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Prevalence and risk factors for obesity in dogs

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Abstract

A study was undertaken to determine the prevalence and the risk factors involved for overweight and obesity in Labrador retriever dogs presented at SKUAST-J in Jammu, J&K through socio-demographic profile of pet owners and pet lifestyle questionnaire. Using multinomial logistic regression the association between obesity and individual risk factors, were calculated (reference category - normal dogs with BCS = 3.0). In Labrador retriever dogs (n=124), the prevalence of obesity was 50.81%. Out of these 50.81% obese dogs, the higher prevalence and potential risk factors for obesity were middle age, female gender and neutering, indoor lifestyle, non-vegetarian and mixed non-vegetarian and vegetarian diet, homemade+commercial diet, snacking and *ad libitum* feeding practices; urban areas, lack of exercise, independent housing and single dog household. Among owner's factors were older age, retired, overweightedness, higher income, lack of awareness of ideal body weight and risk of obesity, less time spending and dog taken care of by person other than family members.

Keywords: Obesity, risk factors, dog & survey

Introduction

Obesity is an escalating global health problem both in humans and domestic animals. In the United States from 2007 to 2008, 32.2% men and 35.5% women were reported as obese with a body mass index greater than 30.0 (Flegal *et al.*, 2010) [8]. In Europe, the current prevalence of obesity is as high as 22.8% in men and 35.6% in women (Branca *et al.*, 2007) [2]. A similar pattern can also be observed in dogs. There is an increasing trend in the incidence of obesity in the pet population (McGreevy *et al.*, 2005) [26] with 25–35 per cent obese (Greco, 2002) [16] and up to 39 per cent overweighted dogs (Lund *et al.*, 2006 and Courcier *et al.*, 2010) [5].

Obesity is defined as the condition of energy balance and excess adipose tissue formation having an adverse effect on morbidity and mortality (Crane, 1991) [6] resulting in body weight in excess of ideal by 20 per cent (Burkholder and Toll, 2000 and Mawby *et al.*, 2004) [3, 25]. Overweight in dogs is defined as weight in excess of ideal by 10 per cent (Hand *et al.*, 2010) [17]. Obesity in dogs is gaining interest in the research field due to similarities in the detrimental health effects associated with obesity as in humans (Branca *et al.*, 2007) [2]. Sedentary lifestyles as well as supply of flavourful, hypercaloric foods contribute to energy imbalances leading to excess weight (Markwell and Edney, 2000). Urbanization has led to indoor lifestyle which confines the dog and limits its physical activity. Living indoors, inactivity, middle age, being neutered, being of mixed breeding and certain dietary factors have been associated with being overweight (McGreevy *et al.*, 2005) [26] and in turn leads to development of cardiac diseases. Occurrence of obesity is higher in Labrador retrievers, Cairn terriers, Cocker spaniels, Dachshunds, Shetland sheepdogs, Basset hounds, Cavalier king Charles spaniels, Golden retrievers, and Beagles (Edney and Smith, 1986) [7].

Hence present study was conducted with the objective to study the prevalence and associated risk factors of obesity among Labrador retrievers presented to veterinary clinics SKUAST- J and other private clinics of Jammu region.

Materials and Methods

The study was carried out in the Division of Veterinary Medicine, Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-J, R.S. Pura and Private Veterinary Clinics in Jammu. A socio-demographic profile of pet owners and pet lifestyle questionnaire was developed. Survey of total 124 household was performed to collect the epidemiological data for identification of risk factors associated with obesity/ overweight and related cardiac problems.

A complete history of patient's description regarding age, gender, deworming and vaccination status, lifestyle of dog (indoors, outdoors, mixed) and utility (working/non working) were gathered from owner. Primary concern of the owner about dog, main symptoms observed, other systemic diseases and symptoms having a potential influence on the circulatory system were also recorded. Details regarding owner's lifestyle, house type, household composition, owner's interaction with the pets and feeding details were recorded through the questionnaire. Examination of patient included present status of appetite, water intake, vomiting, defecation, urination, behaviour, confirmation, posture or gait, syncopal attacks, cyanosis, enlargement of thyroid gland, exercise intolerance. Assessment of obesity was done using body weight, BCS and body fat percentage. The body weight of the dogs was measured using electronic weighing machine. The approximate body weight of Labrador retrievers was set as 65 to 80 lb (29.48–36.28 kg) for males and 55 to 70 lb (25–31.75 kg) for females as per Burr *et al.* (2002) [4]. The dogs having body weight in excess of 10–15% of ideal body weight were considered as overweight whereas those having body weight in excess of 20–25 % were considered as obese (Burkholder and Toll, 2000 [3] and Mawby *et al.*, 2004) [25]. Body condition score of dogs were assigned as a whole number value from 1 to 5 using 5- point scale as described by Lund *et al.* (1999) [21]. A BCS of 1 indicated the animal was excessively thin, 3 was ideal, and 5 was obese. The amount of fat cover over the dogs' ribs and tail base and the abdominal contour were used in assessing body condition.

Results and Discussion

The study documented an overall prevalence of 50.81 per cent obesity among Labrador retriever dogs in Jammu region while 16.13 per cent dogs were overweight (Table no. 1). The results held similarities with findings by Ricci *et al.* (2007) [31] and Pena *et al.* (2008) [30] who found that 60% - 66.1% of dogs in Italy and Spain are obese. Courcier *et al.* (2010) [5] in a cross-sectional questionnaire in UK found that 38.9% dogs were overweight and 20.4% were obese. Various workers reported 22 to 44.4% of dogs were obese in various parts of world (Glickman *et al.*, 1995; Robertson, 2003; Zentek, 2008 and Mao *et al.*, 2013) [13, 32, 34, 23]. This trend can be seen worldwide. Compared with published obesity statistics, there appears to be a higher prevalence of obesity in the canine population in Jammu region in our report, probably due to increased sedentary lifestyle and over humanising nature of pet owners towards their pets. No similar work would be traced from other parts of India for comparison.

Analysis of epidemiological data identified the potential risk factors associated with incidence of dog being obese (Table no. 2). Among the obese dogs, 50.8 per cent were middle aged (4-7 years). It was seen that risk of obesity was directly proportional to age of dogs with risk increasing from 1.440 times for 4-7 years to 2.363 times for dogs between 8-11 years. The study was in accordance with Lund *et al.* (2006) [22]; Holmes *et al.* (2007) [18] and Zentek (2008) [34] who reported that dogs between 6-10 years of age were likely to be obese. McGreevy *et al.* (2005) [26] also reported that the incidence of obesity increases to a maximum as dogs reach middle age (8-10 years) which can be due to a decrease in metabolic rate as an animal ages (Gossellin *et al.*, 2007) [14].

The higher prevalence as well as risk of obesity in females and neutered dogs, recorded in the present study corroborates with the finding of Mori *et al.* (2013) [27] and Holmes *et al.*

(2007) [18]. It thus appears that female dogs accumulated more fat, resulting in increased weight gain. Our study was also in agreement with various workers who also reported that neutered dogs are also more likely to become obese (Edney and Smith, 1986, McGreevy *et al.*, Colliard *et al.*, 2006 and Lund *et al.*, 2006) [7, 26, 22] because of a decreased metabolic rate and increased food intake (Jeusette *et al.*, 2004) [19]. In addition, a decrease in gonadal steroids and changes in the hypothalamic gonadotrophins might have an effect on satiety, feeding and roaming behaviour of dogs (Crane, 1991) [6].

In the present study it was seen that prevalence and risk of obesity was higher in dogs having indoor lifestyle (73.01 per cent, OR: 34.48 fold than mixed) and fed non-vegetarian diet (22.22 per cent, OR: 32.000 fold than vegetarian diet) and mixed vegetarian and non-vegetarian (66.66 per cent, OR: 4.000 than vegetarian diet), homemade plus commercial diet (30.15 per cent, OR: 3.109 fold than homemade diet), scraps and snacks (85.71 per cent, OR: 18.51). These results are supported by findings of Sloth (1992) [33], Lund *et al.* (2006) [22], Ricci *et al.* (2007) [31], German (2010) [9], Bland *et al.* (2009) [1] and Courcier *et al.* (2010) [5]. The possible reason could be because dogs are confined in restricted areas which limit their physical activity. Other studies (Kienzle *et al.*, 1998, Robertson, 2003 and Lund *et al.*, 2006) [20, 32, 22] reported that feeding semi-moist foods, homemade foods, and snacks was associated with obesity. Obese dogs are also fed scraps more often than dogs of normal weight (Kienzle *et al.*, 1998) [20]. These foods are usually higher in caloric density and fat; and owners also tend to ignore their contribution to their dog's total caloric intake (Crane, 1991) [6].

Frequency of feeding plays an important role in obesity. About 54 per cent obese dogs were fed *ad libitum* and such feeding practice was found to be a strong risk factor (OR: 22.862) for canine obesity. The present study was in agreement with Norris and Beaver (1993) [29] and Bland *et al.* (2009) [1] who suggested that dogs have retained their ancestral behaviour of consuming as much food as possible even when there is no issue of food availability. Thus, a dog will rather accept food that is offered to it instead of refusing it which predisposes it to obesity. On the contrary Robertson (2003) [32] found that dogs fed once a day were more likely to be obese than those fed multiple times a day. He argued that being fed several (2-3) times a day in small quantities leads to an increase in energy loss from thermogenesis.

The prevalence of obesity was higher in dogs living in urban area (87.30 per cent) and independent housing (90.48 per cent). The possible reason for this could be easy availability of commercial dog food in urban areas and unknowingly uncontrolled feeding of pets. Higher prevalence of dog obesity among independent housing system might be because independent housing system is common in Jammu. In contrast to the present finding, Mc Greevy *et al.*, (2005) found that dogs in rural areas are more prone to obesity. About 76 per cent obese dogs had single dog household in the present study which is in line with the findings of Robertson (2003) [32] and Grassi *et al.* (2014). This might be attributable to lesser playing activity and energy consumption in case of single dog keeping as compared to multiple dogs living together.

The present study indicated that 57.14 per cent of obese dogs were never exercised and had higher odds (29.467) of being obese, which is in accordance with studies of Mao *et al.* (2013) [23], German (2010) [9], Courcier *et al.* (2010) [5] and Bland (2009) [1]. This might be because dogs that are not subjected to exertion or muscular activity have higher

tendency to accumulate fat.

The socio economic class was an important factor for development of canine obesity. The risk of obesity was significantly associated with owner factors; lifestyle of owners and the owner-dog relationship also seem to have a major impact on the development of obesity in dogs (Table no. 3). Owners decide what, when and how much a dogs eats as well as when and how much exercise it receives. The decision an owner makes might reflect what is most convenient for the owner instead of what a dog requires for optimal health. Owners who are obese had high prevalence (77.77 percent) and risks (14.70) of obese dogs because their dogs are subjected to similar feeding habits as theirs'. Dog obesity also increases with increasing age of their owners, with elderly (OR: 6.429) owners having higher prevalence (47.62 %) of obese dogs as compared to young or middle aged owners. The prevalence of 26.98 % obese dogs was seen in retired owners; this might be because higher number of

owners belonged to active working status than retire status whereas owners who were retired had higher odds 4.68 of owning obese dogs. The results were in agreement with Holmes *et al.* (2007) [18] and Kienzle *et al.* (1998) [20]. These trends can be explained by lack of physical activity with old age which portends to obesity. The risk of obesity also included higher income owners (OR: 4.148) with prevalence of 88.89 % obese dogs. The owners who had no awareness about ideal body weight had higher prevalence (61.90 %) and risk (OR: 4.432) of obese dogs, also owners who spent less time with their dogs had higher prevalence 82.54 % with higher risk (OR: 22.961) of obesity. This may be attributable to combined effect of overfeeding and lesser physical activity of dogs. The finding that dog's taken care of by person other than family members are at higher risk (OR: 4.705) of being obese coincided with other studies (Holmes *et al.*, 2007, Bland *et al.*, 2009, German, 2010 and Nijland *et al.*, 2009) [1-18, 9] but the reason for this remains unclear.

Table 1: Overall prevalence of obesity among surveyed dogs (n = 124)

| Weight categories (BF %) | Number of dogs (n) | Percentage (%) |
|-------------------------------|--------------------|----------------|
| Normal dogs (15.73–27.96) | 41 | 33.06 |
| Overweight dogs (27.16–31.77) | 20 | 16.13 |
| Obese dogs (32.05–65.35) | 63 | 50.81 |

Figure in parenthesis indicate range of body fat percentage

Table 2: Individual multinomial associations between body shape and potential risk factors

| S. No. | Variable | Factors | Number of dogs | Obese dogs (n=63) | | Overweight dogs (n=20) | |
|--------|----------------------|-------------------|----------------|-------------------------|---------|------------------------|---------|
| | | | | OR (95%CI) | P value | OR (95%CI) | P value |
| 1 | Dog Gender | Male | 70 | Ref | | Ref | |
| | | Female | 54 | 8.867(3.254- 24.159) | 0.000 | 5.833 (1.701-20.001) | 0.000 |
| 2 | Neuter status of dog | Intact | 67 | Ref | | Ref | |
| | | Neutered | 57 | 18.500(5.817- 58.835) | 0.000 | 11.306(2.912- 43.897) | 0.000 |
| 3 | Age of Dog | 2-3 yr | 56 | Ref | | Ref | |
| | | 4-7 yr | 55 | 1.440 (0.361-5.744) | 0.605 | 2.571 (0.462-14.324) | 0.281 |
| | | 8-12yr | 13 | 2.363 (1.006-5.551) | 0.048 | 2.637 (0.812-8.569) | 0.107 |
| 4 | Dog utility | Working | 11 | Ref | | Ref | |
| | | Non-working | 113 | 0.797 (0.201- 3.163) | 0.747 | 1.028 (0.172-6.146) | 0.976 |
| 5 | Dog lifestyle | Indoor | 61 | Ref | | Ref | |
| | | Mixed | 63 | 0.029 (0.008-0.107) | 0.000 | 0.053 (0.012-0.231) | 0.000 |
| 6 | Dog exercise | Daily | 46 | Ref | | Ref | |
| | | Weekly | 36 | 1.867 (0.696-5.007) | 0.215 | 3.600 (1.001-12.948) | 0.050 |
| | | Never | 42 | 29.467 (6.184-140.405) | 0.000 | 15.600 (2.417-100.680) | 0.000 |
| 7 | Dog diet | Vegetarian | 29 | Ref | | Ref | |
| | | Non-vegetarian | 21 | 32.000 (3.494-293.065) | 0.002 | 16.000 (1.579-162.097) | 0.019 |
| | | Both | 74 | 4.000 (1.442-11.093) | 0.008 | 0.889 (0.259-3.051) | 0.851 |
| 8 | Dog food type | Homemade | 96 | Ref | | Ref | |
| | | Home+Commercial | 28 | 3.109 (1.057-9.147) | 0.039 | 1.800 (0.426-7.602) | 0.424 |
| 9 | Feed Frequency | 2-3 times/day | 84 | Ref | | Ref | |
| | | <i>ad libitum</i> | 40 | 22.862 (5.076- 102.962) | 0.000 | 4.875 (0.810- 29.326) | 0.084 |
| 10 | Table Scraps | Yes | 55 | Ref | | Ref | |
| | | No | 69 | 0.010 (0.001-0.078) | 0.000 | 0.031 (0.003-0.268) | 0.002 |
| 11 | Snacks | Yes | 76 | Ref | | Ref | |
| | | No | 48 | 0.054 (0.020-0.147) | 0.000 | 0.215 (0.069-0.675) | 0.008 |

The reference category is: normal dogs, Figures in parenthesis depict confidence interval at 95%, Level of significance P<0.05

Table 3: Individual multinomial associations between body shape and potential risk factors

| S. No. | Variable | Factors | Number of dogs | Obese dogs (n=63) | P value | Overweight dogs (n=20) | P value |
|--------|------------------------------|-------------------|----------------|------------------------|---------|------------------------|---------|
| | | | | OR (95%CI) | | OR (95%CI) | |
| 1 | Age of owner | 18-35 yrs | 18 | Ref | | Ref | |
| | | 36-50 yrs | 66 | 1.620 (0.504-5.206) | 0.418 | 1.680 (0.390-7.243) | 0.487 |
| | | 51-65 yrs | 40 | 6.429 (1.716-24.079) | 0.006 | 1.286 (0.196-8.431) | 0.793 |
| 2 | Gender of owner | Female | 17 | Ref | | Ref | |
| | | Male | 107 | 1.415 (0.471-4.256) | 0.536 | 1.853 (0.348-9.864) | 0.470 |
| 3 | Owner body weight | 30-50 kg | 05 | Ref | | Ref | |
| | | 51-70 kg | 46 | 1.393 (0.132-14.705) | 0.783 | 0.536 (0.046-6.240) | 0.618 |
| | | >70 kg | 73 | 14.700 (1.384-156.179) | 0.026 | 4.200 (0.379-46.495) | 0.242 |
| 4 | Owner education | Graduate | 54 | Ref | | Ref | |
| | | Post graduate | 70 | 1.098 (0.492-2.452) | 0.820 | 2.344 (0.786-6.990) | 0.127 |
| 5 | Owner occupation | Active | 100 | Ref | | Ref | |
| | | Retired | 24 | 4.681(1.275- 17.184) | 0.020 | 3.167 (0.635- 15.793) | 0.160 |
| 6 | Owner Income | <₹50,000 /month | 24 | Ref | | Ref | |
| | | >₹50,000/month | 100 | 4.148 (1.500-11.468) | 0.006 | 2.938 (0.734-11.759) | 0.128 |
| 7 | Knowledge about dog weight | Yes | 64 | Ref | | Ref | |
| | | No | 60 | 4.432 (1.879-10.450) | 0.001 | 2.727 (.893-8.326) | 0.078 |
| 8 | Knowledge about obesity risk | Yes | 13 | Ref | | Ref | |
| | | No | 111 | 2.388 (0.703-8.116) | 0.163 | 3.912 (0.447-34.233) | 0.218 |
| 9 | Location | Rural | 20 | Ref | | Ref | |
| | | Urban | 104 | 1.415 (0.471-4.256) | 0.536 | 0.618 (0.169-2.263) | 0.467 |
| 10. | Owner house type | Apartment | 12 | Ref | | Ref | |
| | | Independent house | 112 | 1.319 (0.375-4.642) | 0.666 | 2.639 (0.287-24.244) | 0.391 |
| 11. | Family type | Joint | 51 | Ref | | Ref | |
| | | Nuclear | 73 | 2.631 (1.172-5.908) | 0.019 | 4.235 (1.292-13.889) | 0.017 |
| 12. | Dog Handler | Family person | 78 | Ref | | Ref | |
| | | Others | 46 | 4.705 (1.817-12.187) | 0.001 | 3.238 (0.966-10.850) | 0.057 |
| 13. | Time spent with dog | Yes | 51 | Ref | | Ref | |
| | | No | 73 | 22.961 (8.103-65.064) | 0.000 | 11.333 (3.229-39.777) | 0.000 |
| 14. | No. of dogs in family | One | 95 | Ref | | Ref | |
| | | >1 | 29 | 0.852 (0.346-2.100) | 0.728 | 0.481 (0.118- 1.968) | 0.309 |

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