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THE PRODUCTION OF HYPOALLERGENIC MILK (ВИРОБНИЦТВО ГІПОАЛЛЕРГЕННОГО МОЛОКА)

Чоботарь Д. – здобувачка вищої освіти групи БТ 3/1
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У публікації порушено питання виникнення алергії на коров'яче молоко та актуалізовано проблему виробництва гіпоалергенного молока. Були проаналізовані дослідження вчених щодо вирішення проблеми.
Ключові слова: *корова, молоко, β-лактоглобулін (BLG), ген, геном, діти.*

The publication raised the issue of cow's milk allergy and updated the issue of hypoallergenic milk production. The research of scientists on solving the problem was analyzed.
Key words: *cow, milk, β-lactoglobulin (BLG), gene, genome, children.*

Cow's milk is a food ingredient that is consumed globally because of its rich nutrients such as protein, fat, carbohydrate, and mineral contents. However, cow's milk is also one of the most common foods which usually cause allergic reactions. Cow's milk allergy (CMA) is a common disease in infancy and childhood, and its prevalence approximates 0.3%~3.5% along with rising trend, which severely affect absorption and utilization of nutrients in dairy products.

Although breeding strategies, nutritional management, and quantitative genetics have improved milk yield, these approaches have not led to significant changes in milk composition. With the development of biotechnology, especially in livestock, there will be great opportunities to generate new value-added products for designing milk for human health benefits. Various transgenic cows have been reported for different applications, such as the expression of pharmaceutical proteins, increased milk casein protein, improved resistance to disease, and improved animal welfare.

However, an effective method to reduce the allergic reaction induced by milk has not been developed. Bovine milk contains a variety of allergen proteins such as casein, β-lactoglobulin (BLG) and α-lactalbumin, with the milk whey protein BLG as a major milk allergen. Cow's milk protein allergy affects up to 2-3% of newborns, and the trend is increasing. Different methods have been used to diminish the allergenicity of the BLG, including heating, high pressure, enzymatic hydrolysis and glycation. Although these methods can reduce the BLG allergenicity to a certain extent, the structure and function of other proteins in cow's milk has been damaged which greatly influence the nutritional functions of milk, and the sensitization of BLG is not completely eliminated. By contrast, knocking out the *BLG* gene by gene-editing technology is a more direct approach to completely solve the problem, which is of great significance to the research of hypoallergenic dairy product.

As a result, researchers have attempted to use genetic methods to disrupt BLG production in animals. Knocking out the genes for BLG production could result in animals that produce hypoallergenic milk that doesn't contain BLG.

Genetic approaches are already being attempted for other food allergies. While researchers have had the ability to knock out genes for decades, newer genome editing technologies such as CRISPR-Cas9 and TALENS have made the process more efficient, precise, and easier to use, including in livestock [1].

In a new study, researchers combined cloning techniques with genome editing to create a cow cell line that lacks the genes for producing BLG [2]. They used the same cloning technology used to clone Dolly the sheep, called somatic cell nuclear transfer (SCNT), along with CRISPR genome editing to knockout the genes responsible for BLG production. The researchers thus obtained an embryonic fibroblast cell line lacking the genes responsible for BLG production. Transplanting these cells to recipient animals is expected to create cows without the ability to synthesize BLG, which would thus produce BLG-free hypoallergenic milk [2].

Researchers have previously used a different approach to create cattle producing BLG-free milk. In an earlier study, researchers injected TALENS genome editors into zygotes instead of combining SCNT and CRISPR [3]. They used this approach to generate BLG-knockout calves and showed that they did not produce BLG in their milk. They also characterized the BLG-free milk and showed that there was a slight increase in protein and lower lactose content, although fat and lactose levels remained within the normal range.

These studies indicate that regardless of the specific approach used, genome editing could be a viable technique for producing BLG-free hypoallergenic milk.

As a result, it's unclear when genome-edited hypoallergenic milk will be approved for food use. But certainly for those suffering from milk allergies, it can't come soon enough.

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