Genetic Basis of Nonsocial Fear

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Introduction

Dogs can have fearful reactions to novel stimuli, which results in lowered posture, lowered tails, freezing, barking, etc. (Flint et al, 2018). The genetic basis of nonsocial fear is still unknown. Single nucleotide polymorphisms (SNPs) of various genes have been associated with a number of behavioral differences between dogs (Van Den Berg et al, 2005). Of these SNPs, the rs24602000, which is on the coding region of exon 11 on the gene that encodes for Serotonin Transporters (SERT) in the brains of dogs, is a strong candidate for being related to non-social fear. This SNP has been linked to aggression and impulsive behavior in dogs (Amat et al, 2013). Impulsivity is an intermediary phenotype of anxiety (Holmes, Murphy, & Crawley, 2003), suggesting that changes in serotonin may impact anxiety and fear. Given SERT's role in anxiety and stress responses, we predict our SNP may be related to changes in serotonin reuptake and, therefore, nonsocial fear response in dogs.

Methods

Participants

A convenience sample (n = 6) of dogs known by the experimenters was used. All dogs tested are mixed breeds (M_{Age} = 3.5 years).

Genetic Testing

The serotonin transporter genotypes were determined through the collection of a buccal swab from each dog. From these samples, the DNA was isolated, amplified, and sequenced.

Procedure

- A bubble machine was placed in enclosed room in which distractions were removed.
- 4-5 dog treats were placed next to the bubble machine.
- A video recording device was set up in the room to record the dog's behavior responses to the bubble machine.
- The dog was placed in the experimental area for two minutes.
- The dog's behavior was then scored by two experimenters, who recorded the number of freezes, retreats, lowered postures, lowered tails, flinching, barking, and paw lifts the dog displayed.

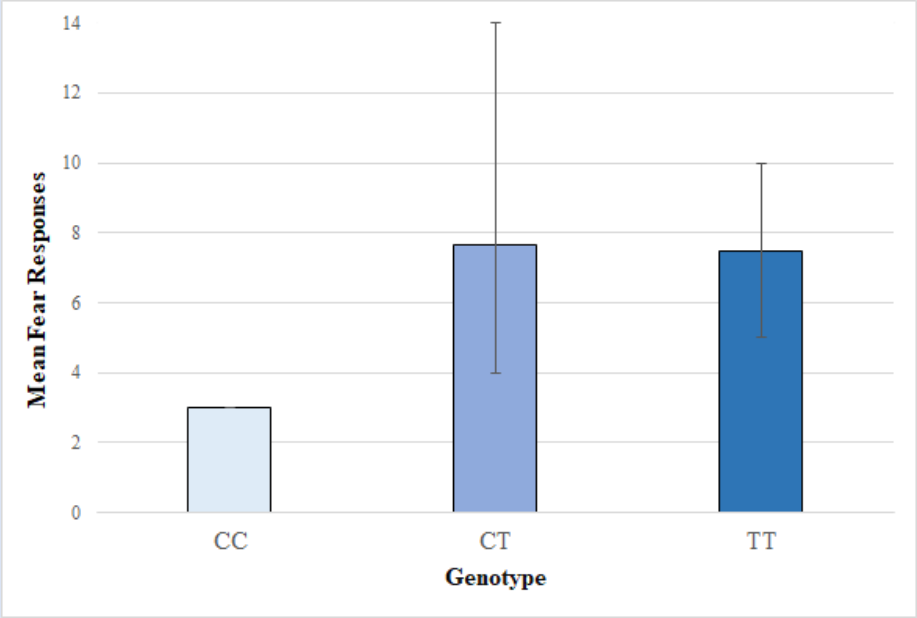

Figure 1. The mean fear response behaviors by the CC (*SD* = 0.0), CT (*SD* = 7.67), and TT (*SD* = 3.54) serotonin transporter genotypes; the 95% CIs are shown for each group.

Results

The sample was overall unfearful of the novel stimulus, displaying few fear behaviors (M = 6.83, SD = 4.26). The trend of the data did not suggest a relationship between the serotonin transporter genotypes and nonsocial fear behavior (see *Figure 1*). A Kruskal-Wallis test supported this trend, showing that there was no significant difference between the serotonin transporter genotypes in terms of their fear behavior ($H(2) = 2.27$, $p = 0.3$).

Conclusion

Based on the results of the study, we cannot conclude that our hypothesis was supported. The results indicated that the most fear responses occurred within the CT genotype, followed by the TT genotype, and lastly by the CC genotype (see *Figure 1*). However, the results also showed that these differences between genotypes were not significant, therefore rejecting the hypothesis. In the future, we would produce the study on a much larger scale. This would allow us to gain a better understanding of the true influence of the SNP on non-social fear in dogs. Future research should examine how this SNP contributes to anxiety disorders among dogs. While this SNP may not have an influence on non-social fear, it may contribute to the development of anxiety or other mental illnesses we see among dogs.