

Vitamin A in cattle fodder is could protect against cow's milk allergy

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Cattle fodder enriched with vitamin A can prevent an allergic reaction against milk Proteins. Credit: Georg Mair/Vetmeduni Vienna

Infants can sometimes develop an allergy to cow's milk that usually subsides by adulthood but may increase the risk for developing other

allergic diseases. The allergic reaction can, however, be prevented by two components of cow's milk interacting together, as researchers of the interuniversity Messerli Research Institute of Vetmeduni Vienna, Meduni Vienna und the University of Vienna now describe in a study published in *Scientific Reports*. Loading of the vitamin A metabolite retinoic acid to the important milk protein Bos d 5, also known as beta-lactoglobulin, in cow's milk can prevent an allergic reaction against the protein.

A real milk allergy occurs in about three to five percent of European children and more rarely in adults. The disease is different from lactose intolerance, in which a lack of the enzyme lactase results in the inability to properly break down lactose, a sugar found in [milk products](#). In the case of a milk allergy, the immune system itself reacts with a distinct immune response against the [milk proteins](#). Specialized immune cells are formed which produce antibodies against the milk proteins and so trigger a potentially much more dangerous allergic [reaction](#).

A study of the interuniversity Messerli Research Institute of Vetmeduni Vienna, Meduni Vienna and the University of Vienna has now shown that the components of the cow's milk itself can help to prevent this reaction. The key is that the milk [protein](#) beta-lactoglobulin, a relevant agent for [allergic reactions](#), literally "pockets" a metabolite of vitamin A called retinoic acid. This, however, would require cows to receive a sufficient supply of this vitamin, for example, through an abundance of green fodder.

Loading with retinoic acid transforms a potential milk allergen into a milk tolerogen

If infants become allergic to cow's milk, their bodies produce so-called Th2 lymphocytes. These are specialized immune cells that produce

antibodies to fight milk proteins as part of the immune system. One of the most important of these so-called milk allergens is the protein Bos d 5. Also known as beta-lactoglobulin, it is part of a family of proteins known as the lipocalins. "This special protein family is characterized by molecular pockets that can take in small molecules like retinoic acid, which is a metabolite of vitamin A," explains first author Karin Hufnagl.

"Our study showed that an 'empty' milk protein supports the activation of Th2 lymphocytes and so initiates an allergic chain reaction," says Hufnagl. However, if it, so to speak, pockets the [retinoic acid](#), then the immune cells react moderately, without an allergic immune reaction. "An adequate loading of the milk protein could thus prevent that small children or even adults become sensitized and express a milk allergy," summarizes study leader Erika Jensen-Jarolim.

No artificial supplements: vitamin-A-enriched fodder during milk production is the key

Milk, and above all cow's milk, is an essential food product for most people. For allergy patients, however, it poses a risk. Besides causing a swelling of the mouth or the mucous membranes, other symptoms can include diarrhoea or aggravated atopic dermatitis, and, in rare cases, can even induce an allergic shock. In addition, a cow's [milk allergy](#) carries the risk of other allergic diseases, such as atopic dermatitis or allergic asthma. "A sufficient supply of vitamin A to the milk producers, i.e. the cows, could counteract this effect in which a harmless food protein is converted into a milk allergen," says Hufnagl. It is uncertain, however, whether the positive effect of natural vitamin A shown in the study can also be achieved through dietary supplements. "Artificial supplementation of a diet with vitamins may not achieve the same effect as natural agents and will likely result in inadequate loading of the [milk](#) allergen. It is therefore necessary to supply [vitamin](#) A to an appropriate

extent already during the keeping or feeding of the animals. This can be achieved, for example, by increasing the supply of green fodder. Corresponding follow-up studies must still be carried out, however," says Hufnagl.

More information: Karin Hufnagl et al. Retinoic acid prevents immunogenicity of milk lipocalin Bos d 5 through binding to its immunodominant T-cell epitope, *Scientific Reports* (2018). [DOI: 10.1038/s41598-018-19883-0](https://doi.org/10.1038/s41598-018-19883-0)

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