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Effect of interactions with humans on behaviour, mucosal immunity and upper respiratory disease of shelter cats rated as contented on arrival

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ABSTRACT

Sustained positive affect may decrease vulnerability to upper respiratory infections in cats admitted to a shelter. Incidence of upper respiratory infections was examined in cats rated as Content upon admission to an animal shelter when provided with or without treatment to sustain contentment. Ninety-six cats rated as Content upon admission were provided with either human interaction, including petting, playing, and grooming, in four 10 min sessions/d for 10 days or were exposed to a control treatment of a human standing in front of the cage with eyes averted for the same period. Changes in emotional state and mucosal immune responses were measured daily in treated and control groups. Infectious status was determined upon admission and on days 4 and 10 using combined conjunctival and oropharyngeal swab specimens tested by quantitative real-time PCR for feline herpes virus type 1, feline calicivirus, *Mycoplasma felis*, *Chlamydophila felis*, and *Bordetella bronchiseptica*. The onset of upper respiratory disease (URD) was determined by veterinary staff based on clinical signs, including ocular or nasal discharge. Treated cats were more likely to remain Content (Incident Rate Ratio [IRR]:1.13, Confidence Interval: 0.98-1.30, P <0.0001) and less likely to be rated as Anxious or Frustrated than Control cats over a 10 day period (IRR: 0.61, 95% CI: 0.42-0.88, P =0.007). Feline secretory IgA (S-IgA) quantified in faeces by ELISA techniques, was greater for Treated than Control cats (1451 Vs 846 μg/g). Within the Treatment group, S-IgA was greater for cats that sustained Contentment throughout the study period compared to cats that became Anxious or Frustrated (1846 Vs 1394 μg/g). An increasing proportion of Control than Treated cats shed pathogens over time (Control 22%, 36%, 61%; Treated 35%, 26%, 32% on d 1, 4 and 10, respectively; P =0.006). Control cats were more likely to develop URD than Treated cats (HR 2.9, CI: 1.30-6.67, P =0.01). Cats that responded positively to Treatment had a lower incidence of URD than negative responders (P =0.02). We conclude that the provision of human interaction treatments to shelter cats can facilitate sustained contentment, enhance secretion of S-IgA, and reduce incidence of URD.

1. Introduction

Humans with a tendency to be happy, pleased, relaxed, and lively are less susceptible to upper respiratory infection when compared to those with less happy dispositions (Cohen et al., 2003), and exposure to pleasant stimuli that induce positive affect stimulates mucosal immune response (Watanuki and Kim, 2005). Research with cats suggests a mechanism and cross species validity, since cats that are Content even in stressful situations show a higher level of secretory immunoglobulin A (s-IgA) than those that are Anxious or Frustrated (Gourkow, 2014a), and treatments that induce contentment also stimulate s-IgA (Gourkow et al., 2014b). This mucosal immune antibody is the first line of defence against pathogens causing upper respiratory tract disease URD (Adédoyin et al., 2007), which are found in high concentrations on shelter equipment, hands and clothing of caretakers (Hurley, 2011). The glue-like substance in the mucosae of the nose, mouth and intestinal tract prevents pathogens from penetrating the epithelial wall (Brandtzaeg, 2003). Conversely, IgA deficiency is characterized by recurrent signs of (URD) in adult humans (Jacob et al., 2008), children (Sandin et al., 2011) and dogs (Felsburg et al., 1985).

Similar to cell-mediated immunity (Mori et al., 2001), the mucosal immune system is affected by emotional states and can be manipulated by behavioural modifications (Ader and Cohen, 1975; Rogers et al., 1976; Wayner et al., 1978). Relaxation therapy stimulates secretion of S-IgA (Taniguchi et al., 2007) and lowers

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incidence of URD (Cohen, 2005; Hewson-Bower and Drummond, 1996; Hucklebridge et al., 2000; Segerstorm and Miller, 2004 Taniguchi, 2007). The growing awareness of the importance of positive affect on respiratory health in shelter cats is reflected in current guidelines and standards for the care of animals in shelters (Newbury et al., 2011). These authors proposed that enhancing emotional wellbeing should hold the same significance as other aspects of animal care, such as nutrition and veterinary care. In humans, social support (positive human interactions) facilitates coping during times of stress and decreases susceptibility to disease (Wang et al., 2003). Even looking at a photograph of a favourite person increases IgA concentration (Matsunaga et al., 2008). In shelter dogs, positive human interactions, including petting, grooming, and walking with a familiar person, reduces cortisol and heart rate (Bergamasco et al., 2010; Coppola et al., 2005; Hennessy et al., 1998). Cats may similarly benefit from such interactions. For example, laboratory cats prefer interactions with humans to playing with toys (De Luca et al., 1992).

The hypothesis that sustained positive affect may be achieved in shelter cats by providing positive human interactions was examined, together with its effects on S-IgA and incidence of upper respiratory infection.

2. Material and methods

This study was approved by the University of Queensland Animal Ethics Committee (CAWE/231/10).

2.1. The shelter and experimental ward

The study took place at the Vancouver Branch of the British Columbia Society for the Prevention of Cruelty to Animals (BC SPCA, Vancouver. Canada). The shelter had six separate housing areas, with a maximum capacity to house 120 cats. The facility also included an isolation area for sick cats and an on-site veterinary hospital. A small room adjacent to the reception area was used for examination and vaccination of incoming cats.

A housing unit located on the second floor of the shelter was used as the experimental ward. This room was maintained at a constant temperature of 20 ± 2 °C, and was naturally lit with the provision of artificial light for 4 h each day. Visitors were discouraged from entering the experimental ward; however, approximately 24 people over the course of the study were provided entry to look for their stray cats. Apart from this, the only people entering the ward were shelter staff, the experimenter and an intern (volunteer research assistant). In common with most shelter environments, some sounds of dogs barking, as well as people walking and talking nearby, were audible to the human ear. The experimental ward included a food preparation area out of sight of the cats. Feed was provided twice daily at 0700 and 1700 h and comprised 70 g of age-appropriate pellets and approximately 30 g of wet food (Science Diet, Hill's Pet Nutrition, Inc. ®/Ô Topeka, KS, U.S.A.). Fresh water was provided ad libitum. Feeding was undertaken by the intern, the experimenter or shelter staff.

The cat housing in the experimental ward consisted of 20 stainless steel cages (76 × 76 × 71 cm). Each was furnished with litter boxes and non-absorbent cat litter (Veterinary Concepts, Wisconsin, U.S.A.), a stainless steel food and water bowl, and a towel for bedding. Each cage was fitted with an infrared camera (Sony CCD25 M crystal-View Super Hi-Res ICR IR Camera SLED w/9-22 mm Vari-focal Lens, Microtech Advanced Technologies Ltd, Vancouver, Canada) mounted at cage height on a rod suspended from the ceiling at 1 m from the cage door. Footage was available for viewing real-time in an adjacent room, and was stored for subsequent analysis.

2.2. Biosecurity

Shelter staff cleaned cages daily by removing all waste, changing bedding, and wiping walls with a clean cloth soaked in water while the cats remained in the cage. Cages were disinfected between cats with a 1% disinfectant solution (Virkon®, Du Pont, Mississauga, Ontario, Canada). Staff and the experimenter sanitized their hands (Microsan™ Antiseptic instant hand sanitizer. DEB Worldwide Healthcare Inc. Ontario, Canada) following each contact with a cat.

2.3. Animals

This study was part of a research project designed to examine the effects of behavioral interventions on mucosal immunity and the respiratory health of cats rated as Anxious, Frustrated or Content upon admission. Between May and November 2010, cats that had been surrendered by their owner or brought in as strays by a humane officer, that were over 6 months old and free of clinical signs of upper respiratory disease (URD) such as mucopurulent nasal and/or ocular discharge, conjunctivitis (uni or bi-lateral), sneezing and / or coughing and injury, formed the pool from which cats (n =250) were obtained for this study. Of the 250 cats, 96 were assessed as Content upon admission and enrolled in the positive human interaction study (Table 1). Of these, 22 cats were taken out of the observation ward before the end of the 10-day observation period. In the Control group 7 cats were redeemed to owners (4,1,1,1 cats on days 2, 4, 5 and 7 respectively) and 7 cats were sent to isolation (3,1,1,2 cats on days 3, 4, 6, 7, 8 respectively). In the Treatment group 6 were redeemed to owners (1, 3, 2 on days 2, 3 and 5 respectively and 2 cats were sent to isolation on days 8 and 9, respectively.

Nine cats were sent to isolation for medical reasons and 13 were redeemed by their owner. Of the 74 cats that remained in the study for 10 days or more, 56 were adopted (average days to adoption = 31), 2 were euthanized (average days to euthanasia = 37) and 16 went to isolation (average days to isolation = 17). The 74 cats that remained in the experimental ward for 10 days were transferred by staff to an adoption area afterwards. The health and fate of all study cats still in the shelter was monitored for up to 40 days.

2.3.1. Physical examination, viral and bacterial cultures

Upon admission, cats were examined by a certified animal health technician (AHT) to determine the presence of clinical signs of upper respiratory disease such as mucopurulent nasal and/or ocular discharge; conjunctivitis (uni or bi-lateral) sneezing and / or coughing and injuries. They were vaccinated (Fel-O-Guard+3 Boehringer Ingelheim Ltd., Burlington, Ontario, Canada) and dewormed (Strongid® T. Pfizer, Quebec, Canada).

Cats were also examined daily by an AHT. Those with clinical signs of URD were sent to a medical isolation ward for treatment. Ocular and pharyngeal swabs were taken immediately following intake examination (Day 0) by the AHT. Subsequent swabs were obtained on days four and ten for all study cats still at the shelter, which did not apparently adversely affect their mood (which we defined as a persistent emotional state over 24 h). Saliva samples were analysed by real-time PCR assays (PCR oligonucleotides and protocols, IDEXX, Westbrook, Maine, USA, Burns et al., 2011). Each test used a fluorescent probe that matched with a unique segment of the organism's DNA or cDNA to ensure high specificity and sensitivity for *Bordetella bronchiseptica*, *Chlamydophila felis*, *feline calicivirus*, *feline herpesvirus type 1* (FHV-1), H1N1 influenza virus and *Mycoplasma felis*. Real-time PCR was performed with standard primer and probe concentrations (Roche LightCycler® 480 Probes Master mastermix, Roche Applied Science, Indianapolis, USA), default cycling conditions for the Roche LC480 instrument,