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THERE IS A GENE DOSE EFFECT FOR CDDY-ASSOCIATED DISC DISEASE RISK IN DACHSHUNDS

This is a Breeder Summary of the paper entitled “[The Relationship Between Radiographic Disc Calcification Score and *FGF4L2* Genotype in Dachshunds](#),” authored by Stacey Sullivan, David Redden, Froydis Hardeng, Malin Sundqvist, Michelle Kutzler.

Study Background: Some traits in animals are determined by genes and these are referred to as genetic traits. Genes are inherited in pairs of alleles (gene copies, with the possibilities being 0, 1 or 2 gene copies). When a gene is “dominant” the trait it controls is present or absent based on the presence or absence of the gene which means that 1 or 2 copies of the gene results in the presence of the trait in the animal. However, some dominant traits show a “gene dose” effect. This means that when an animal has 2 copies, the trait is expressed maximally in the animal, but with one copy, the trait is expressed to a lesser extent.

Chondrodystrophy (CDDY) is a gene that results in short limb length in dogs. It also increases risk of intervertebral disc disease (IVDD). It has been reported to be dominant for both traits (short limb length and IVDD risk). While most dachshunds (85%) have two copies of the CDDY gene, some dachshunds inherit one copy (N/CDDY), and some inherit no copies (N/N).

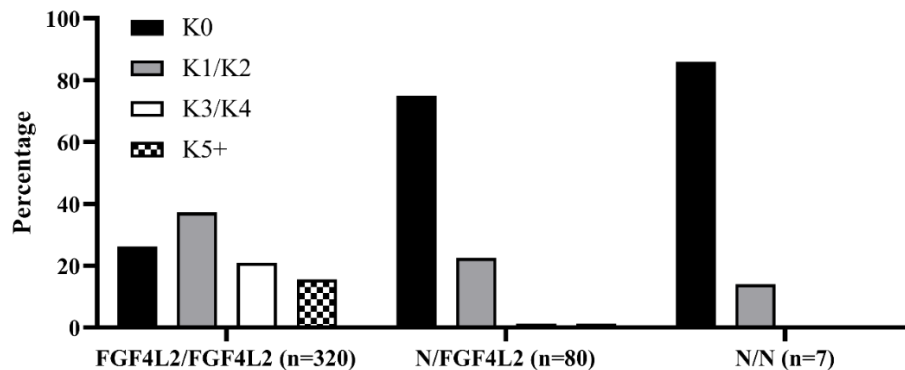
In many countries, dachshund spinal health breeding schemes are in place. These schemes are based on the dog’s Radiographic Disc Calcification Score. To obtain this score, spinal x-rays are taken between ages 2 – 4 years. The number of calcified discs seen on these x-rays is the Radiographic Disc Calcification Score, also known as the K-number (K-n). A dog that is K0 has no calcifications, a dog that is K1 has one calcification, and so on. In the scientific literature, it has been determined that a lower K-n correlates to a lower likelihood of symptomatic disc disease as follows:

K0 = 7% risk of symptomatic disc disease = very low risk
K1 or K2 = 12% risk of symptomatic disc disease = low risk
K3 or K4 = 23% risk of symptomatic disc disease = dachshund breed average
K5+ = 69% risk of symptomatic disc disease = very high risk

Study Questions and Results: There has been some evidence published in the scientific literature that suggests a gene dose effect for CDDY in dogs. This study sought to determine whether there is a gene dose effect for IVDD risk in dachshunds. The authors looked to see whether dachshunds with zero or one copy of CDDY (N/N or N/CDDY dachshunds) have better spinal scores (i.e. lower risk of symptomatic disc disease) than CDDY/CDDY dachshunds. The data confirmed with a high degree of statistical certainty that dachshunds with zero or one copy of CDDY have fewer calcifications (lower K-n) and therefore a lower risk of symptomatic disc disease. In fact, dachshunds in this study with only one copy of CDDY had such good spinal scores that they were similar to dachshunds with no copies of CDDY. However, a limitation of this study is there were only 7 N/N dogs included in the study (due to the rarity

of this genotype). A second larger study that includes more N/N dachshunds would increase the statistical certainty of this finding, but because N/N dogs don't carry CDDY and its associated disc disease risk, it would be expected that all or most N/N dogs will have low K-n (meaning the study conclusions would not change, we would just have more statistical certainty).

The graph below visually represents the finding that dogs with N/N or N/CDDY have much lower K-n scores overall, which is expected to mean less symptomatic disc disease.



Dachshund breeders can immediately employ this data by identifying each dog's genotype for CDDY (FGF4L2) and selecting for mates with at least one N where possible to maximize the likelihood of producing puppies with a lifetime of decreased disc disease risk.

You may not realize you have an "N" dachshund! Because multiple genes are responsible for limb length in dogs, and a different gene (CDPA) that nearly all dachshunds carry is a stronger gene for determining short limb length, N/CDDY dachshunds are indistinguishable from CDDY/CDDY dachshunds. Because there is so little data on the limb length of N/N dachshunds, it is impossible to say whether they appear taller, but dachshunds with only one copy of CDDY are winning in show rings every day!

This Breeder Summary was written by: Stacey Sullivan and Kat Meyers

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