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Applied Animal Behaviour Science 107 (2007) 287–298
APPLIED ANIMAL BEHAVIOUR SCIENCE
www.elsevier.com/locate/applanim

Traits and genotypes may predict the successful training of drug detection dogs

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Accepted 6 October 2006
Available online 13 November 2006

Abstract

In Japan, approximately 30% of dogs that enter training programs to become drug detection dogs successfully complete training. To clarify factors related to the aptitude of drug detection dogs and develop an assessment tool, we evaluated genotypes and behavioural traits of 197 candidate dogs. The behavioural traits were evaluated within 2 weeks from the start of training and included *general activity*, *obedience training*, *concentration*, *affection demand*, *aggression toward dogs*, *anxiety*, and *interest in target*. Principal components analysis of these ratings yielded two components: Desire for Work and Distractibility. Desire for Work was significantly related to successful completion of training ($P < 0.001$). Since 93.3% of dogs that passed training and 53.3% of the dogs that failed training had Desire for Work scores of 45 or higher, we will be able to reject about half of inappropriate dogs before 3 months of training by adopting this cut-off point. We also surveyed eight polymorphic regions of four genes that have been related to human personality dimensions. Genotypes were not related to whether dogs passed, but there was a weak relationship between Distractibility and a *5HTT* haplotype ($P < 0.05$).

Keywords: Drug detection dog; Training; Behavioural traits; Genotype

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0168-1591/$ – see front matter
doi:10.1016/j.applanim.2006.10.005

1. Introduction

The dog (*Canis familiaris*) is the oldest domesticated animal. Domestication is estimated to have taken place between 12,000 and 14,000 years ago (Clutton-Brock, 1995), though some estimates suggest domestication occurred as early as 15,000 years ago (Savolainen et al., 2002). From ancient times dogs have served as hunting dogs, guard dogs, herding dogs, army dogs, food, pets, and other roles. Today, some dogs play an active role in our society as guide dogs, drug detection dogs, and rescue dogs.

Previous studies have attempted to develop aptitude measures that are related to successful training of dogs for certain tasks. One study (Wilsson and Sundgren, 1997) showed that, compared to German Shepherds that were not suitable for work as police dogs, German Shepherds that were suitable were rated as higher in 'courage', 'hardiness', 'prey drive', 'defense drive', and 'nerve stability'. In another study Rooney and Bradshaw (2004) showed breed differences in behavioural attributes that are desirable for dogs used to locate explosives, weapons, or drugs; English Springer Spaniels and Border Collies scored significantly closer to ideal levels than Labrador Retrievers and cross breeds for 'agility', 'tendency to be distracted when searching', 'independence—ability to work without constant guidance', 'stamina', and 'motivation to obtain food'.

Studies assessing aptitude for becoming guide dogs have also been reported by Serpell and Hsu (2001) who asked breeders to rate puppies on a questionnaire that later predicted whether dogs would be suitable guide dogs. In addition, Kikkawa et al. (2005) reported that salivary secretory immunoglobulin A (sIgA) concentration, a marker of psychological stress in humans, predicted whether dogs were suitable as guide dogs.

It is also likely that genetic factors influence behavioural traits in dogs and aptitude for various roles. There are more than 400 canine breeds differing in external morphology and behaviour (Hart and Hart, 1985; Bradshaw et al., 1996; Svartberg, 2006), suggesting that genes underlie these morphological and physiological traits (Saetre et al., 2006). Because some breeds are known to be better suited as working dogs, it is possible that genetic differences among breeds underlie this aptitude. In humans, several candidate genes have been reported to have association between their polymorphisms and personality (Catalano et al., 1993; Rubinow and Schmidt, 1996; Ebstein et al., 1997; Reif and Lesch, 2003). Although many studies have examined personality and temperament in dogs (Jones and Gosling, 2005), the genetic contribution to behavioural traits in dogs has not been clarified. We therefore surveyed genes that have been related to human personality dimensions.

Among the genes, the polymorphism of the dopamine receptor D4 gene (*DRD4*) has been related to novelty seeking (Ebstein et al., 1997). In dogs, previous studies have reported the existence of polymorphisms of exon1 (Ito et al., 2004), exon3 (Niimi et al., 1999), and intron2 (Nara et al., 2005) of *DRD4*. In addition, these studies demonstrated that aggression was higher in breeds in which the frequency of long alleles was high than in breeds where the frequency of short alleles was high (Ito et al., 2004).

The serotonin transporter 1A (*5HTR1A*) and serotonin transporter (*5HTT*) genes play a role in anxiety through the signal transduction of serotonin (Lesch et al., 1996; Reif and Lesch, 2003). In dogs, substitution at A808C (Lys/Gln) in *5HTR1A* was identified (van den Berg et al., 2003). We identified two polymorphic repeats [(GAAA)n and (GAAAA)n] in the intron of *5HTT* (Hong et al., 2006). The androgen receptor (*AR*) gene is related to human sexuality and personality (Rubinow and Schmidt, 1996; Jönsson et al., 2001). We have identified two poly-glutamine repeats (Q1 and Q2) in dogs (Maejima et al., 2005).

The use of dogs to prevent the smuggling of illegal drugs began in West Germany after World War II. In present-day Japan, approximately 100 dogs (mostly Labrador Retrievers) serve in this