



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(11): 2002-2004
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www.thepharmajournal.com
Received: 10-09-2021
Accepted: 12-10-2021

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Behavioral changes associated with age-related cognitive impairment in geriatric dogs

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Abstract

A questionnaire based survey was conducted on 94 dogs of ≥ 8 years of age for the behavioral changes. Behavioral changes associated with age-related cognitive impairment fall mostly into 5 categories namely disorientation, socio-environmental interaction, sleep-wake cycle, house soiling and physical activity. Age related prevalence of impairment in different categories was recorded. Number of dogs with alteration in one, two, three and four behavioural categories were 31 (32.98%), 39 (41.49%), 18 (19.15%) and 6 (6.38%), respectively. The most impaired behavioural category was socio-environmental interaction (65.96%) followed by sleep-wake cycle (62.77%), general activity (32.98%), house soiling (25.53%) and disorientation (11.70%).

Keywords: cognitive impairment, geriatric dog

Introduction

Geriatric or old age is the most crucial stage that needs special attention. It is manifested with changes in behavioural pattern, accompanied by structural and functional changes at the tissue or cellular levels. Behavioral changes viz., changes in cognitive function, sensation, visual acuity and mobility have been reported in geriatric dogs. Common behavior problems in older dogs include separation anxiety, aggression toward people, soiling inside the house, excessive vocalization and phobias (Landsberg and Araujo, 2005) [6]. Signs consistent with cognitive dysfunction such as disorientation, altered sleep-wake cycles, decreased response to stimuli or decreased activity levels, are quite prevalent in older dogs and cats. These signs become more common with increasing age (Bain *et al.*, 2001 and Moffat and Landsberg, 2003) [2, 7]. The present study was planned to identify and categorize commonly occurring behavior problems in geriatric dogs.

Materials and Methods

The study population consisted of 94 dogs of ≥ 8 years of age presented at TVCC, FVSc & AH, SKUAST-J, R.S. Pura for health checkup, vaccination or treatment. For evaluation of cognitive/behavioral status in dogs, questionnaires were prepared as per Osella *et al.* (2007) [9] (Table 1).

Results and Discussion

Data was obtained for 94 dogs, comprising 61 (64.89%) males and 33 (35.11%) females representing 3 age groups, namely, 8-10 (n=66, 70.21%), 11-13 (n=26, 27.66%) and 14-16 (n=2, 2.13%) years old. The prevalence of behavioural changes associated with age-related cognitive impairment in different categories were recorded and proportion of dogs with impairments in one, two, three or \geq four categories were also observed (Table 2).

Dogs with alteration in one category

Dogs with alteration in one category were 31 (19 males and 12 females) and the age range was 8-10 years whereas weight ranged from 11-49 kg. Out of 31 dogs 12 (38.71%) dogs had alteration in socio-environmental interaction, 11 (35.48%) in sleep-wake cycle and 3 (9.68%) in house soiling. Five dogs (16.13%) had general activity changes.

Dogs with alteration in two categories

Dogs with alteration in two categories were 39 dogs (26 males and 13 females). Age range was

8-12 years whereas weight ranged was 9-43 kg. Twenty nine dogs had alteration in socio-environmental interaction (74.36%), 26 in sleep-wake cycles (66.67%), 7 in house soiling (17.95%), 4 in disorientation (10.26%) and 12 had general activity changes (30.77%).

Dogs with alteration in three categories

Dogs with alteration in three categories were 18 (9 males and 9 females). Age range was 10-13 years whereas weight ranged between 12-39 kg. Out of these 15 (83.33%) had alteration in socio-environmental interaction, 16 (88.89%) had

alteration in sleep-wake cycle, 10 (55.56%) in house soiling, 5 (27.78%) in disorientation and 8 (44.44%) had changes in general activity level.

Dogs with alteration in four categories

Dogs with alteration in four categories were 6 (4 males and 2 females), age ranged between 9-15 years whereas weight ranged from 9-37 kg. Six dogs had alteration in socio-environmental interaction, sleep-wake cycle and general activity (100%), 4 (66.67%) house soiling and 2 (33.33%) in disorientation.

Table 1: Criteria for evaluation of cognitive status in dogs (Osella *et al.*, 2007) ^[9]

Category	Description of the category	No. of items	Description of items
Disorientation (D)	Confusion, altered spatial orientation, failure in recognizing familiar people, surroundings and routines	9	1. Gets lost in familiar location outdoors; 2. gets lost in familiar location indoors; 3. decreased recognition of familiar people outdoors; 4. decreased recognition of familiar people indoors; 5. goes to wrong side of door; 6. goes to wrong door in the house; 7. restless, agitation, wandering in the house; 8. gets stuck, Cannot navigate around or over obstacles; 9. abnormal reaction to well-known objects
Socio-environmental interaction (I)	Altered interaction with people or other dogs, late or no answer to learnt commands	13	Decreased interest in greetings; decreased interest in petting; decreased interest in play with the owners; decreased interest in play with toys; decreased interest in play with other dogs; decreased responsiveness to commands; decreased ability to perform tasks; in need of constant contact; increased irritability; increased aggressiveness toward other dogs outdoors; increased aggressiveness toward household dogs; increased aggressiveness shown by the other dogs
Sleep-wake cycles (S)	Increased daytime sleep, decreased and altered sleep at night	4	Restless at bedtime; switches between insomnia and hypersomnia; restless sleep, waking at nights, pacing and/or vocalizing, without any need to go outside; increased daytime sleep
House soiling (H)	Accidents indoors, loss of urination and/or defecation control with or without incontinence	6	Indoor elimination random sites or in view of owners; elimination in crate or sleeping area; decrease of signaling; indoor elimination on return after going outside; change of substrates for elimination; incontinence
Activity (A)	Decreased purpose activities and increased repetitive aimless activities	7	Decreased responsiveness to familiar stimuli; decreased exploration and activity, apathy; staring, fixation, snaps at air or objects; excessive licking owners, household objects; pacing, wandering, vocalization aimlessly; increased appetite; decreased appetite

The 39 items of the questionnaire were grouped in five categories: disorientation (9 items), socio-environmental interaction (13 items), sleep-wake cycles (4 items), house soiling (6 items) and general activity (7 items).

Table 2: Cognitive status of dogs on the basis of alteration in cognitive behavior

Behavioural Category	Impairment				% of dogs impaired in each category
	One category n=31(32.98%)	Two category n=39(41.49%)	Three category n=18(19.15%)	Four category n= 6(6.38%)	
Disorientation	0 (0%)	4 (10.26%)	5 (27.78%)	2 (33.33%)	11.70%
Socio-environmental interaction	12 (38.71%)	29 (74.36%)	15 (83.33%)	6 (100%)	65.96%
Sleep-wake cycle	11 (35.48%)	26 (66.67%)	16 (88.89%)	6 (100%)	62.77%
House soiling	3 (9.68%)	7 (17.95%)	10 (55.56%)	4 (66.67%)	25.53%
Activity	5 (16.13%)	12 (30.77%)	8 (44.44%)	6 (100%)	32.98%

The behavioural changes observed in this study included disorientation, socio-environmental interaction, sleep-wake cycles, house soiling and physical activity. Impairment in these behavioural categories reflected that loss of memory and learning time increases as dogs advance in age. In this study, 31 dogs had alteration in one category, 39 dogs in two categories, 18 dogs in three categories and 6 dogs in four categories. The most impaired behavioural categories were changes in socio-environmental interaction (65.96%) and sleep-wake cycle (62.77%) followed by physical activity (32.98%), house soiling (25.53%) and disorientation (11.70%). The results obtained and provide estimates of various degree of age related behavioural changes associated with cognitive dysfunction syndrome (CDS) and are in alignment with the previous studies (Bain *et al.*, 2001, Neilson *et al.*, 2001, Baranyiova *et al.*, 2004, Osella *et al.*,

2007, Yalcin *et al.*, 2010 and Svicero *et al.*, 2017) ^[2, 8, 3, 9, 13, 12]. Impairment in 1 category can be considered as mild impairment, while in case where more than one category is involved, it may be designated as severe.

When dogs are of 7 years of age or older, they are considered to be senior canines, and are at increased risk of developing an age related health problems (Laflamme, 2005) ^[5]. The term "cognition" refers to mental processes such as perception, conscience, learning, memory and decision-making, which allows the individual to obtain information from the environment and make decisions, act and function in a normal way (Pineda *et al.*, 2014) ^[10]. The cognitive deficit observed in patients with CDS refers to a decreased capacity to obtain information, process it, retain it and make decisions that result in behavioral changes (Pineda *et al.*, 2014 and Landsberg and Araujo, 2005) ^[10, 6]. Clinical signs of canine cognitive

dysfunction may appear at 7 years of age, which become more relevant as dogs age (Benzal and Rodriguez, 2016) [4]. Azkona *et al.* (2009) [1] also reported prevalence and severity of behavioural changes associated with age such as cognitive impairment: sleep/wake cycles, social interaction, learning and house training and signs of disorientation. In several studies, cognitive behavioral changes have been correlated with pathological changes in the frontal and parietal lobe in the canine (Rofina *et al.*, 2006). Our findings support the previous reports that, increasing age is a determinant factor for the prevalence of these types of diseases (Bain *et al.*, 2001, Neilson *et al.*, 2001 and Azkona *et al.*, 2009) [2, 8].

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