The Veterinary Journal 197 (2013) 868–872

Contents lists available at SciVerse ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Age, sex and reproductive status affect boldness in dogs

Melissa J. Starling [a,*], Nicholas Branson [b], Peter C. Thomson [a], Paul D. McGreevy [a]

[a] Faculty of Veterinary Science, University of Sydney, NSW, Australia
[b] Deakin Research, Deakin University, VIC, Australia

ARTICLE INFO

Article history:
Accepted 14 May 2013

Keywords:
Dog
Personality
Age
Sex
Reproductive status
Boldness

ABSTRACT

Boldness in dogs is believed to be one end of the shy–bold axis, representing a super-trait. Several personality traits fall under the influence of this super-trait. Previous studies have found that boldness is affected by breed and breed groups, influences performance in sporting dogs, and is affected in some cases by the sex of the dogs. This study investigated the effects of dog age, sex and reproductive status on boldness in dogs by way of a dog personality survey circulated amongst Australian dog owners.

Age had a significant effect on boldness ($F = 4.476$; DF = 16,758; $P < 0.001$), with boldness decreasing with age in years. Males were bolder than females ($F = 19.219$; DF = 1,758; $P < 0.001$) and entire dogs were bolder than neutered dogs ($F = 4.330$; DF = 1,758; $P < 0.038$). The study indicates how behaviour may change in adult dogs as they age and adds to the literature on how sex and reproductive status may affect personality in dogs.

Introduction

The study of personality may offer a framework to explain some of the variation observed in animal behaviour. One of the chief benefits of understanding behavioural variability in animals is improving our ability to predict how individuals are likely to behave (Svartberg, 2003). Such information can be used to modify the way particular animals are managed and trained. In addition, it may inform decisions on the suitability of particular environments they are kept in, and the work they may be used for. Fine-tuning the way we interact with and keep animals at the individual level to best suit that individual's strengths and weaknesses has the potential to improve animal welfare and improve human–animal interactions.

Boldness in dogs has been characterised by trainability, willingness to play with humans, a low reported frequency and intensity of fearful behaviour directed towards humans and dogs, as well as non-social objects or events in previous studies (Svartberg, 2002, 2005; Svartberg and Forkman, 2002). In a second study using the methods described here, we identified one component with high positive loadings on items related to play with humans and other dogs and negative loadings on items relating to avoidance and behaviour indicating fear (Starling et al., 2013). The loadings suggest that the component we identified is similar to that labelled 'boldness' in previous studies (Svartberg, 2002; Svartberg and Forkman, 2002; Svartberg et al., 2005).

The domestic dog (*Canis lupus familiaris*) is one of the most commonly kept animals in Western societies, with 36% of households in Australia including one or more dogs (ACAC, 2010). Dogs often live in close proximity to humans, sharing living spaces in the home and public outdoor spaces for leisure activities and exercise. It is therefore of particular importance to understand our canine companions and manage and accommodate their basic nature and needs. These may change as the dog matures and ages. For example, aging dogs are known to approach cognitive tasks in different ways (Salvin et al., 2011) and may lose behavioural inhibition or the use of their senses as they age (Salvin et al., 2012). These physiological changes may have an effect on perceived personality. It is unknown when personality in dogs stabilises, but previous studies suggest behaviour in dogs under 9 months of age is not strongly indicative of adult dog behaviour in most cases (Goddard and Beilharz, 1986). There are remarkably few studies investigating whether personality in dogs may change as they age beyond early adulthood but prior to old age (Jones and Gosling, 2005).

The effect of sex and reproductive status on dog personality has been assessed in a limited number of studies. There is some evidence to suggest that neutered dogs are more aggressive, more excitable, and more anxious than entire male and female dogs (Farhoody and Zink, 2010). Male neutered companion dogs are believed to be more trainable than male entire dogs (Serpell and Hsu, 2005), and male dogs have been shown to be bolder than female dogs, although this association has not been identified in high performing sport dogs (Svartberg and Forkman, 2002). In summary, the effects of sex and reproductive status on dog personality have not been widely documented or unified in a single

* Corresponding author. Tel.: +61 439 255 918.
E-mail address: mjstarling@fastmail.com.au (M.J. Starling).

1090-0233/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.tvjl.2013.05.019

study. The current study examines the effects of sex and reproductive status as well as age on aspects of personality in the dog.

Materials and methods

Item generation

A survey was developed for dog owners to report on the personality of their dogs. Demographic data were collected on the age and gender of the dog owners, where and when they had obtained the dog, and how long they had owned it. Survey items were drawn from the Canine Behavioural Assessment and Research Questionnaire (CBARQ) (Hsu and Serpell, 2003) and guided by previous work by Svartberg on boldness in dogs (Svartberg, 2002, 2005). CBARQ has been validated by correlating survey answers with professional diagnoses of behavioural problems (Hsu and Serpell, 2003). For the current questionnaire, items from CBARQ that may be associated with boldness or shyness and indicated by everyday dog behaviour were retained, with the exception of stranger-directed aggression. This factor has been shown to have a low loading on the component associated with boldness and was not strongly associated with aggressiveness in everyday life (Svartberg, 2005).

It is possible that aggressiveness as a trait is unrelated to the shy–bold axis (Scott and Fuller, 1965; Svartberg, 2005) or that it can be readily expressed at either end of the spectrum since aggression can emerge in bold dogs that are motivated to guard and shy dogs that are pushed to defend. Items not found to be associated with boldness and shyness were also excluded to focus on items most likely to be predictive of future behavioural tendencies. In addition, because Svartberg (2002, 2005) showed that separation-related behaviour, predatory behaviour, owner-directed aggression, and dog-directed behaviour in the home environment had no correlation with the Swedish Working Dog Club Dog Mentality Assessment (DMA) personality traits, and to that extent were not validated, these items were also excluded.

Additional items covering play behaviour developed by Svartberg (2002, 2005) were included in our questionnaire. It used two forms of five-point rating scales, with different sections using either of those forms. One was a semantic differential-type rating scale as used by Hsu and Serpell (2003) and the other offered a selection of graded options: 'never', 'seldom', 'sometimes', 'usually', and 'always', that referred to the frequency of the behaviour in the recent past.

A further section exploring proactive and reactive behaviour was added to the survey. It included questions developed from reviews of the characteristics of proactive and reactive coping styles (Koolhaas et al., 1999, 2010; Coppens and de Boer, 2010). These questions used the semantic differential-type 5-point rating scale on which respondents were asked to rate the intensity of their dog's behaviour ranging from 0, where the behaviour was not observed, to 4, where the behaviour was extreme.

Participants

The survey was circulated via Australian Internet forums and e-mail lists with a focus on domestic dogs. Respondents were sought exclusively from Australia to avoid international variables being introduced into the results. Respondents were 18 years or over, and under 80 years in age, and were asked to report on a dog with which they lived. They were requested to complete additional surveys for additional dogs if they lived with more than one.

Statistical analysis

Statistical analyses were carried out with the program R (R Development Core Team, 2011). Mean substitution was used for missing data as per Svartberg (2002, 2005), and surveys with more than five missing responses were not used. A principal components analysis (PCA) was run on the results from the survey. The number of components extracted was determined by the scree plot method, as there was a clear division in the scree plot.

The component extracted from the PCA was subjected to further analysis using linear mixed models using the 'lme' function in *R* and was used as a boldness measure. Fixed effects included dog gender, age, reproductive status, and United Kennel Club (UKC) breed group, owner gender, owner age group, and dog's origin. Breed was considered a random effect nested within the fixed effect UKC Breed Group. Terms were first tested for significance using the *t* test or 'ANOVA' function in *R* and, if they were significant, added to a linear model. The terms in the models were tested using the 'ANOVA' function, comparing the linear model containing the new term with a linear model excluding the new term. The Akaike Information Criterion (AIC) value was also used to assess the model-of-best-fit. The UKC breed groups included Companion, Guardian, Gundog, Scenthound, Herding, Terrier, Sighthound/Pariah, and Northern and Spitz groups. UKC breed groups are closest to the international convention adopted by Fédération Cynologique Internationale (FCI), but use fewer groups. The reduced breed groups better suited the smaller number of breeds in the current study.

The linear mixed model was then compared to the linear model containing all significant fixed-effect factors using a likelihood ratio test using the 'ANOVA' function in *R* to assess the significance of the random effects in the model. Dogs of mixed breed heritage were assigned to a breed group called 'mixed' if their breed composition was unknown or only one parent was known. Where all breeds listed in the makeup of a mixed breed individual belonged to the same UKC group, the dog was categorised as also belonging to that UKC group. Otherwise the individual was categorised as 'mixed'. Dog age, sex and reproductive status were entered into the model as fixed effects.

Results

Principal components analysis

The survey generated 1054 responses that could be used. The PCA produced one major component (PC1) called 'boldness' that accounted for 21.4% of the variation. The retained component was characterised by high loadings on factors relating to play and sociality and negative loadings on avoidance and other behaviours indicating fear. Although this component had much in common with the over-arching personality called 'boldness' in other studies (Svartberg, 2002, 2005), it has not been validated with behavioural measures.

Linear regression

The model-of-best-fit included five terms: age (in years), sex, reproductive status, breed, and breed group. Age and gender of the owner were not significant, and nor was origin of the dog or age of the dog when acquired. So, these terms were not included in the final model. The estimated regression coefficient and related output of the model-of-best-fit is shown in Table 1. Boldness in general decreased with age (Fig. 1) ($F = 4.476$, numDF = 16, denDF = 758, $P < 0.001$). Age was treated as a categorical variable and is presented as such here to enable better comparison with studies where dogs are pooled into age groups (Kubinyi et al., 2009).

Male dogs were bolder than female dogs (Fig. 2a) ($F = 19.219$, numDF = 1, denDF = 758, $P < 0.001$), and entire dogs of either sex were bolder than de-sexed dogs of either sex (Fig. 2b) ($F = 4.330$, numDF = 1, denDF = 758, $P = 0.038$). An interaction between sex and reproductive status was tested and revealed no significant interaction. Nor were there any significant interactions between breed group and age. In most cases, there were no correlations between breed group and sex. The exception was a significant correlation between the Scenthound group and sex (male) (regression coefficient = −3.315, SE = 1.511, DF = 752, $P = 0.029$), where numbers were low ($n = 9$). Further analysis of breed and breed group will be discussed in a future publication.

Discussion

The results of the current study complement those from a previous report by Kubinyi et al. (2009) that found that male dogs were bolder than female dogs and younger dogs of both sexes were bolder than older dogs. The current study showed a significant negative correlation between age of dogs and boldness: boldness scores decreased as the age of the dog increased.

Published personality and temperament studies in dogs have a strong focus on animals under 2 years of age, possibly because such studies are often aimed at improving methods of selecting individual dogs for training programs to become working dogs, for example for police, military, or guide dogs (Jones and Gosling, 2005). Conversely, there has also been some focus on aging dogs, generally $\geqslant$10 years, that may be subject to canine cognitive dysfunction (Neilson et al., 2001; Chan et al., 2002). So dogs between these age groups are poorly represented in personality studies.

In the Australian pet dogs sampled, a shift was found towards the shy end of the shy–bold axis as the dogs aged. Until the age