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Genetic Canine Aggression
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Abstract:
Canine aggression can pose a serious concern for public and animal welfare. Most of what we know about aggression comes from bite statistics, expert opinions and breed-specific aggressiveness. These sources can often be misleading due to biases toward large or powerful breeds. In this review, I will examine a study that suggests a small number of genes control aggression. In these studies a variety of dogs were used. Canine Behavioral Assessment and Research Questionnaire (C-BARQ) and observation were used to determine the aggressive level of each dog. The dogs used in the study were euthanized and their cerebral spinal fluid (CSF) was examined.

Results:
- 5-HIAA and HVA levels were lower in dominant-aggressive dogs than the control group (Figure 1).
- Median concentrations for 5-HIAA in the aggressive group was 202.0 pmol/ml. The median concentration in the control group was 298.0 pmol/ml.
- Median concentration of HVA in the aggressive group was 318.0 pmol/ml. Median concentration for control group was 553.0 pmol/ml.
- This finding is consistent with studies in humans, non-human primates, and rodents in which low levels of 5-HIAA have been found to be associated with aggressive behavior.

Methods:
- 21 dogs were included in the aggressive group and 19 were included in the control group.
- The dogs were humanly euthanized.
- CSF aliquot no. 2 was used for metabolite analysis.
- Concentrations of 5-HIAA, homovanillic acid (HVA), dopamine, MHPG, norepinephrine were measured with liquid chromatography using electrochemical detection.

Serotonin and Homovanillic Acid Background Information:
5-HIAA is the main metabolite of serotonin. The serotonin transporter (aka SERT or 5-HTT) is a type of monoamine transporter protein that transports serotonin from the synaptic cleft to the presynaptic neuron. Studies in mice show that the length variation in 5-HTTLPR (serotonin-transporter-gene-linked polymorphic region) have been found to partly account for anxiety-related personality disorders and it also alters the expression of 5-HTT. Serotonin has been shown to decrease impulsive behavior.
HVA is associated with dopamine levels in the brain. The dopamine transporter (DAT) gene is known to have a variable number of tandem repeat of polymorphism in the 3’ non-coding region. Differences in the repeats have been shown to affect the expression of the transporter and lead to psychiatric disorders.

Figure 1. Box plot of CSF 5-HIAA, HVA, and MHPG concentrations in 21 dominant-aggressive and 19 non-aggressive dogs ((Reisner, Mann, Stanley, Huang, and Houpt)

Figure 2. Sharky The Pit bull (www.facebook.com/PitBullSharky)

Figure 3. Characteristics of aggression and median CSF 5-HIAA, HVA, and MHPG values of 21 dominant-aggressive dogs (Reisner, Mann, Stanley, Huang, and Houpt)

Figure 4. A high performance liquid chromatography, equipped with a diode array detector, a fluorescence detector, and an electrochemical detector (www.aub.edu.lb)

References