sensitization when challenged with high amounts of peanut protein.⁵ This led to a broad discussion on how safe topical preparations (cosmetics as well as therapeutics containing peanut oil) are in respect to allergy.

In general, peanut allergies are more prominent in countries with high peanut consumption. The European Agency for the Evaluation of Medicinal Products (EMA) has recently published a position paper on the allergenic potency of herbal medicinal products containing soy or peanut protein.⁶ In the following, we would like to discuss the immunological findings as well as the clinical experience with the use of peanut-containing products to improve skin diseases.

Peanut allergy: sensitization and elicitation of symptoms

Proteins from peanuts may induce sensitization and can cause type I allergic reactions. The major peanut allergens have been characterized at a molecular level and cloned.⁷ The symptoms of peanut allergy comprise urticarial skin reactions, affection of gastrointestinal and respiratory mucosa as well as angioedema and other clinical signs of anaphylaxis. Contact urticaria may also develop in presensitized persons. Different routes of sensitization have been identified in the past. Cross-sensitivity between peanut and soy proteins are common. Oral exposure to peanuts or foods containing peanuts is the most important route of sensitization. Exposure *in utero* and via breast-feeding as well as consumption of soy products are other possible causes.⁸ Amount and structure of the proteins ingested or applied are the key elements in the complex process of sensitization. The composition of natural vegetable oils (e.g. peanut or soy bean), differ not only in the production process, but also in the content of proteins and their allergenic properties. Crude oils, deodorized oils and completely refined oils differ substantially in protein content. For instance, protein content in refined oils is reduced by a factor of 100 compared with crude oils.^{9,10}

The relevance of this difference was demonstrated in clinical trials, skin and oral provocation tests. In a double-blind controlled trial patients with peanut allergy were orally exposed to crude and refined peanut oil. Ten per cent of the patients had symptoms after intake of the crude oil, none reacted to the refined oil.¹¹ Skin prick tests were carried out in 41 children with a positive *in vivo* or *in vitro* test against peanut. Skin reactions occurred in 15 children tested exclusively with crude oil samples, none to refined oil preparations.¹² Equivalent outcomes have been seen in soy-sensitized persons, who also did not react to a challenge with refined soy oil.¹³

Lack and coauthors discussed a possible route of sensitization through topical use of skin care products containing peanut oil in infancy.³ Data of children treated with such preparations showed a significant independent relation to peanut allergy. However, the data reflect the assessment by a retrospective analysis without specifying peanut oil containing skin care products nor analysing the quantity of topicals used. Furthermore, no questions on peanut consumption during pregnancy or lactation were asked prospectively. Strid and coauthors could show that epicutaneous exposure in a BALB/c mice model induced potent Th 2-type immunity with high levels of IL-4 and serum IgE.⁵ Nevertheless, evidence-based clinical studies in humans in support of a topical route of sensitization as a relevant source for peanut allergy are missing.

Most of the studies dealing with a possible allergenic effect of peanut constituents in topical preparations are anecdotal, retrospective in nature or lack adequate controls, namely matched individuals for relevant risk factors with clearly defined and quantitatively measured use of emollients without peanut ingredients. Furthermore, the influence of possible exposure to peanut allergens during pregnancy and lactation has not been clearly quantified. Undoubtedly, there is a dilemma in studying this question at different levels, namely with regard to quantitative or qualitative aspects and regarding the difference between the sensitization and the elicitation of an allergic response.

With regard to the quantitative aspect ('how much peanut protein is required to induce allergic reactions?'), there are only data with regard to the elicitation. Here, some studies show that probably, below a dosage of 1 mg of peanut allergen no clear-cut allergic reactions occur by oral provocation, except for occasional minor subjective and unspecific symptoms. The situation becomes even clearer when the threshold is set at 0.1 mg: below this dosage no reactions at all have been observed after oral provocation with peanut allergen.¹¹⁻¹³

However, no clinical data are available with regard to the dosages required to induce sensitization against peanut allergen via the epidermal route. Data of the mouse model were generated by estimated application of 100 µg peanut protein on the skin.⁵ Regarding the quantitative aspects, it has been clearly shown that there is a huge difference between crude peanut oil and highly refined preparations that contain only minute amounts of peanut protein.^{9,10} So, this qualitative difference between various peanut preparations has to be taken into consideration.

Peanut oil used in bath oils

Peanut oil (*oleum arachidis*) is extracted from the seeds from *Arachis hypogaea*, a plant of the legume family. It is broadly used in the nutritional (e.g. margarine, salad

dressings) and the cosmetic sector (e.g. soap, creams). In the pharmaceutical industry, it is used as a vehicle for active ingredients in topical, enteral or parenteral preparations. Peanut oil has excellent barrier-restoring and smoothing properties when applied on skin.² To treat dry and very dry skin conditions (e.g. eczema), peanut oil-containing products are key elements.² Especially, bathing in medicinal bath oil containing peanut oil as active ingredient can provide important benefit through restoring barrier lipids.²

Also, in our personal experience of having treated thousands of patients – infants as well as elderly persons – most patients benefited from using bath oils containing refined peanut oil. Not a single case of allergic reaction has ever occurred. In general, peanut oil containing bath oils are well tolerated and considered as a safe treatment modality.²

Risk evaluation with regard to allergy

In evaluating the risk of certain substances with regard to allergy, the distinction has always to be kept in mind between the phase of sensitization (induction of allergy) and elicitation (triggering of symptoms) of allergic diseases. Most of our knowledge only deals with the latter, namely the elicitation phase in humans. There is only little information regarding the sensitization phase during which formerly healthy individuals – with or without a certain genetic predisposition – start to build up a pathogenic specific immune response leading to disease at a later stage. Fortunately, this is not seen in every case. From epidemiological trials we know very well that about 50% of individuals showing positive skin prick tests or raised specific IgE antibodies against environmental allergens do not suffer from actual allergic disease, that is, the individual is sensitized without any clinical signs of allergic disease.¹

In order to study the risk of exogenous factors or substances in the sensitization phase, prospective controlled trials would have to be carried out on a large number of individuals starting in early life, preferably starting at birth. Although there are birth cohorts following children over the first years of life, only few controlled intervention studies have been designed, mostly in the field of nutrition with respect to the effect of breast feeding vs. hypoallergenic formula in early infancy.

To our knowledge, there is no controlled trial comparing the effect of clearly defined topical skin care products in this age group with regard to the development of possible sensitization. The fact that there was a higher incidence of peanut allergy in eczema children does not necessarily allow the conclusion that by topical application of peanut oil-containing products the development of a peanut allergy has been enhanced. Rather the other

way: patients with eczema have an inborn higher risk to develop IgE-mediated sensitization and disease. Naturally, for the treatment of their skin condition they use more topical skin care and therapeutic products, some of them containing peanut oil. We clearly have the problem of the 'chicken and the egg' in analysing these epidemiological studies.

There is a long debate regarding the frequency of contact allergy in atopic eczema. Although some authors report a decreased frequency of contact sensitization in patients with atopic eczema, in some textbooks a higher risk for development of contact dermatitis is mentioned.¹⁴ We studied the frequency of positive patch test reactions against common contact allergens in atopic vs. non-atopic individuals attending the allergy division of a large dermatology department; in both groups the prevalence of positive contact sensitization was 40%. Interestingly, in the detailed analysis there was a difference in that contact allergy to metals (e.g. nickel salts) was more prominent in atopics, whereas contact allergy to topicals (e.g. vehicles like lanolin) applied to the skin was lower than in the non-atopic group.¹⁵

Conclusion

To summarize, there might be an occasional case of an allergic reaction in a peanut-sensitized individual after topical contact with peanut allergen-containing creams or bath oils. However, these events are extremely rare, if at all precisely documented. A possible induction of sensitization against peanut proteins through contact with the skin via a skin care product in humans is still a matter of speculation that should be clarified in further studies.

In general, the treatment of dry skin conditions with topical peanut oil preparations is safe and beneficial when refined oils are used. The risk to induce allergic type I sensitization by applying refined peanut oil-containing products to the skin is – until now – only theoretical and neither substantiated by clinical studies nor case reports.

Patients with atopic disease, especially with eczema, need adequate skin care because of the disturbed barrier function. The risk of inducing damage to these affected individuals by neglecting this very important skin care seems much higher than the speculative risk of an enhancement of sensitization against substances contained in those products.

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