



The National Food Institute conducts research to understand how and why some food proteins induce allergy through the skin.
📄 Skin. National Food Institute

Food allergy may develop through the skin

Food allergy not only develops after ingestion of food. What we put on our skin and in our hair can also cause allergies. The more knowledge we have about how allergies develop, the better the options for preventing and treating them will be. The National Food Institute works to prevent and treat allergies and to promote tolerance.

Millions of people around the world suffer from food allergies, and, in the worst cases, the condition can be fatal. Therefore, the National Food Institute conducts research on how to prevent, treat, and manage food allergy.

When people become allergic, it is mostly - with a few exceptions - the proteins, which people develop allergies towards. The body can create a type of antibodies whose original purpose was to fight parasites. When such antibodies start reacting to foods that are normally harmless, a faulty response has occurred in the body, which then causes the allergy.

Why do people primarily become allergic to certain foods and not to others? The basis of the research is to understand why some food proteins are allergenic and others not. Therefore, the researchers study both the allergenic and tolerogenic properties of proteins - i.e. the properties that contribute to allergy and tolerance development, respectively.

It is important to explore both aspects because this provides the researchers with the knowledge they need to develop new strategies that can prevent and treat allergies. One purpose of the research is to change the structure of a protein, so that the protein may still give us tolerance but not cause allergy.

Scratches and inflammation increase the risk

The Institute's research is conducted through rat experiments. This provides the researchers with the opportunity to examine what happens when the animals are exposed to the given protein for the first time. Almost all research related to the sensitization phase of allergies (where the allergy occurs) is conducted on animals as it is impossible to retrospectively go back in a person's life to see how this person developed the allergy. However, by studying sensitization in the animals, the researchers can obtain knowledge that will help them to prevent and treat allergies.

A number of the Institute's research projects relating to exposure suggest that we are likely to develop allergies through the skin, i.e. when allergenic substances come into contact with your skin from the environment or from the cosmetics we use, including shampoos, conditioners, etc. The researchers are, therefore, working on projects relating to skin sensitization, which focus on examining how and why some food proteins can cause allergy through the skin.

"We know that the nature of the skin affects whether you will develop allergies. If the barrier of your skin is broken, you may be at greater risk. Furthermore, if you have an inflammation

such as in the skin disease atopic dermatitis, you are also more exposed," Senior Researcher and Head of Research Group Katrine Lindholm Bøgh says.

"It would be amazing to have the resources to develop tools and techniques to retrospectively diagnose how the patient has developed his or her allergy: Did the person develop the allergy after food ingestion or through the skin? Such knowledge would be of great significance in respect of both the treatment and prevention strategies, which would make life easier for patients who are predisposed to developing an allergy - or who are already allergic," Katrine Lindholm Bøgh says.

If we haven't eaten it, we shouldn't put it on our skin

How easy or hard it is to become allergic to a substance that we put on our skin is among other things dependant on the properties of the proteins.

Proteins that have been used in a bottle of shampoo may have been modified. The manufacturer of the shampoo may have used processed food proteins which have been made more emulsifying and foaming through hydrolysis. Because the proteins have been modified people may be at greater risk of developing an allergy to it. This is because we have not previously eaten the exact same protein. The immune system sees it as a brand new protein to which the body has not yet developed any tolerance.

Modified food proteins in cosmetic products thus constitute a greater risk than non-modified proteins.

"It is very important that you have eaten a food protein before you put it on your skin. Otherwise, it could cause the immune system to see it as a new substance with various consequences. You can become allergic to a substance when you are exposed to it for the first time, but you are also at risk of losing tolerance to something which you were previously able to tolerate," Katrine Lindholm Bøgh explains.

"From Japan we know examples of people who have used a soap with modified wheat protein and subsequently became allergic to the modified wheat protein, while others also became allergic to non-modified wheat which they tolerated before using the soap," Katrine Lindholm Bøgh says.

Whether a protein can cause an allergy also depends on the context in which the protein occurs. It probably matters whether the protein occurs in a soap, lotion, or oil. Therefore, the researchers are studying what influence the context - or matrix - has on developing an allergy.

Interaction between industry and authorities benefits consumers

The researchers closely collaborate with the industry in respect of testing products and helping to develop innovative solutions.

One example is birch sap, which many people with a birch pollen allergy have started to drink to reduce their allergic symptoms. There is no scientific evidence of the positive effect of birch sap yet, and, therefore, the researchers are testing birch sap by using animal studies to find science-based evidence of the effect of the sap.

Another example is the Innovation Fund Denmark project ALLEVIATE, that aims to develop new products which can prevent cow's milk allergy and treat peanut allergy. The new products would be able to promote people's tolerance to the proteins in food that can cause allergies. The aim of the project is to develop partly ingredients for an infant formula that prevents babies and toddlers from becoming allergic to cow's milk, partly a drug candidate for the treatment of peanut allergy.

The recommendations and risk assessments which the Institute delivers to the Danish Veterinary and Food Administration and the Danish Environmental Protection Agency also help the authorities to decide what ingredients should be allowed in the products on our supermarket shelves.

“**The ambition is** to contribute to fewer people becoming allergic in the long run, that more people can get treatment, and that people with allergies can manage their allergies in an easier way. It would increase the quality of life if allergy sufferers could go to the supermarket knowing which products are safe to buy and use, and which products they must avoid. Moreover, it is our ambition to get a better understanding of the connection between stress and allergy. We know that the risk of developing allergic reactions is greater when we are exposed to the allergen while we are physically or mentally stressed. As both stress and allergy are on the rise, it is obvious and essential to look at the connection between the two phenomena, which both have a negative effect on our quality of life.”

Katrine Lindholm Bøgh

Senior Researcher and Head of Research Group