

# Enzyme in cosmetic products can act as allergen via the skin

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Papain is an important industrial protein-degrading enzyme that is used, for example, in the food and cosmetic industries. When humans or animals come in contact with papain, strong allergic reactions of the skin can be the result, as scientists from the Messerli Research Institute of the University of Veterinary Medicine Vienna, the Medical University of Vienna, and the University of Vienna have found out. Their study was published in the *Journal of Investigative Dermatology*.

Papain is found naturally in papaya and is often referred to as a "plant-based pepsin" in reference to the digestive enzyme pepsin that is present in the stomach. Erika Jensen-Jarolim, Head of the Department of Comparative Medicine at the Messerli Research Institute, and her team researched the effect of papain directly on the skin of mice as well as on skin cells in the petri dish. The cosmetic industry uses papain in exfoliating treatments to remove dead surface skin. There even are enzyme-based shampoos for house pets to clean the fur and make it easier to brush.

## How papain induces allergic reactions

Skin consists of several layers joined via cellular connections called "tight junctions". First authors Caroline Stremnitzer and Krisztina Manzano-Szalai and the project team showed that papain induces a breakdown of these cell-cell junctions. On the skin, papain results in a loss of the barrier function. "After just a short period of time, papain

increased vascular permeability and inflammatory cells infiltrated the skin," Jensen-Jarolim explains. Around two weeks after being exposed to papain, the researchers found antibodies to papain in the mice. These immunoglobulins are the cause of the allergic reaction toward the enzyme. "Exposed mice not only experienced a loss of the barrier function of the skin, but also had a specific allergic sensitization toward papain. The animals developed an allergy," says allergy expert Jensen-Jarolim.

## **Caution is called for with papain-containing products**

But the permeation of the skin barrier does not appear to be a prerequisite for sensitization toward papain. "The enzyme remains allergenic even when its enzymatic function has been blocked," explains Jensen-Jarolim. The disruption to the skin barrier, she says, is essential for the infiltration of other allergens and bacteria. In humans and in animals, diseases of the skin such as atopic dermatitis, commonly referred to as eczema, involve an increased permeability of the skin with a heightened risk for bacterial, fungal, or viral colonisation. Besides genetic factors, allergenic enzymes from external sources may also contribute to the symptoms. It is striking that papain has an enormous structural similarity with one of the most important house dust mite allergens. The authors conclude that sensitization toward these house dust mite allergens follows the same principle. "People with sensitive [skin](#) as well as small children should avoid the enzyme (EC Number 3.4.22.2) as much as possible and observe the ingredients declaration for consumer products as regulated by EU Directive 2000/13/EC," says Jensen-Jarolim.

**More information:** "Papain Degrades Tight Junction Proteins of Human Keratinocytes In Vitro and Sensitizes C57BL/6 Mice via the Skin Independent of its Enzymatic Activity or TLR4 Activation." *J Invest Dermatol*. 2015 Feb 23. [DOI: 10.1038/jid.2015.58](https://doi.org/10.1038/jid.2015.58)

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