Canine hyperactivity reflected in the blood count

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Determining the blood metabolites in hyperactive and normally behaved German shepherds revealed a significant link between hyperactivity and lower blood phospholipid levels. Credit: Faculty of Veterinary Medicine, University of Helsinki

Professor Hannes Lohi's research group from the University of Helsinki

and the Folkhälsan Research Centre has studied the blood count of hyperactive and impulsive dogs, together with the LC-MS Metabolomics Centre of Biocentre Kuopio (University of Eastern Finland). The results indicate that the metabolites of phospholipids, tryptophan in particular, differ from the blood counts of the control dogs. These results are similar to previous research done on ADHD patients. The study was published in the *Behavioral and Brain Functions* journal on 29 September 2016.

General fearfulness, sensitivity to noise as well as hyperactivity and impulsiveness are the most common behavioural problems in dogs. At their worst, they can have a very negative impact on the wellbeing of the dog and owner alike.

"Behaviour and behavioural disorders often develop as a combination of hereditary and environmental factors, which makes studying them challenging. Metabolomics, or the study of the metabolism, provides us with new clues on the biological issues underpinning behavioural disorders while promoting genetic research. At the moment, metabolomics research in dogs is rare, and the purpose of this pilot study was to examine new approaches and attain information on any metabolic abnormalities associated with hyperactivity in dogs," explains Professor Lohi.

Abnormal metabolic blood test results in hyperactive dogs

Determining the blood metabolites in hyperactive and normally behaved German Shepherds revealed a significant link between hyperactivity and lower blood phospholipid levels.

"We knew to expect this discovery from research on the human side, as

several studies have recorded lower blood lipid and fatty acid levels in ADHD patients than in control groups. However, the causal relationship is not clear and requires further studies, particularly ones with more extensive research data. Our discovery supports the existing belief that human and canine diseases are similar, which suggests dogs can serve as excellent models for human illnesses," states doctoral student Jenni Puurunen.

"It is significant that the dog's age, sex or fasting had little impact on the link between behaviour and metabolites. We also controlled for dietary changes by feeding all dogs the same food for two weeks before testing," explains Puurunen.

Intestinal health can impact canine behaviour

One of the most interesting discoveries in the study was the negative correlation between hyperactive behaviour and the levels of the metabolites of tryptophan, a vital amino acid. This metabolite is only produced when intestinal bacteria process the tryptophan received in food. The discovery suggests differences in the gut bacteria of hyperactive and normally behaved dogs, which is very significant in light of the discovery made a few years ago about the connection between the brain and the intestines.

"We know that the composition of the gut microbiota significantly influences the creation of neurotransmitters, for example, those which regulate mood and behaviour. The effect also works vice-versa, so that a stress reaction in the brain can have an adverse effect on the gut microbiota. Consequently, we cannot tell whether our discovery is the cause of canine hyperactivity or its consequence," Puurunen says.

A globally unique metabolomics project is underway

Earlier this year, Lohi's research group released an article on a study of the metabolomics of fearful dogs, which revealed differences between the blood counts of fearful and fearless dogs. However, more extensive research is required to confirm these pilot-stage findings. The research group has launched an extensive collection of samples to test new metabolomics technology together with the company Genoscoper. If successful, the new system could become a significant tool to speed up genetic research, particularly as it relates to behavioural studies.

The study is part of a more extensive canine behaviour project underway at the research group. The project seeks to determine the environmental and hereditary factors as well as metabolic changes relating to behaviour and behavioural disorders, and map their similarities with corresponding illnesses in humans.

More information: Jenni Puurunen et al, A non-targeted metabolite profiling pilot study suggests that tryptophan and lipid metabolisms are linked with ADHD-like behaviours in dogs, *Behavioral and Brain Functions* (2016). DOI: 10.1186/s12993-016-0112-1

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