

Belgian shepherd dogs seem to have genetic protection against diabetes

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Belgian Shepherd, the Malinois variety. Credit: Carin Lyrholm

A genetic interaction which may protect Belgian shepherd dogs from developing diabetes has been discovered in a project led by researchers from the Swedish University of Agricultural Sciences and Uppsala University. In this breed, the researchers found a novel mechanism of

regulating blood sugar levels via an interaction of genes located on two different chromosomes.

The results were published on May 13 in the journal *PLoS ONE*. The study was led by Associate Professor Katja Höglund from the Swedish University of Agricultural Sciences (SLU) in close collaboration with Dr. Marcin Kierczak and Professor Kerstin Lindblad-Toh from Uppsala University (UU).

Diabetes is a serious health problem in both [dogs](#) and humans. Some dog breeds have an increased risk of developing diabetes, while other breeds are affected very rarely. Diabetes is characterized by a chronic excess of glucose in the blood.

One way to diagnose and monitor diabetes is to measure the concentration of fructosamine in the blood, since this reflects the [blood glucose level](#) over a period of time. The researchers behind the present study have analyzed DNA of more than 500 dogs to see if there are genetic factors that influence the natural variation of fructosamine concentration in healthy dogs.

"To capture this variation in the best possible way, we gathered data from dogs of 9 different breeds, examined in five European countries", says Katja Höglund, a veterinary researcher with special interest in physiologic variation and its genetic background in dogs.

When the nine breeds were analyzed together, the researchers found no association between the dogs' blood values and their DNA. However, when breeds were analyzed separately, the researchers found variations in a region on chromosome 3 associated to fructosamine concentration in Belgian shepherds. Within and close to this region, they found interesting candidate genes, which have previously been implicated in glucose metabolism.

"To better understand why this association is breed-specific, we then looked for areas in the genome where Belgian shepherds clearly differ from other [breeds](#)", explains PhD student Simon Forsberg from SLU, whose research aims at better understanding complex interactions between genes.

During their further investigations the team found a region on chromosome 5 that interacts with the previously identified region on chromosome 3. This provides a plausible explanation to the breed-specificity of the initial finding.

"The interacting region harbors three very interesting genes, but the exact mechanism of the interaction remains to be determined. The Belgian shepherd breed has a low risk of developing diabetes and our findings could be connected to a protective mechanism against the disease. Now we are trying to learn more about this phenomenon", says Dr. Marcin Kierczak, whose research is focused on the development and application of statistical methods to analyze genomic data.

The breed in focus in this study, the Belgian shepherd (of the Malinois variety), is a hard working herding type of breed, closely related to the German shepherd, another breed that rarely suffers from diabetes.

"Dogs need a good oxygen supply and an even blood-sugar level to work hard. Our hypothesis is that dogs with good blood glucose control have been selected in the course of developing the Belgian shepherd, thus creating a breed with a protective trait against development of diabetes", says Katja Höglund.

The Swedish University of Agricultural Sciences, Uppsala University and the Broad Institute has for about ten years had extensive research collaboration where the dog is used as a model animal for hereditary diseases that affect both dogs and humans. Today, there are on-going

research projects concerning around twenty diseases, including [diabetes](#), cancer, immune-mediated diseases, behavior, eye disease and cardiomyopathy in several [dog breeds](#).

More information: "The Shepherds' Tale: a genome-wide study across 9 dog breeds implicates two loci in the regulation of fructosamine." *PloS ONE*, [DOI: 10.1371/journal.pone.0123173](https://doi.org/10.1371/journal.pone.0123173)

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