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DRD2 is associated with fear in some dog breeds

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ABSTRACT

Behavioral problems occur frequently in dogs and represent a significant threat to dog welfare. Anxiety, phobias and fears comprise the majority of canine behavioral conditions. The identification of an association between specific behavioral phenotypes and genetic variants of candidate genes would be a valuable tool in selection for dogs less susceptible to anxiety and fear, which may improve animal welfare. The DRD2 gene encodes the dopamine receptor 2. In this study, we found 8 SNPs in the DRD2 gene of the Havanese, a breed that shows large variation in a behavioral phenotype that manifest itself as a tendency to react fearfully by withdrawing in social situations. Significant associations were detected between two SNPs in exon 2 of the DRD2 gene and increased social fear in Havanese dogs (n=158), as evaluated through observation by an external evaluator (respective allelic odds ratio: 4.35, 4.07) and through owner questionnaires (respective allelic odds ratio: 1.96, 2.2). Because different types of fear related behavioral disorders commonly co-occur, the SNPs in exon 2 were also investigated for possible association to noise reactivity in 5 breeds: Havanese (n=121), collie (n=94), Irish soft coated wheaten terrier (n=44), Nova Scotia duck tolling retriever (n=33) and standard poodle (n=29). Significant associations were detected between SNPs in exon 2 of the DRD2 gene and noise reactivity in the Irish soft coated wheaten terrier (respective allelic odds ratio: 2.64, 2.88) and collie (allelic odds ratio: 3.03). The same SNP alleles were associated with the beneficial phenotypes in the three breeds.

Keywords: Havanese, dopamine, anxiety, social fear, noise reactivity, provocative behavioral evaluation

INTRODUCTION

Behavioral problems occur frequently in dogs (Bamberger and Houpt, 2006) and represent a significant threat to dog welfare. Behavioral problems are an important cause of both dog abandonment (Scarlett et al., 1999) and euthanasia (Houpt et al., 1996). In one study from the United States, at least one behavioral reason was recorded for 40% of relinquished dogs and behavioral reasons accounted for 27% of single-reason canine relinquishments (Scarlett et al., 1999). In one set of UK shelters, problematic behavior was responsible for 34.2% of relinquishments (Diesel et al., 2010), which is similar to the 35% calculated for purely behavioral relinquishments in the US (Dolan et al., 2015). The most recent data indicate that 20% of 3.3 million shelter dogs in the US are euthanized (ASPCA, 2018), with dogs with behavioral concerns especially at risk. (Marston et al., 2004) reported that 54% of 4,846 relinquished dogs in three shelters in Australia were euthanized for temperament, aggression or other behavioral problems. Behavioral problems pose the single largest health and longevity threat to modern pet dogs (Dreschel, 2010).

Various types of anxiety constitute a large portion of these behavioral issues, including anxiety in general, various phobias, separation anxiety, noise reactivity and various social and environmental fears. (Bamberger and Houpt, 2006) found that anxiety, phobias and fears comprise well over 20% of cases presented at a large university behavioral clinic. Fear aggression towards owners (5.2%) and

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