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RESEARCH PAPER

A prospective study of breed differences in the thermal pain sensitivity of dogs

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Abstract

Objective To compare the thermal nociceptive thresholds (TNTs) of dogs from three working/sport breeds.

Study design Experimental prospective study.

Animals Thirty healthy adult dogs of mixed age, sex and reproductive status, 10 of each of three breeds: Harrier Hound, Greyhound and New Zealand Huntaway.

Methods On one day of each week for 4 weeks, unrestrained dogs were tested six times. TNTs were measured using a remotely activated device comprising a thermode attached to the thoracic limb, controlled by a microprocessor attached to the animal. Latency to exhibit behaviour indicative of nociception after initiation of heating and the temperature of the thermode at the point of behavioural response were measured. Linear mixed-effects models were fitted to the data, with dog included as a random effect, initial thermode temperature as a covariate and day, week and breed as fixed effects.

Results Initial thermode temperature significantly affected dogs' latency to respond ($p < 0.001$). Breed had a significant effect on both latency to respond and response temperature. Huntaways took longer to respond than Harriers or Greyhounds. For example, when the initial thermode temperature was 30 °C, Huntaways took 39.0 seconds to respond compared with 35.8 seconds for Harriers and 36.8 seconds for Greyhounds. Huntaways also responded at higher temperatures (mean ± standard deviation: Huntaways 49.7 ± 1.3 °C, Harriers 48.4 ± 1.6 °C and Greyhounds 48.7 ± 1.6 °C).

Conclusions and clinical relevance Huntaways appeared to be less sensitive to thermal pain than the other breeds. Such information could be used by researchers and clinicians to better understand the generalizability of data gathered from a specific breed to the wider canine population or to tailor more effective pharmacological approaches to pain management in dogs.

Keywords breed, dog, thermal pain sensitivity.

Introduction

Within mammalian species, sensitivity to pain may vary because of several inherent factors including genetic relatedness, for example, breed or strain. In particular, many rodent strains selected to exhibit differences in behavioural or physiological traits also show differences in pain sensitivity (e.g., LaCroix-Fralish et al. 2007), and various indicators of pain sensitivity are moderately to highly heritable in laboratory rodents (e.g., Mogil et al. 1999). However, there are no known investigations of intraspecific differences in pain sensitivity relating to dog breed.

The domestic dog as a subspecies (*Canis lupus familiaris*) is extraordinarily diverse, with over 1000 breeds in existence worldwide (Morris 2008). Modern breeds exhibit not only morphological, but also behavioural, physiological and metabolic differences (reviewed by Fleischer et al. 2008; Mehrkam & Wynne 2014), some of which may influence inherent pain sensitivity or its expression. Alternatively, breed differences in pain sensitivity may contribute to observed differences in working utility or behavioural phenotype (Arnott et al. 2015).

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Baseline pain sensitivity is commonly characterized using nociceptive threshold testing, which involves application of a quantifiable stimulus until a response, usually behavioural, is observed (Love et al. 2011). The minimum stimulus intensity at which the response occurs is taken to reflect the animal's pain sensitivity (IASP Task Force on Taxonomy 1994). Thermal nociceptive threshold (TNT) testing involves stimulation of peripheral thermal nociceptors by heating or cooling the skin (Le Bars et al. 2001). In dogs, TNTs have been reliably measured using a radiant heat source (Wegner et al. 2008; Williams et al. 2014) and a thermode in direct contact with the skin (Hoffmann et al. 2012); two of these studies were undertaken on Beagles and one included a variety of dog breeds.

The aim of this study was to evaluate thermal pain sensitivity in three breeds of dog: two hunting/sport breeds (Harrier Hound and Greyhound) and one livestock herding dog (New Zealand Huntaway).

Materials and methods

The study was conducted at Massey University, Palmerston North, New Zealand in November and December 2014. All procedures were approved by the Massey University Animal Ethics Committee (protocol 14/77).

Animals

Thirty healthy adult dogs were used in this study, 10 of each of three working/sport breeds: Harrier Hound, Greyhound and New Zealand Huntaway (Table 1). The breeds were chosen because of the availability of appropriate numbers of animals and because of similarities in the housing and management of the sample populations. Most of the Harriers had been gifted to the research colony because they were considered unsuitable for hunting use (e.g., inappropriate behaviour during the hunt). The Greyhounds were managed as a colony or kept as pets;

Table 1 Breed, sex, reproductive status, approximate age and source of dogs and distance travelled to research testing facility

Breed	Dog	Sex/Status	Age (years)	Source	Distance travelled (km)
Harrier	H1	M/N	3	MU research colony	1
	H2	M/N	4	MU research colony	1
	H3	M/N	6	MU research colony	1
	H4	F/E	3	MU research colony	1
	H5	F/E	4	MU research colony	1
	H6	F/E	5	MU research colony	1
	H7	F/E	6	MU research colony	1
	H8	F/E	7	MU research colony	1
	H9	F/E	9	MU research colony	1
	H10	F/E	10	MU research colony	1
Greyhound	G1	M/N	2	Private owner A	44
	G2	M/E	3	Private owner A	44
	G3	M/N	6	Private owner A	44
	G4	M/N	8	Private owner A	44
	G5	M/N	9	Private owner A	44
	G6	M/N	6	Private owner B	28
	G7	F/E	3	Private owner A	44
	G8	F/E	5	Private owner A	44
	G9	F/E	9	Private owner A	44
	G10	F/E	4	Private owner B	28
Huntaway	HW1	F/E	<1	Private research colony	19
	HW2	F/E	3	Private research colony	19
	HW3	F/E	4	Private research colony	19
	HW4	F/E	5	Private research colony	19
	HW5	F/E	5	Private research colony	19
	HW6	F/E	5	Private research colony	19
	HW7	F/E	5	Private research colony	19
	HW8	F/E	6	Private research colony	19
	HW9	F/E	8	Private owner A	44
	HW10	F/E	8	Private owner A	44

E, entire; F, female; M, male; MU, Massey University; N, neutered.

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