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Repetitive behaviour in kennelled domestic dog: Stereotypical or not?

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HIGHLIGHTS

- The majority of 30 kennelled dogs showed repetitive behaviour when stimulated.
- These dogs could be divided into four groups, based on their repetitive behaviour.
- There were significant differences between groups in their response to a stressor.
- Dogs which behaved repetitively when unstimulated responded atypically to stress.
- Connections between repetitive behaviour and wellbeing in dogs need further study.

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ABSTRACT

Repetitive behaviour is common in kennelled dogs, yet its motivational basis remains relatively unexplored. We examine the repetitive behaviour of 30 kennelled working dogs in ten contexts both coinciding with, and in the absence of, commonly occurring arousing stimuli, such as care staff, other dogs and food preparation. A large proportion (93%) of subjects performed some repetitive behaviour, most commonly bouncing, but only 17% in the absence of the arousing stimuli. Subjects could be divided into four groups according to the stimuli eliciting, and the duration, of their repetitive behaviour, and these groups were compared on the basis of their cortisol response to an acute psychogenic stressor — a veterinary examination. Urinary cortisol/creatinine response curves differed significantly between the groups. In particular, those dogs which performed repetitive behaviour at times of minimal stimulation, showed a distinctly different pattern of response, with cortisol levels decreasing, as compared to increasing, after the veterinary examination. We conclude that dogs showing repetitive behaviours at times of high arousal are motivationally distinct from those "stereotyping" in the absence of stimulation. We suggest that those dogs showing spontaneous repetitive behaviours may have past experiences and/or temperaments that affect both their reactions to a veterinary examination and to long-term kennelling. For example, some dogs may find isolation from humans particularly aversive, hence affecting their reactions both to being left in a kennel and to being taken to the veterinary surgeon. Alternatively, such dogs may have atypical responsiveness of their hypothalamic–pituitary–adrenal (HPA) axis, possibly brought about through chronic stress. High levels of repetitive behaviours in response to inaccessible husbandry events may be explained if such behaviour has inadvertently been reinforced by attention from staff, and therefore may not always be indicative of aversion to kennelling or compromised welfare.

1. Introduction

Repetitive and invariant behaviour patterns, with no obvious function or goal, are often defined as stereotypical [1]. At the population level, such behaviours are commonly thought to indicate poor welfare, since they develop in situations where an animal may be frustrated, stressed, fearful, restrained or lacking stimulation and higher incidence is usually seen in environments where other indicators of poor welfare co-occur [1]. However, at an individual level, within a given environment, stereotypies often occur in individuals which are "better off" and show fewer concurrent symptoms of poor welfare than their non-stereotyping counterparts, as their performance may help animals to cope [2]. Therefore the use of stereotypical behaviour as an indicator of welfare, needs to be interpreted with caution, as whilst the presence of such behaviour in a given environment is cause for concern, those individuals showing the highest levels, are not necessarily those suffering the most.

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Studies of stereotypic behaviour in captive farm, laboratory, and zoo animals have increased dramatically in recent years [3], and have started to methodologically investigate causation as well as form. However, large numbers of companion animals, and in particular dogs, are kept in confinement, and very commonly exhibit repetitive behaviours; up to 46% of kennelled dogs have been observed to exhibit repetitive behaviours [4] on average for over 30% of the observed time [5]. However, systematic study of the causes of repetitive behaviour in this species is currently sparse.

A number of authors have interpreted repetitive behaviour in kennelled dog as indicative of compromised welfare [6–9], and chronic stress [10,11]. Behaviours described include repetitive pacing (walking or trotting back and forth along a boundary line), circling (walking or trotting around pen), spinning (turning in a tight circle pivoting about hind legs), and wall bouncing (jumping at wall and rebounding); [12]; all of which have been observed in dogs kept in restricted environments e.g. rescue shelters [7] and laboratories [13]. However, levels reported vary substantially. This is unsurprising given the range of methodologies used and that dog behaviour has previously been shown to differ according to time of day and presence of an observer [14]. One of the defining features of stereotypical behaviours in general is that the behaviour is not only repetitive but also apparently functionless. However, deciding whether a behaviour has a function is often problematic. Therefore, Mason suggests a better distinction may be, between "abnormal repetitive behaviours" and "stereotypical behaviours" the latter of which can be demonstrated to be caused by deficits in housing that induce frustration, whilst causality of the former may be unknown [15]. We question whether every dog observed to perform repetitive behaviours can really be described as stereotypical, and hence whether all these behaviours are indicative of compromised welfare.

Several case studies have described the development and treatment of reportedly stereotypical behaviour in pet dogs [16,17]. Drugs trials using open field tests often report increased stereotypical behaviour, for example in response to L-deprenyl (a treatment for Cushing's disease and senile mental deterioration) [18] and adrafinil (a vigilance enhancing drug); [19] and concurrent with cognitive decline [20]. Population-based analyses investigating why some dogs develop repetitive behaviours, whilst others do not, are rare. It is widely believed that specific repetitive behaviours are more common in certain breeds [17] for example tail-chasing in German Shepherd Dogs [21]. Detailed owner surveys found a reduced prevalence of repetitive tail chasing behaviour to be linked to nutrient supplementation (specifically B6), later maternal separation, neutering, multi-dog households, and the presence of children, but levels did not vary between four breeds (deliberately selected for apparent tail-chasing proneness [22]).

Similar aetiological studies for other repetitive behaviours are currently lacking, and the form and motivation behind repetitive behaviours in kennelled dogs are far from understood. Therefore we systematically studied repetitive behaviours in a population of kennelled working dogs. We recorded behaviour both during periods of high arousal promoted by the presentation of external stimuli, and periods of low arousal, free from human contact and under minimal external stimuli. In the former, we presented stimuli regularly encountered in a kennel environment, such as food delivery and other dogs passing by, known to be particularly arousing. We hypothesised that these would elicit the performance of repetitive behaviour in a majority of dogs, and that the number and type of situations in which dogs performed repetitive behaviour would differ with their motivation and potentially also their welfare status.

We then compared groups of individuals responding in different ways using a physiological indicator of stress, urinary cortisol/creatinine ratio (C/C ratio). C/C ratio is a useful measure of acute stress in kennelled dogs [23,24] with excretion products in urine pooling over several hours [25]. However during chronic stress, absolute levels have given conflicting information and may be unreliable [26,27,9,28]. More reliable information may be obtained by challenging the HPA system and measuring its responsiveness, changes being potential evidence of chronic stress [28]. Whilst studies often suggest that chronically stressed animals become hyper-responsive [28] past studies of children [29] and detailed studies of beagle dogs indicate that chronically stressed animals can be hypo-responsive (e.g. [30]). Challenging the system can be done by administration of secretagogues such as CRH and ACTH (e.g. [30]) or via non-invasive behavioural means. For example, Horváth et al. [31] used a challenge involving an unfamiliar human approaching threateningly, to elicit an HPA response in working police dogs. Here we use a commonly aversive stimulus, a clinical veterinary examination which has been demonstrated to act as an acute stressor for many dogs [32]. We applied this standardised stressor to the thirty dogs and measured their urinary cortisol levels before and at three points post-application, using the same methodology as Gaines [12] based on that validated by van Vonderen et al. [32]. We then compared the physiological responses of the dogs with their repetitive behavioural profiles, to explore potential differences in welfare status.

2. Materials and methods

2.1. Subjects

The subjects comprised thirty male German Shepherd fully trained Police Dogs, six of which were neutered; ages ranged from 18 to 112 months (mean = 4 years 2 months ±2.2 years). The dogs had diverse and unknown original backgrounds, with most procured as young adults by the working dog training establishment (therefore, for the older dogs, time living in kennels could not be estimated accurately, but would presumably have correlated strongly with age). To be included in the study, they must have been resident in their current dog section for more than three months and not be on any prescription medications; dogs receiving dietary supplements (fatty acid, Omegas 3 and 6 or pancreatic enzymes) were included.

2.2. Housing and husbandry

The study took place at a working dog establishment in the UK which had accommodation for forty working dogs in individual wooden kennels each comprising a loose run area (4.8 m^2) and an enclosed resting area (1.4 m^2). The kennels were arranged in two rows facing each other with a central access aisle and access passages at each end and half way up the rows. The whole kennel area was without external walls, but was covered by a metal framed curved roof which also covered adjacent feed preparation and animal treatment rooms. The sound of food preparation, which could be heard throughout the kennels, was used as one of the experimental stimuli, but these areas were not accessed at any other time during the experiment. Three larger loose run compounds were located outside (each including a sheltered area) to provide the dogs with a space for exercise out of their kennels.

Table 1
Schedule of data recording.

Day 1	0700 − ±30 min	Urine sample 1
	1000 − ±30 min	Clinical examination
	1015 − ±30 min (immediately after examination)	Urine sample 2
Possible time of stimulus presentation		
	1215 − ±30 min (2 h after exam)	Urine sample 3
	1245 − ±15 min	Minimal stimulation recording 1
Alternative time of stimulus presentation		
	1700 − ±30 min	Minimal stimulation recording 2
Day 2	0700 − ±30 min	Urine sample 4