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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 suggest 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.

## 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.

## 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

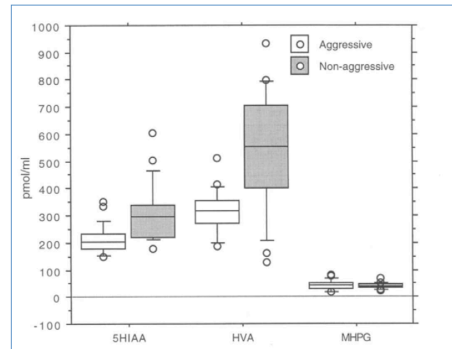


Figure 1. Box plot of CSF 5-HIAA, HVA, and MHPG concentrations in 21 dominant-aggressive and 19 non-aggressive dogs ((Reisner, Mann, Stanley, Huang, and Houpt)



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

| Behavioral category        | Variable                                 | Number of dogs |     | 5-HIAA |       | HVA   |       | MHPG |      |
|----------------------------|--|----------------|-----|--------|-------|-------|-------|------|------|
|                            |  | agg            | non | agg    | non   | agg   | non   | agg  | non  |
| Impulsivity/dishabition    | Bites without warning <sup>1</sup>       | 16             | 3   | 196.8  | 244.0 | 302.0 | 400.0 | 41.0 | 38.8 |
|                            | Lacerates or punctures skin <sup>1</sup> | 17             | 4   | 197.4  | 239.0 | 302.0 | 367.4 | 38.6 | 46.0 |
| Aggression                 | Bites > once per episode                 | 5              | 14  | 207.0  | 212.4 | 330.0 | 321.4 | 39.4 | 45.0 |
|                            | Circumstances are unpredictable          | 15             | 4   | 197.4  | 238.0 | 320.0 | 351.0 | 41.6 | 48.4 |
| Circumstances <sup>4</sup> | Trembles during episodes                 | 10             | 5   | 217.4  | 226.0 | 330.4 | 356.0 | 40.4 | 48.2 |
|                            | Attends to people                        | 9              | 10  | 207.0  | 212.4 | 326.0 | 321.4 | 39.4 | 45.0 |
| Circumstances <sup>4</sup> | Owner present or voice – no contact      | 10             | 5   | 214.6  | 202.0 | 330.4 | 356.0 | 48.4 | 41.6 |
|                            | Positive contact by owner                | 13             | 5   | 223.6  | 202.0 | 330.0 | 318.0 | 46.4 | 38.6 |
|                            | Threatening contact by owner             | 7              | 9   | 234.0  | 207.0 | 326.0 | 335.0 | 46.4 | 48.2 |
|                            | Passive presence                         | 13             | 3   | 202.0  | 226.0 | 326.0 | 356.0 | 41.6 | 48.2 |
| Disrupted while resting    |  | 14             | 3   | 216.4  | 202.0 | 330.4 | 255.0 | 46.4 | 32.6 |

Figure 3. Characteristics of aggression and median CSF 5-HIA, 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)

## Results:

- 5-HIAA and HVA levels were lower in dominant-aggressive dogs than the control group (Figure 1)
- Median concentrations for 5-HIAA in aggressive group was 202.0 pmol/ml. The median concentration in the control group was 298.0 pmol/ml.
- Median concentration of HVA in 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 level of 5-HIAA have been found to be associated with aggressive behavior.

## References

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