

**University of Veterinary Medicine, Budapest**  
**Department of Animal Breeding, Nutrition and Laboratory Animal Science,**  
**Department of Biomathematics and Informatics**

## **The role of dog owners' behaviour in canine obesity**

**Thesis by**  
**Marine Lorin**

**Supervisors:**

**Dr. István Hullár, M.Sc., PhD**  
associate professor  
Department of Animal Nutrition

**Zsolt Abonyi-Tóth, MSc**  
managing expert  
Department of Biomathematics and Informatics

**Budapest, Hungary**

**2016.**

## Table of Contents

1. Introduction .....	1
2. Review of Literature.....	2
2.1 A growing threat for canine health .....	2
2.2 Consequences of obesity .....	2
2.3 Diagnosis of obesity in dogs.....	3
2.4 Aetiology of obesity .....	4
2.4.1 Breed and genetics.....	5
2.4.2 Neutering .....	5
2.4.3 Age and gender.....	6
2.4.4 Owner's implication.....	6
3. Own Investigation .....	8
3.1 Aim of the study .....	8
3.2 Material and methods .....	8
3.2.1 Study participants .....	8
3.2.2 Questionnaire design .....	9
3.2.3 BCS analysis by the veterinarians .....	9
3.2.4 Statistical analysis .....	9
3.3 Results .....	10
4. Discussion .....	20
5. Conclusions .....	28
6. Summary .....	29
7. Appendix .....	30
8. References .....	32
Acknowledgments .....	35

## **1. Introduction**

A striking fact nowadays in the veterinary practices is the increasing number of overweight dogs among the canine patients. Obesity is a new phenomenon which, in the human population, appeared with the expansion of fast foods and the persistently increasing cost of living. Even if it could sound paradoxical with the constant improvement of animal nutrition science in food industry, a recent British survey carried out by the Pet Food Manufacturer's Association, has established that 77% of vets believe that pet obesity is on rise with 45% of overweight dogs and 40% of overweight cats (PFMA, 2014). A dog is considered overweight when its body weight is more than 15% above the optimal body weight and is seen as obese when it exceeds its ideal body weight by 30%. However, because of the lack of standards and references in the case of crossbred animals and mongrels, the application of this definition remains difficult. Instead a body condition scoring system is often used to assess the weight of animals. It relies on the visual estimation of overall body shape and/or the palpation of one or different body regions to evaluate the fat composition (Burkholder, 2000). Canine obesity, alike human obesity, may predispose the patient to a various number of health disorders like for instance joint and cardiovascular problems, diabetes mellitus, constipation, and finally results in a shortened life expectancy.

Previous studies have already identified risk factors associated with obesity in pet animals. These include gender, neutering, age and breed as well as dietary factors. In France, Colliard et al. (2006) reported 38.8% of overweight dogs including 5% of obese dogs and have determined that neutered female and retriever breeds are of greater risk of being overweight. However, one factor remains understated: the owner role in canine obesity. Indeed, the quality and quantity of dietary intake and physical activity are two parameters largely controlled by human and, when imbalanced, lead to an increase in fat deposition. This study proposes to explore the human behaviour towards pet animals by evaluating the methods with which owners care for their dog on a daily basis.

## **2. Review of Literature**

### **2.1 A growing threat for canine health**

Nowadays, obesity is considered the most common form of malnutrition in small animal practice. However in many cases, it remains undetected since most of the owners will not consult their veterinarian for the weight problems of their pets. Instead they will come for another concern later on, leaving time for the overweight to sustain and settle. Recent surveys undertaken around the world suggest that 25% to 40% of dogs presented to veterinary clinics are overweight or obese: 38.8% of dogs were overweight by veterinary assessment in France (Colliard et al., 2006), 41% in Australia (McGreevy et al., 2005) 34.1% in USA (Lund et al., 2006) 45% according to vets in the UK (PDSA, 2014) and, more recently, 52% in Germany (Becker et al., 2012). In the past years, obesity has not really been considered a serious health problem as practitioners believed it was rather an aesthetic issue. Now we know that obesity not only makes our companion reluctant to move but also seriously endangered his life.

### **2.2 Consequences of obesity**

Similarly to humans, obesity has detrimental effects on dog's health. According to German (2006), those animals would be more likely to suffer from orthopaedic problems and arthritis, glucose intolerance predisposing to type 2 diabetes mellitus, cardiovascular diseases and in particular hypertension, urinary disorders (feline lower urinary tract disease, FLUTD in cats, incontinence in spayed bitches), reproductive disorders, dermatitis, respiratory problems leading to exercise intolerance and increased anaesthetic risks. The ultimate consequence of all these is a decreased lifespan.

This tendency was also shown previously in a series of studies carried out with 2 groups of Labrador retriever dogs (Kealy et al., 2002). Both were composed of 24 animals each treated identically except from the feeding regime. One group was fed ad libitum then fed in a way that they stayed overweight (BCS: body condition score 6.5/9) and the other group was fed 25% less than the previous one (BCS 4.5/9, close to optimal). In addition to being leaner, dogs from the latter group lived approximately two years longer than the overweight group (median lifespan of 13.0 years against 11.2 years).

Thus, obesity not only badly affects the animal quality of life but also decreases significantly its life expectancy and can therefore be regarded as a significant animal welfare issue.

### **2.3 Diagnosis of obesity in dogs**

The simplest method to determinate overweight in dog remains the measurement of the body weight. It provides a rough evaluation when compared with the standards for each breed and in association with visual analysis of the whole body shape, length and height. Demographic factors like gender and age must also be taken into account.

Body condition scoring is a subjective and semi-quantitative method for evaluating body composition that combines visual assessment from the top and the side and/or palpation of the ribs, the waist and the base of the tail (Burkholder, 2000). Two systems are in used nowadays: a 5 and a 9-point system, with 1 standing for “very thin” or “emaciated” and 5 or 9 standing for “obese”. The optimal body condition is described by 3/5 or 5/9 depending on the scale chosen (Table 1).

Morphometric measurements, though more common in human assessment of obesity (BMI: Body mass Index), can also be applied to dogs and cats. The ratio of the pelvic circumference to the distance between the patella and the hock joint can predict the body fat in dogs. Even though this technique is described in the literature, it is far much less used in dogs than in cats because of the great variability among dog breeds compared to cat breeds. Moreover, standards for mixed breeds and mongrels are not provided which significantly reduces the use of morphometric measurements in this species.

Modern methods have been developed recently to measure body composition including dilution methods, bioelectrical impedance analysis, dual energy X-ray absorptiometry, densitometry, computed tomography, magnetic resonance imaging, determination of total body electrical conductivity, determination of total potassium and neutron activation analysis.

Despite a huge range of techniques available, none of them is reliable without taking a good medical anamnesis of the patient: is the animal suffering from other health issues? Is the animal receiving any medications? What are the feeding habits and the physical activities performed? Those are key factors in the establishment of a precise and relevant diagnosis.

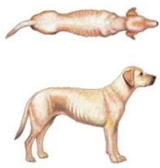
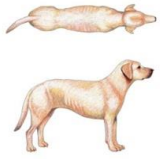
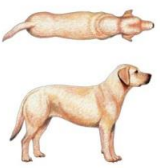


Condition	Picture	BCS	Examination findings	Fat mass %
Very thin		1/5	Rib cage easily palpable, prominent bony structures; no body fat	0%
Lean		2/5	Skeletal structure visible; little body fat	10%
Optimal		3/5	Rib cage easily palpable but not showing, smooth contour of tailbase; moderate amount of fat	20%
Overweight		4/5	Rib cage barely palpable, tailbase thickened; body weight greater than normal	30%
Obese		5/5	Rib cage not palpable, tailbase barely palpable; large amount of body fat	40%

Table 1: Body Condition Scoring for dogs, adapted from Nelson and Couto (2014)

## 2.4 Aetiology of obesity

Like in humans, the etiology of obesity is complex and can involve several social and environmental factors. Weight gain develops when there is an imbalance between the energy intake and the energy expenditure. It is well known that some endocrine diseases can result in obesity like hypothyroidism, hyperadrenocorticism, hyperinsulinism, acromegaly and hypopituitarism. Drugs can be responsible for an increase food intake or a decrease metabolic rate: glucocorticoids, progestagens, phenobarbital, primidone thus leading also to secondary obesity.

Even if other health issues and medications must be taken into account while establishing an overweight diagnosis, it is suggested that less than 5% of obesity is due to one of these.

#### 2.4.1 Breed and genetics

Edney and Smith (1986) and later on, Kronfeld et al. (1991), reported that certain dog breeds have higher propensity to becoming overweight or obese. Labrador Retrievers were found to be more prone to develop obesity. Other breeds include Cairn terriers, Cocker spaniels, long-haired Dachshunds, Shetland sheepdogs, Basset hounds, Cavalier King Charles spaniels and Beagles (Edney and Smith, 1986).

The first reason why such a tendency is observed is that the Labrador is a very popular breed. It is the breed number one in the US (American Humane Association, 2011), in the UK by analysis of microchipping data (BBC, 2015) and in France where almost 10% of the dogs are Labrador.

Genetics also explains why these animals are more likely to beg for food than other breeds and therefore more likely to be overweight. Raffan et al. (2016), in a study including 15 obese and 18 lean Labrador, reported a deletion in the pro-opiomelanocortin POMC gene. The mutation was found absent from 38 other breeds except for other flat-coat retrievers. According to Raffan et al. (2016) this deletion is associated with increased body weight, adiposity and appetite in Labrador and other retrievers. However, since the mutation was absent from some obese dogs and was present in some individuals from the lean group, it seems that other environmental factors may have an influence.

#### 2.4.2 Neutering

The incidence of obesity has also been shown to be higher in neutered animals. Unfortunately, no clear statements have been made on the real link existing between the losses of sex hormones, the alteration in body weight and adiposity. The decrease concentration of sex hormones in the blood following removal of the gonads in both male and female could alter energy expenditure due to a subsequent decrease in the metabolic rate by approximately 25-30%. This would be associated with an increase in the food intake following neutering.

### 2.4.3 Age and gender

Age, although in a lesser extent, has also been involved in the aetiology of obesity. Courcier et al. (2010) demonstrated that dogs classified either as overweight or obese were older than normal weight dogs. As for human, ageing is accompanied by a reduction of the metabolic rate and an accumulation of fat tissue. Furthermore, exercise quantity is more likely to decrease with age, which could emphasize the phenomenon. Similarly, Courcier et al. showed that female-neutered were more at risk of being obese compared with male-neutered dogs. The fat accumulation over time is more pronounced in female than in male.

### 2.4.4 Owner's implication

#### i) Dietary intake and exercise

Owners are the ones who control many parameters in the life of their pet. Two of them are of particular importance and result in the development of obesity when not properly managed: the feed intake and the exercise.

For obvious reasons already well discussed in the aetiology of human obesity in the past decades, a dog which receives a more caloric meal or a higher quantity than the optimal amount prescribed has higher chances to become overweight or even obese if this feeding behaviour lasts over time. However, there was no dependence proven between the type of food fed (dry or homemade food) and obesity (Edney and Smith, 1986). Robertson (2003) showed a relationship between the frequency of feeding and obesity. Dogs fed once a day were more likely to be obese than dogs fed more than once a day. This trend would be explained by the fact that repeated intake of small portions per day would increase the energy expenditure through digestion process and thermogenesis. Besides the meals, many dogs receive extra food in the form of snacks or table scraps, which increase the amount of calories ingested daily. Bland et al. (2009) noted that households with normal weight dogs give significantly less treats than households containing obese animals.

There is also a significant association between exercise frequency and obesity. Bland et al. (2009) showed that an obese dog is exercised for a shorter time than a normal weight dog but their study does not say if the low exercise frequency is a cause or a consequence of obesity.



ii) Human-animal bond

To understand better canine obesity, it is also essential to focus on human obesity, the social status of owners and the relationship that humans have with their pets. Kienzle et al. (1998) reported that owners of obese dogs were more likely to be obese themselves. This study has also shown that people with a lower income had higher chances to own an obese dog. It reflects the already well-known link between obesity and socio-economic status in human (McLaren, 2007): people earning more money would be able to buy healthier foodstuffs, more expensive than less nutritious food items.

Kienzle and al. (1998) also noted that there would be a possible link between obesity and the human-animal bond. They reported that obese dog slept more often in the owner's bed, that owners spoke more and on a greater variety of subjects to their dogs and that they were less afraid of contracting diseases from their dogs than were owners of normal dogs. Their interpretation is that those owners tend to over humanize their pets and to translate every need by a request for food.

It is therefore possible that, without even noticing it, the owner, by following the expression “dog is the man's best friend” to the letter would be one of the responsible of canine obesity.

### **3. Own Investigation**

#### **3.1 Aim of the study**

The aim of the study was to investigate whether the owner plays a role in the development of canine obesity. Based on already carried out studies, a certain profile of dog owner was targeted. Follows are the hypotheses that were statistically tested:

- 1) **Age** → older people have heavier dogs
- 2) **Sex** → females have heavier dogs
- 3) **Household** → people living alone have heavier dogs
- 4) **Job** → People not working have heavier dogs
- 5) **Behaviour**
  - owners not able to resist when their dogs beg have heavier dogs
  - owners exercising less their dogs have heavier dogs
  - owners feeding randomly their dogs have heavier dogs
  - owners feeding more treats to their dogs have heavier dogs
- 6) **Habitat** → dogs living inside are heavier

By comparing the BCS evaluation of both the veterinarian and the owner, I also wanted to estimate the capability of owners to recognise the overweight of their pet.

#### **3.2 Material and methods**

##### **3.2.1 Study participants**

The study was carried out in two veterinary clinics: one canine practice and one mixed practice in Sarthe, France and conducted over a six-month period (November 2015 to April 2016). Both clinics are situated at the periphery of Le Mans, the biggest city of the county therefore in an area considered semi-rural. Three veterinarians were involved in the study and the questionnaires were distributed to clients who agreed to take part in the survey. Only owners of normal, overweight and obese dogs were selected. People had to fill the paper sheet in the waiting room before the consultation with the practitioner. Altogether 51 dog owners filled the questionnaires. After the answers were collected, the participating vet assigned a body condition score to each dog and notified it on the corresponding questionnaire during the consultation.

### 3.2.2 Questionnaire design

The questionnaire consisted in sixteen closed-ended questions (Appendix). Specific questions were related to dog and owner demographics (age, sex and status of the owner as well as age, sex, breed and neutering status of the dog). The other questions surveyed the feeding habits (treat feeding frequency, presence during cooking or meal and if yes, scraps feeding, determination of daily amount of food given), the number of people in the household, the people responsible for the feeding and whether the dog spends more time inside or outside. Data on the owner perception of the weight of their pet and the physical activity were also recorded. People were asked to evaluate the BCS of their companion animal too. This was performed by using pictures of a five-point modified scale ranging from 2 to 5 with 2 standing for “lean” and 5 for “obese”, from which, one had to be selected by the owner. The photographs were arranged in a circular pattern and not linearly classified from BCS 2/5 to 5/5 to avoid immediate perception of extremes and drawings were not accompanied by titles. The owner BCS perception was later compared with the BCS evaluation carried out by the veterinarian.

### 3.2.3 BCS analysis by the veterinarians

Veterinarians had to record the BCS of the dog during the consultation time after the owner had filled the questionnaire using a 5-point system to be able to compare it with the one the client had chosen. The method used was principally a visual assessment of the BCS combined with the measure of the weight of the animal. Even if standard weights are not available, this technique was also used in the case of mixed breeds and mongrels. Palpation was not performed. The practitioner analysis was consequently mostly subjective but justified by a good experience in this field. After the vet evaluation, 31 dogs were considered “normal” (BCS 3/5) and 20 dogs were considered “overweight” (BCS 4/5) or “obese” (BCS 5/5).

### 3.2.4 Statistical analysis

For the statistical analysis, homogeneity test was made to compare the proportion of normal, overweight and obese dogs using Fishers's exact test. The R statistical program was used (R Core Team, 2016).

### 3.3 Results

Here are the answers to the questions asked to the 51 dog owners relevant for the statistical analysis. Data were recorded differentiating owners of normal, overweight and obese dogs. Then, percentages were calculated grouping both overweight and obese dogs together and graphs were designed.

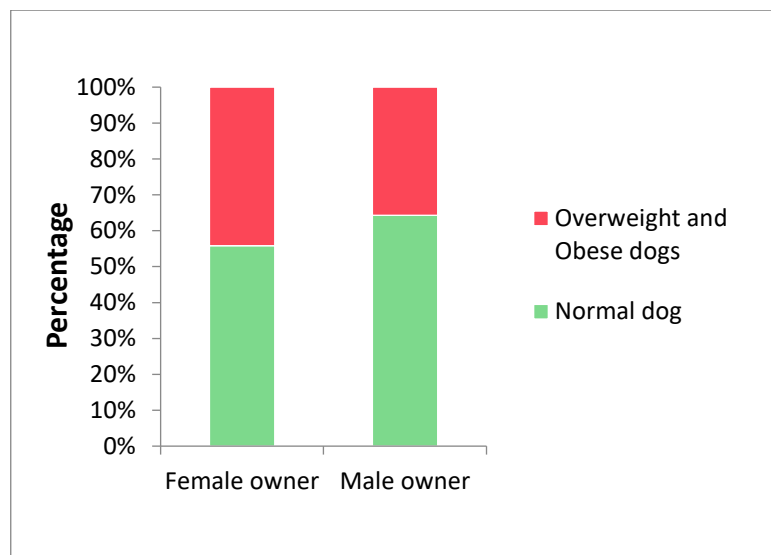
1. What is your gender? (Fisher's p-value = 1.0000)

	Female owner	Male owner
Normal dog	19 (39.6%)	9 (18.8%)
Overweight dog	11 (22.9%)	4 (8.3%)
Obese dog	4 (8.3%)	1 (2.1%)

Table 2: Distribution of normal, overweight and obese dogs according to the owner's gender

It can be seen that more female owners came to the clinic. Female owners brought more overweight and obese dogs than male owners. Statistically, our data did not prove dependence of the body condition and the gender.

Figure 1: Percentage of normal, overweight and obese dogs according to the owner's gender



On this graph a small tendency is visible, as the red area is wider in case of female owners.

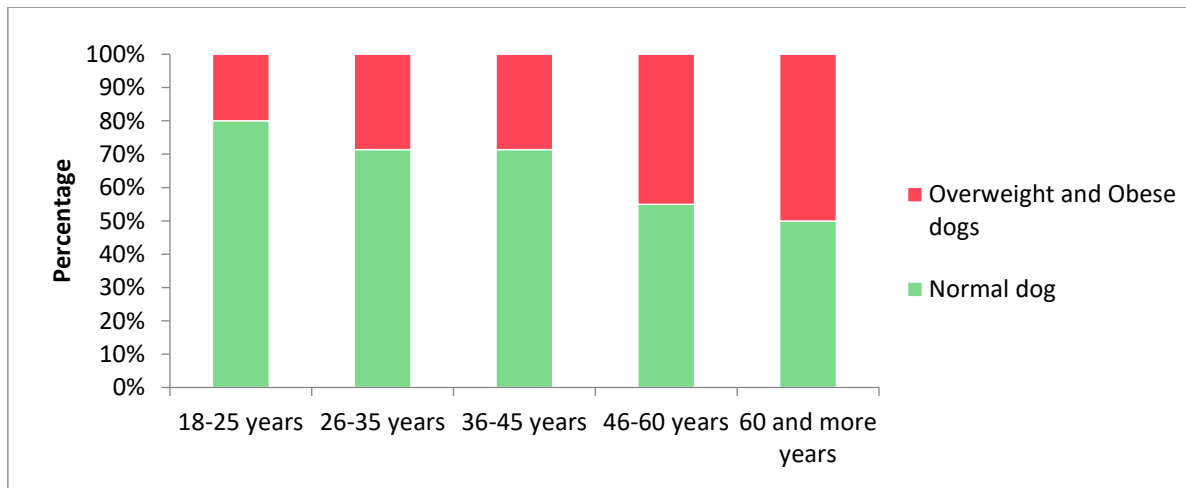
2. What is your age group? (Fisher's p-value = 0.3567)

	18-25 years	26-35 years	36-45 years	46-60 years	60 and more years
Normal	4 (7.8%)	5 (9.8%)	5 (9.8%)	11 (21.6%)	6 (11.8%)
Overweight	1 (2.0%)	1 (2.0%)	0 (0%)	8 (15.7%)	5 (9.8%)
Obese	0 (0%)	1 (2.0%)	2 (3.9%)	1 (2.0%)	1 (2.0%)

Table 3: Distribution of normal, overweight and obese dogs according to the owner's age

Most of the overweight and obese dogs which came to the veterinary clinic were brought by 46 years old and more owners. Statistically, our data did not prove dependence of the body condition and the age group.

Figure 2: Percentage of normal, overweight and obese dogs according to the owner's age



On this graph, some tendency is visible as the green area gets smaller with increasing age and the red area gets wider. A much bigger sample would be needed to fully prove it.

3. How many people are in your household, including you? (Fisher's p-value = 0.0787)

	1	2	3	4	5
Normal dog	2 (3.9%)	13 (25.5%)	4 (7.8%)	11 (21.6%)	1 (2.0%)
Overweight dog	5 (9.8%)	5 (9.8%)	2 (3.9%)	1 (2.0%)	2 (3.9%)
Obese dog	1 (2.0%)	3 (5.9%)	1 (2.0%)	0 (0%)	0 (0%)

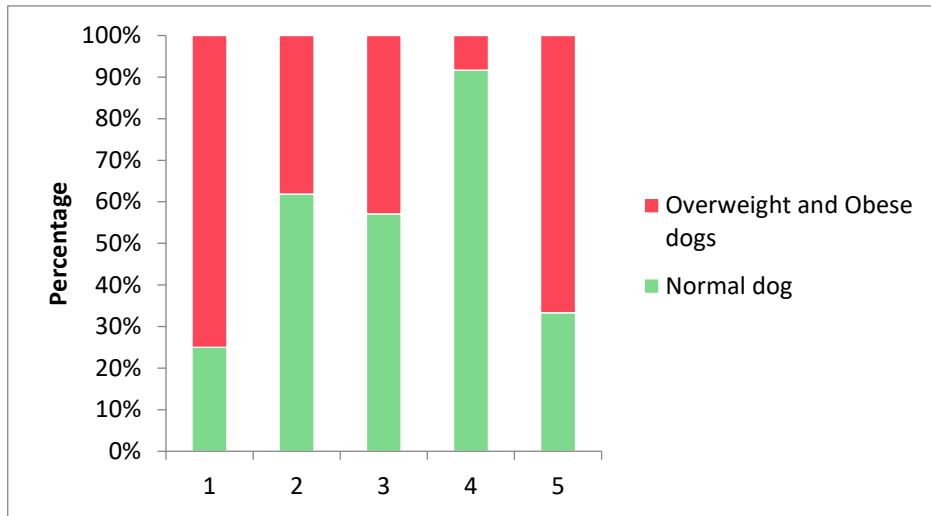
Table 4: Distribution of normal, overweight and obese dogs according to number of persons in the household

In households counting only 1 or 2 persons significantly more dogs were obese. We do not see any obese dogs in families counting 4 or 5 members. The pairwise comparison showed a difference between households of 1 and 4 persons (Fisher's tests with Holm correction,  $p=0.0444$ ). It means some tendency is visible but sample size is not enough to prove difference between groups.

	1	2	3	4	5
1		0.9391	1	0.0444	1
2			1	1	1
3				0.9391	1
4					0.7319
5					

Table 5: P-values of pairwise comparisons (Fisher's test with Holm correction)

Figure 3: Percentage of normal, overweight and obese dogs according to the number of persons in the household.



On this graph, we can see nice tendencies: we have significantly more obese and overweight dogs in household counting 1 person and significantly less in households counting 4 people.

4. What is your status? (Fisher's p-value = 0.8936)

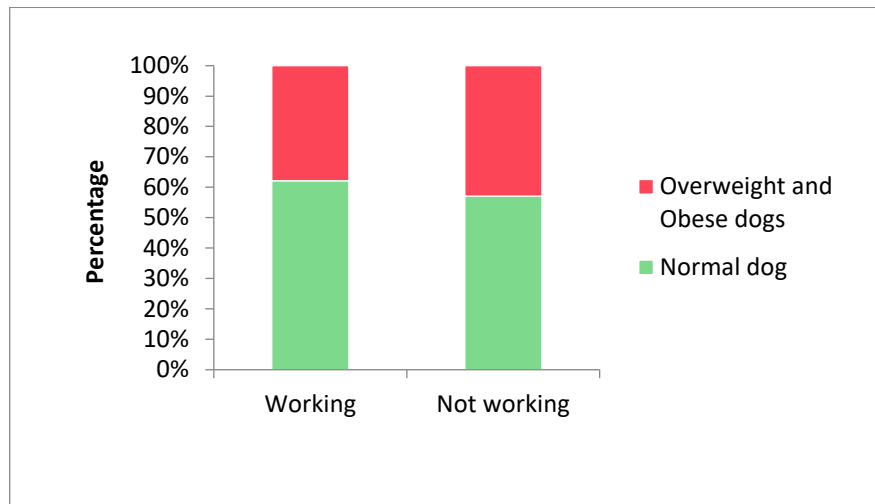
Students and employed people were grouped as «working» while retired or unemployed people were grouped as «not working».

	Working	Not working
Normal dog	23 (45.1%)	8 (15.7%)
Overweight dog	10 (19.6%)	5 (9.8%)
Obese dog	4 (7.8%)	1 (2.0%)

Table 6: Distribution of normal, overweight and obese dogs according to the owner's status

When it comes to numbers, most of the obese dogs were brought to the clinic by people who have a job. Statistically, our data did not prove dependence of job and obesity.

Figure 4: Percentage of normal, overweight and obese dogs according to the owner's status



On this graph, we almost have no difference between the green and red areas for working and not working people. Still, as percentage, there are slightly more overweight and obese dogs in non-working households.

5. Are you able to resist when your dog begs for scraps? (Fisher's p-value = 0.1759)

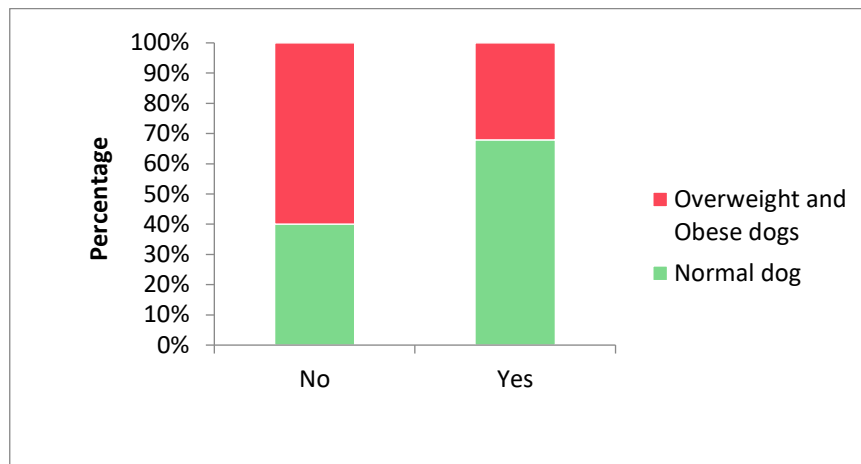
	No	Yes
Normal	6 (14.0%)	19 (44.2%)
Overweight	7 (16.3%)	6 (14.0%)
Obese	2 (4.7%)	3 (7.0%)

Table 7: Distribution of normal, overweight and obese dogs according to the owner's capability to resist

Most of dog owners are able to resist their animal when he begs for food. Compared to the total number of people who answered “No” to the question, more overweight and obese dogs are seen when people are not able to resist. Statistically, our data did not prove dependence of owner's capability to resist their dog and obesity.



Figure 5: Percentage of normal, overweight and obese dogs according to the owner's capability to resist



On this graph, using percentages the red area is wider when people are not able to resist their dog.

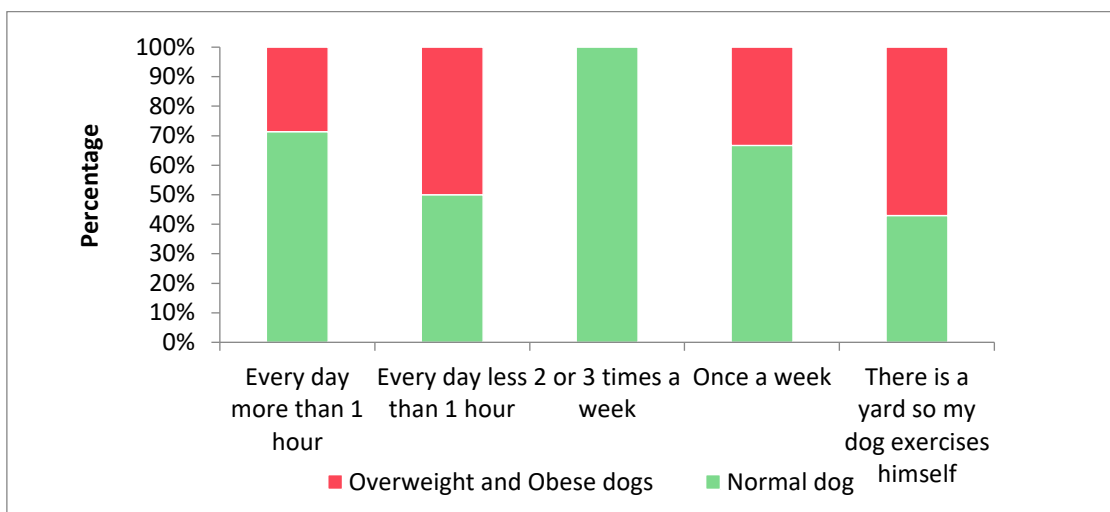
6. How often do you exercise your dog? (Fisher's p-value = 0.3216)

	Every day more than 1 hour (1)	Every day less than 1 hour (2)	2 or 3 times a week (3)	Once a week (4)	There is a yard so my dog exercises himself (5)
Normal	10 (19.6%)	7 (13.7%)	6 (11.8%)	2 (3.9%)	6 (11.8%)
Overweight	4 (7.8%)	5 (9.8%)	0 (0%)	1 (2.0%)	5 (9.8%)
Obese	0 (0%)	2 (3.9%)	0 (0%)	0 (0%)	3 (5.9%)

Table 8: Distribution of normal, overweight and obese dogs according to the amount of exercise

Most of the obese and overweight dogs were brought by owners who walk the dog everyday less than 1 hour and when the dog has the garden to exercise himself. We do not have any obese and overweight dogs in families walking the dog 2 or 3 times a week. Statistically, our data did not prove dependence of the amount of exercise and obesity.

Figure 6: Percentage of normal, overweight and obese dogs according to the amount of exercise



On this graph, the percentages confirm the numerical findings.

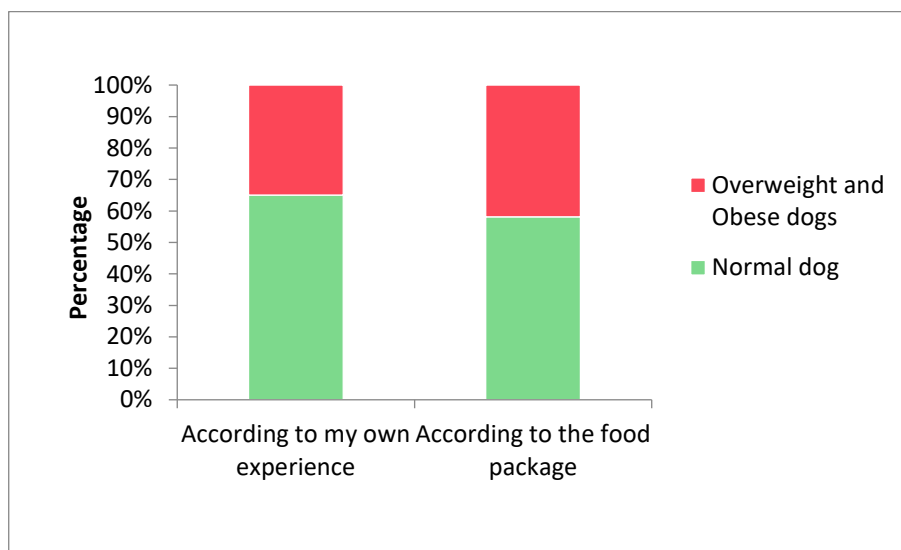
7. How do you determine the daily amount of feed given to your dog? (Fisher's p-value = 0.7587)

	According to my own experience	According to the food package
Normal	13 (25.5%)	18 (35.3%)
Overweight	6 (11.8%)	9 (17.6%)
Obese	1 (2.0%)	4 (7.8%)

Table 9: Distribution of normal, overweight and obese dogs according to the way owner determines the amount of food to be given

When it comes to number, most of overweight and obese dogs are seen in households where the food package is used as a reference for feeding. Statistically, our data did not prove dependence of feeding behaviour and obesity.

Figure 7: Percentage of normal, overweight and obese dogs according to the way owner determines the amount of food to be given



On this graph, there is almost no difference between the green and red area for people feeding their dog according to their own experience or according to the food package. Still, while using the percentages, there are slightly more overweight and obese dogs in household where people feed their dog according to the indications found on the feed package.

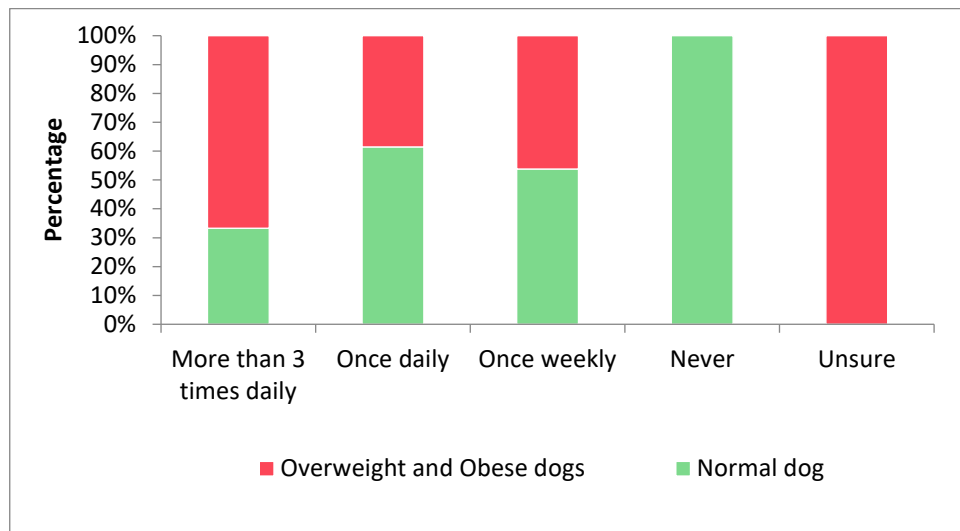
8. How frequently do you feed treats to your dog? (Fisher's p-value = 0.0430)

	More than 3 times daily (1)	Once daily (2)	Once weekly (3)	Never (4)	Unsure (5)
Normal	1 (2.0%)	16 (31.4%)	7 (13.7%)	7 (13.7%)	0 (0%)
Overweight	1 (2.0%)	6 (11.8%)	6 (11.8%)	0 (0%)	2 (3.9%)
Obese	1 (2.0%)	4 (7.8%)	0 (0%)	0 (0%)	0 (0%)

Table 10: Distribution of normal, overweight and obese dogs according to treat feeding frequency

The majority of dogs is fed snacks once daily. There is not a single overweight or obese dog when treats are never fed. Statistically, not easy to interpret tendencies are visible on data.

Figure 8: Percentage of normal, overweight and obese dogs according to the treat feeding frequency



On this graph, there are significantly more overweight and obese dogs in households feeding treats more than 3 times a day.

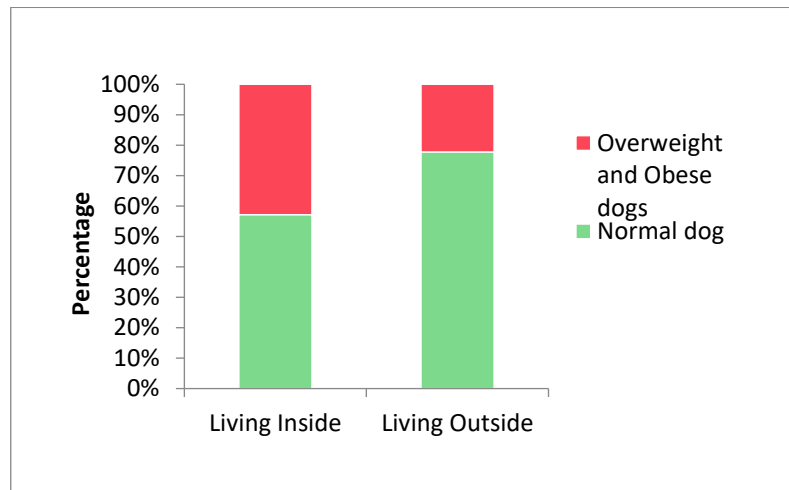
9. Where does your dog live mostly? (Fisher's p-value = 0.6358)

	Inside	Outside
Normal	24 (47.1%)	7 (13.7%)
Overweight	13 (25.5%)	2 (3.9%)
Obese	5 (9.8%)	0 (0%)

Table 11: Distribution of normal, overweight and obese dogs according to the habitat

Most of the obese and overweight dogs live inside. Statistically, our data did not prove dependence of habitat and obesity.

Figure 9: Percentage of normal, overweight and obese dogs according to the habitat



On this graph, the green area is wider in household where the dog is kept outside. The red area is wider in household where the dog is kept inside.

## 4. Discussion

The overall aim of this study was to establish the profile of people owning overweight dog and to determine their role in the obesity of their pet.

One of the goals of the study was to show that women were more at risk to own an obese dog. While this cannot be stated with certainty, a possible explanation would be that women have a stronger maternal behaviour and are sometimes too closely involved to be able to consider their pet as an animal and not as an integral part of the family.

Even though women took their dog more often than men to the veterinary clinic (71% female individuals against 29% male individuals, Table 2) because they were supposed to be more implicated in the daily care of their dog, no significant relationship was seen between obesity and female ownership following analysis however percentages used to draw the graph show this tendency. The sample size and veterinarian selection of the patients are most probably in question.

No such hypothesis was examined in the literature and only Courcier et al. (2010) counted a greater number of females among the owners without proving the dependence of gender and obesity in dogs. Nevertheless, a single study carried out in feline patients noticed that more overweight cats were owned by females than were normal weight cats (Kienzle and Bergler, 2006).

Owner's age seems to be an important factor in the development of obesity in dog. Mason (1970) reported that obesity was more prevalent in dogs belonging to middle-age or older owners. Similarly, Courcier et al. (2010) established the same conclusion with increasing risk of dog being overweight with increasing owner age.

In this study, graph appears to demonstrate that people belonging to the “46 years old” and “60 years old and more” groups are more likely to own an overweight dog (Figure 2). The reason behind the fact that older owners own fatter dogs is that they may exercise their pet less often and less intensively as their age becomes a brake to physical activity. It is therefore more probable that the dog will be restricted to a 10-minute walk with an elderly person instead of a half an hour jogging with a 25 years old one.

The effect of the household was also examined in this study. Edney and Smith (1986) and later Robertson (2003), reported that dogs in single-dog family were more obese than

those in a multiple-dog family. Dogs together are more likely to play and to exercise than dogs alone.

This study aimed to show the influence of the number of family members on canine obesity. Results suggested a tendency for households of 1 and 4 persons. Households counting only 1 individual were at risk to own an obese dog while the opposite is seen in households with 4 individuals. There may be a higher chance for a single person to report attention on the dog by feeding him more often and in higher quantities. In contrast, in households counting many members, source of play is increased resulting in greater energy expenditure.

These issues were not apparent in the study carried out by Brand et al. (2009) where dogs belonging to multiple-member families were more prone to be overweight. This could be explained by the fact that control of feed intake is more complicated when the family counts many members and especially children for who the temptation is big to offer the dog table scraps and thus leading to increase energy intake by the pet.

Previous studies have identified the socioeconomic status of the owner as a cause of obesity in dog. Here the aim of the study was to demonstrate the role of owner occupation in canine obesity as not-working and retired people are expected to have fatter dogs. People having no job will spend more time together with their dogs and the risk is higher to feed them more. Owners retired represented significantly higher risk of obesity in dogs (Colliard et al., 2006). The data recorded in this survey did not show the dependence of job and obesity statistically.

Kienzle et al. (1998) instead reported that people with a lower income were more represented among owners of overweight dogs, a finding confirmed by Courcier et al. (2010), that they bought more often pet food at the local supermarket and fed more often low price dog food than owners of normal dogs. Surprisingly enough, the team also highlighted that owners of obese dogs were often obese too (Kienzle et al., 1998). As discussed above, the aetiology of human obesity in developed countries remains mostly the lower socioeconomic classes with people not being able to afford healthier and more expensive food. Since the owner is controlling dog feeding, the same will apply when it comes to choose and buy dog food.

The present study investigated the capacity of dog owners to resist their dog when he begs for food. The question was asked only to people whose dog is present at the time of

cooking or taking a meal. Similarly, Kienzle et al. (1998) observed that owners of overweight dogs were more likely to give in to begging behaviour bringing out the fact that obese dog owners are somewhat laxist in the education of their animal. Statistically our data did not prove the dependence of obesity and capability to resist.

Many previous reports have been made about the relationship between the exercise frequency and the body shape. Dogs classified as overweight or obese generally receive significantly less exercise than dogs classified as normal (Bland et al., 2009, Courcier et al., 2010). We may also consider that owners of obese dogs may be ashamed to be seen walking along with an obese dog (obese human may be ashamed to go out to avoid judging passer-by looks) as the vision of an obese animal can be comparable to animal cruelty.

These studies do not say if obesity was a consequence or a cause of the decreased exercise frequency namely if the dog became obese due to the lack of exercise or if the obese dog is less exercised because of his condition and the difficulty for him to move. However, according to Robertson (2003) the intensity of exercise did not affect the obesity.

With the use of the questionnaires, no dependence was statistically proven between obesity and frequency of exercise. This may be due to the design of the question. People were asked to choose between “every day more than 1 hour”, “every day less than 1 hour”, “2 or 3 times a week”, “once a week”, “there is a yard and therefore my dog exercises himself”. The presence of the garden as a place where the dog can free range is seen by some owners as sufficient for the dog to undertake exercise whereas others no matter the yard will ensure walks and exercises to maintain their pet body shape. This could explain why some clients ticked two boxes, therefore biasing the results. Moreover, alike frequency of feeding treats, this question summoned the memory of the owner which could be inaccurate in recalling the exercise frequency and regularity.

One of the aims of the study was to demonstrate the particular feeding behaviour of owners of obese dogs. Statistically, people feeding their animals according to their own experience (and therefore not measuring the amount to be given) were not more at risk to have a heavier dog. It may be possible, and this is also based on my experience, that owners of obese dogs feeding according to the prescriptions figuring on the package will take as a reference the amount of dry/wet food to be given prescribed for the actual weight of their dog which is obese and not the amount of feedstuffs corresponding to the weight their dog should be at.



Previous studies demonstrated that there was no relationship between type of ration fed (dry food or homemade) and overweight. However, the number of meals fed per day could have an influence on canine obesity. Dogs fed once daily or three times and more were found to be fatter than dogs fed twice a day (Bland et al., 2009). Similarly, Robertson (2003) noted that animals fed once a day only tended to be more obese than those fed more than once a day. Colliard et al. (2006) confirmed it when they showed that distribution of 3 or 4 meals per day was associated with a significant lower risk for dogs to be obese. This finding supports the hypothesis that repeated intakes of food increase energy loss through thermogenesis. Nevertheless, the study recently conducted by Courcier et al. (2010) differs from the others insofar that they did not find any association between obesity and feeding frequency.

The effect of feeding snacks on pet's weight was then investigated. Although no clear relationship was found between the number of treats fed and obesity, there was not a single overweight or obese dog in households where treats were not fed at all. I believe a clearer result would have been obtained knowing which kind of treat was given to dogs. Nowadays, many kinds of treats are available on the market and they are not always equivalent regarding the calorie supply. It may be possible that, even though there are more normal weight dogs fed treats once a day than overweight and obese dogs (61.5% and 38.5% respectively), the size of the treat and/or the calorie content is lower in treats fed to normal dogs.

Many other studies proved that households with overweight and obese dogs gave snacks significantly more often than households with normal dogs (Kienzle et al., 1998, Robertson, 2003, Colliard et al., 2006, Bland et al. 2009, Courcier et al., 2010). Given their high caloric value, it is important that owners are aware, and this can be one of the roles of the veterinarian, of the risk on the pet health when snacks are fed on a high frequency.

One of the last points that this study proposed to demonstrate was the relationship between the dog's habitat and dog's weight. It is expected that a dog which lives inside (flat or house) most of the daytime is restricted and cannot undertake exercise as much as wanted and is therefore more dependent on the owner. On the other hand, sometimes dogs kept in flats are actually taken for a walk more frequently than those kept in gardens as people may think the garden is a sufficient source of training. Statistically the data did not prove the dependence even if a tendency appears on the graph (Figure 9). A possible explanation would be that mostly small breed and toy breed dogs are kept inside and they may be at lower risk

of being obese as the weight variation is smaller in smaller dogs.

Furthermore, normal canine behaviour suggests that dog will try to conserve energy during periods when food is not available (Norris and Beaver, 1993). A dog kept outside in the garden for instance, will not use up more energy as he will try to keep strength in case food would not be forthcoming. This fits in with the finding that people who relies on the yard as a way for the dog to exercise may still have overweight dog as the animal will not necessarily walk or run. This is surely very much dependent on the dog breed.

The final goal in this survey was to compare the body condition scoring of owners and of veterinarians to check the capability of owners to identify overweight. In terms of normal weight dogs, clinicians and owners agreed 14 out of 28 evaluations (2 owners did not pick up any picture) therefore 50% of agreement was achieved which can be explained by the fact that pictures representing BCS 2/5 and 3/5 are quite similar on the questionnaire. For dogs classified as overweight or obese, owners and vets agreed about 15 out of the 20 evaluations (75% of agreement) from which only one dog was seen slimmer than he was and 4 fatter than they actually were (BCS 5/5 when evaluated 4/5 by the veterinarian). To me, this finding demonstrates that owners are able to see their dogs as they are: namely too fat but do not identify this as being overweight therefore are not able to recognise the visual aspect of their animal as a pathological condition.

According to White et al.(2011) there are more owners disagreeing with the veterinarian's BCS evaluation when the vet scored the animal as overweight than when he scored the dog as being normal. Similarly, Colliard et al. (2006) showed that owners underestimate the weight of their dogs when they are overweight. This indicates that owners are not always able to see that their pet is too fat and therefore that he needs to lose weight.

To interview the clients, different appropriate methods can be used. White et al. (2011) recruited and interviewed patient owners on-site mostly to establish owners' perception of dog weight and the discrepancies with the veterinarian BCS scoring. The interviewer read orally the questions and wrote down the answers given by the randomly selected dog owner. This avoids misunderstanding and possible rewording of the question by the interviewer in case needed. The sample is bigger in this way as somebody is permanently present in the clinic recording the results. An interesting factor that could have been also analysed with a physical interviewer is that the weight of the owner could also have been estimated and the result of Kienzle et al. (1998) demonstrated: "owners of obese

dogs were more often obese themselves”. Robertson conducted a random telephone survey to interview the dog owning households of the Perth metropolitan region in Australia (2003). Bland et al. decided to distribute questionnaires to dog owners through pet shops, vet clinics, universities, dog obedience schools and dog care centres (2009). This method was chosen to carry out my survey as I was not able to be physically present on the 2 clinics to conduct the study myself.

Furthermore, to inhibit the difference in BCS evaluation by the three veterinarians, a single practitioner should have been requested to perform the scoring. Another alternative would have been that the 3 veterinarians communicated to use the same techniques (visual assessment and body weight measurement).

To obtain more comparable results, the same dog breed or at least the same weight group (e.g. medium size dog: 15-25 kilos) should have been used to carry out the study. Choice was made not to select medium size dog in this study because the sample groups would have been too small.

To conclude, it is clear that human being has responsibilities in canine obesity. He is the one controlling most of the aspects of his pet's life: feeding type and frequency, exercise, habitat, etc. Either in excess or in deficit, they may cause decreased energy expenditure and increased fat deposition.

The strength of the human-animal bond is also an important parameter in developing dog's overweight. “There are barely any indications that human-pet bond between overweight dogs and their owners is closer than that between normal dogs and their owners” (Kienzle et al. 1998) however there are significant differences between the way obese dog owners and normal dog owners act with their animal. Too much empathy of the dog owner is easily seen in the consultation room: the owner talks more about and to their animal, is more receptive to the animal's suffering, more affected by the animal's pain, is more willing to save the animal no matter what the price is (emotional and economical). Although this kind of behaviour is not always blameworthy, it may inhibit the owner from standing back in order to assess what the true needs of the dog are and what is really good for him. In the case of canine obesity, the love the people feel for their pet is often translated by a supply of food: they tend to interpret their entire pet's need as a desire for food (Kienzle et al. 1998).

Last but not least, dog owners may not recognise their pet as being overweight (White et al., 2011). This indicates that owners are not always able to see that their pet is too fat and therefore that he needs to lose weight.

It appeared to me while leading this study that a crucial point in managing canine obesity and especially overweight owing to over humanisation of the pet is the communication between the owner and his/her veterinarian. Even if we can find more and more data on the internet, the practitioner remains the main reliable source of information. However, a study carried out in Australia shows that only 43% of the veterinary practices offer the clinic services to manage obesity (Bland et al., 2010).

Care must be taken to get onto the weight question with the owner soon during the life of the pet, for instance during the first vaccination consultation. A survey carried out in United States (Yaissle et al., 2004) compared the evolution of dog weight during an obesity management program in both a control group and an owner education treatment group. The latter received nutrition-related classes during the 6-month weight loss program. Dogs' weight significantly decreased in both groups but the interesting fact is that there was no significant difference between the mean weight loss in the control group (14.7%) and in the educated group (15%). A conclusion is that once overweight has set up, no matter if the owner is educated, the weight loss will not be greater that is why it is important to deal with the problem before it settles down and to approach it early enough.

To weight the dog at each further appointment as well as to use the body condition scoring should also be integral parts of the clinical examination. To achieve a good estimation, clinicians must be aware of the existence of the BCS and should be able to use this tool properly. In a survey conducted with 148 dogs, German and Morgan (2008) concluded that animals were infrequently weighted and that vets did not commonly assess the BCS indicating that practitioners are either unfamiliar with the technique or reluctant to use this simple tool.

It is also the role of the veterinarian to let the owners understand that obesity is harmful for health and can decrease the lifespan of their pet. A task which can become even more difficult when the owner is overweight as well. They must be aware that this condition can significantly lower the quality of life both for their pet and for them. To achieve significant results during weight loss period, both the cooperation of the patient and the owner are requested. Strict changes in every day habits are necessary namely decreased energy intake and increase energy expenditure. It is of utmost importance to appoint a target weight which corresponds to the breed standard and that will be achieved in the short term to avoid the owner to get discouraged (1-2% Body Weight per week) with the help of a proper slimming diet: low in calorie but rich in fibres, proteins, complex carbohydrates,

minerals and vitamins. To maintain this ideal body weight is the long-term challenge.

Interestingly enough, some Danish researchers discovered that when rats and pigs were fed restricted diet instead of ad libitum, there were propensity for aggression, frustration and development of stereotypes (Kasanen et al., 2010). Although maximum life expectancy was achieved by decreasing the food intake, hunger caused a mean behaviour in these animals.

A dilemma arises here: is it preferable to have a lean dog but aggressive or to have a fatter but happier animal? Depending on the welfare definition an answer can be given. If welfare is defined in terms of health and longevity, then the food restriction should be applied. However, if welfare is defined as happiness and wellbeing then ad libitum feeding may be preferred. But it would be a professional mistake as a vet to advise ad libitum feeding justified only by the wellbeing of the animal. Surely a dog may be able to eat more if they are also exercised more. Moderation is here the key issue. To feed good quality feedstuffs in good quantities on a regular basis and to provide the appropriate amount of exercise is the best attitude to fight against overweight. Owners must be aware that another form of affection than feeding can be given: plays, training, walks etc.

Condemning owners of fat companion animals without either providing assistance or finding the underlying cause may simply worsen the problem. Instead it is one of the practitioner roles' to highlight the danger of overweight and to find solutions adapted to the situation to improve both the owner and the dog quality of life. With increased prevalence of overweight humans and animals, canine obesity, as human obesity, is and remains an important welfare issue of this century.

## 5. Conclusions

The main goal of this study work was to establish the responsibility owners have in development of canine obesity. According to my results the main conclusions can be drawn as follow. The risk of canine obesity is higher:

- in case of female owners,
- in households with 1 person only,
- if the owners are getting older (46 years old and more),
- when treats are fed,
- when owners walk their pet every day less than 1 hour,
- in case of dogs kept in garden without taking them for a walk.

## 6. Summary

Obesity is a multifactorial disease which prevalence is increasing around the world both in human and dog population. Factors like female dogs, older animals, Labrador retriever breed and neutering have been demonstrated on numerous occasions to be at risk of obesity. The overall aim of this study was to investigate an understated parameter: the role that owner plays in the obesity of dogs by evaluating how overweight and obese dog owners' care for their animals on a daily basis compared to owners of normal weight dogs. Questionnaires were distributed in two private veterinary clinics in the periphery of Le Mans, France to owners of both "overweight and obese" dogs and "normal weight" dogs. Altogether 51 dog owners accepted to fill in the questionnaires. Answers of 20 "overweight and obese" dog owners and 31 "normal" dog owners were collected.

According to my results the main conclusions can be drawn as follow. The risk of canine obesity is higher:

- in case of female owners,
- in households with 1 person only,
- if the owners are getting older (46 years old and more),
- when treats are fed,
- when owners walk their pet every day less than 1 hour,
- in case of dogs kept in garden without taking them for a walk.

## 7. Appendix

### QUESTIONNAIRE NUTRITION - HEALTH

1. What is your gender and age group?

<input type="checkbox"/>	Male	<input type="checkbox"/>	18-25
<input type="checkbox"/>	Female	<input type="checkbox"/>	26-35
		<input type="checkbox"/>	36-45
		<input type="checkbox"/>	46-60
		<input type="checkbox"/>	60 and +

2. How many people are in your household, including you ?

3. If more than 1, how many person(s) feed the dog?

<input type="checkbox"/>	Always one and the same person
<input type="checkbox"/>	The person who is at home when the dog is going to be fed

4. What is your status?

<input type="checkbox"/>	Student
<input type="checkbox"/>	Unemployed or not working
<input type="checkbox"/>	Employed
<input type="checkbox"/>	Retired

5. What is the breed of your dog?

6. What is your dog gender?

<input type="checkbox"/>	Male	<input type="checkbox"/>	Neutered
<input type="checkbox"/>	Female	<input type="checkbox"/>	Non neutered

7. Do you consider your dog to be overweight?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No
<input type="checkbox"/>	Unsure

8. How frequently do you feed treats to your dog?

<input type="checkbox"/>	More than 3 times daily
<input type="checkbox"/>	Once daily
<input type="checkbox"/>	Once weekly
<input type="checkbox"/>	Never
<input type="checkbox"/>	Unsure

9. Is your dog present when you are cooking or having a meal?

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
--------------------------	-----	--------------------------	----



10. If yes, are you able to resist when he begs for scraps?

<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
--------------------------	-----	--------------------------	----

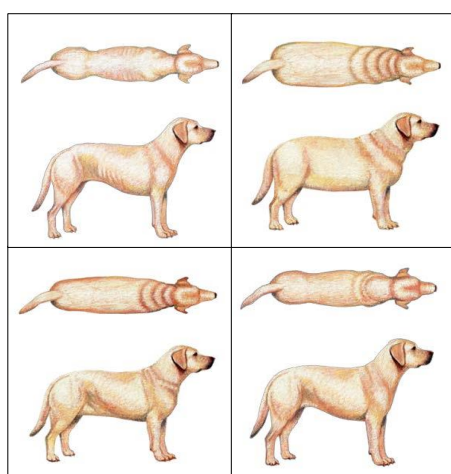
11. Do you monitor your dog's weight?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No
<input type="checkbox"/>	Unsure

12. Do you know your dog's weight?

<input type="checkbox"/>	Yes, in this case, please specify : ..... kg
<input type="checkbox"/>	No

13. Which picture best illustrates the condition of your dog? (circle the picture)



14. How do you determine the daily amount of feed given to your dog?

<input type="checkbox"/>	according to the food package
<input type="checkbox"/>	according to my experience

15. How often do you exercise your dog?

<input type="checkbox"/>	Every day more than 1 hour
<input type="checkbox"/>	Every day less than 1 hour
<input type="checkbox"/>	2 or 3 times a week
<input type="checkbox"/>	Once a week
<input type="checkbox"/>	There is a yard and therefore my dog exercises himself

16. Where does your dog live mostly?

<input type="checkbox"/>	Inside
<input type="checkbox"/>	Outside

## 8. References

- U.S. Pet (dog and cat) population fact sheet,  
<http://www.bradfordlicensing.com/documents/pets-fact-sheet.pdf> Downloaded: 05.05.2016
- Pet Obesity: Five Years On,  
[http://www.pfma.org.uk/\\_assets/docs/PFMA\\_WhitePaper\\_2014.pdf](http://www.pfma.org.uk/_assets/docs/PFMA_WhitePaper_2014.pdf) Downloaded:  
28.04.2016
- BECKER, N., DILLITZER, N., SAUTER-LOUIS, C. & KIENZLE, E. (2012): Feeding of dogs and cats in Germany. *Tierärztliche Praxis Kleintiere*, **40**, 391-397.
- BLAND, I.M., GUTHRIE-JONES, R.D., TAYLOR, J. HILL (2009): Dog obesity: owner attitude and behaviour. *Preventive Veterinary Medicine*, **92**, 333-340.
- BLAND, I.M., GUTHRIE-JONES, R.D., TAYLOR, J. HILL (2010): Dog obesity: veterinary practices' and owners' opinions on cause and management. *Preventive Veterinary Medicine*, **94**, 310-315.
- BURKHOLDER, W.J. (2000): Use of body condition scores in clinical assessment of the provision of optimal nutrition. *Journal of the American Veterinary Medical Association*, **217**, 650-654.
- COLLIARD, L., ANCEL, J., BENET, J.-J., PARAGON, B.-M. & BLANCHARD, G. (2006): Risk factors for obesity in dogs in France. *Journal of Nutrition*, **136**, 1951-1954.
- COURCIER, E. A., THOMSON, R. M., MELLOR, D.J. & YAM, P.S. (2010): An epidemiological study of environmental factors associated with canine obesity. *Journal of Small Animal Practice*, **51**, 362-367.
- EDNEY, A.T.B. & SMITH, P.M. (1986): Study of obesity in dogs visiting veterinary practices in the United Kingdom. *Veterinary Record*, **118**, 391-396.
- GERMAN, A.J. (2006): The growing problem of obesity in dogs and cats. *Journal of Nutrition*, **136**, 1940-1946.
- GERMAN, A.J. & MORGAN, L.E. (2008): How often do veterinarians assess the bodyweight and body condition of dogs? *Veterinary Record*, **163**, 503-505.
- KEALY, R.D., LAWLER, D.F., BALLAM, J.M., MANTZ, S.L., BIERY, D.N., GREELEY, E.H., LUST, G., SEGRE, M., SMITH, G.K., & STOWE, H.D. (2002): Effects of diet restriction on life span and age related changes in dogs. *Journal of the American Veterinary Medical Association*, **220**, 1315-1320.
- KASANEN, L. H. E., SORENSEN, D. B., FORKMAN, B. & SANDOE, P. (2010): Ethics of feeding: the omnivore dilemma. *Animal Welfare*, **19**, 37-44.

- KIENZLE, E. & BERGLER, R. (2006): Human-animal relationship of owners of normal and overweight cats. *Journal of Nutrition*, **136**, 1947-1950.
- KIENZLE, E., BERGLER, R., MANDERNACH, A. (1998): A comparison of the feeding behaviour and the human-animal relationship in owners of normal and obese dogs. *Journal of Nutrition*, **128**, 2779-2782.
- KRONFELD, D.S., DONOGHUE, S. & GLICKMAN, L.T. (1991): Body condition and energy intakes of dogs in a referral teaching hospital. *Journal of Nutrition*, **121**, 157-158.
- LUND, E.M., AMSTRONG, P.J., KIRK, C.A. & KLAUSNER, J.S. (2006): Prevalence and risk factors for obesity in adult dogs from private US veterinary practices. *International Journal of Applied Research in Veterinary Medicine*, **4**, 177-186.
- MASON, E. (1970): Obesity in pet dogs. *Veterinary Record*, **86**, 612-616.
- MCGREEVY, P.D., THOMSON, P.C., PRIDE, C., FAWCETT, A., GRASSI, I. & JONES, B. (2005): Prevalence of obesity in dogs examined by Australian veterinary practices and the risk factors involved. *Veterinary Record*, **156**, 695-672.
- MCLAREN, L. (2007): Socioeconomic status and obesity. *Epidemiologic Reviews*, **29**, 29-48.
- NELSON, R.W., & COUTO, C.G. (2014): Small animal internal medicine 5th edition Canada; Elsevier; Mosby., 1473p.
- NORRIS, M.P., BEAVER, B.V. (1993): Application of behaviour therapy techniques in the treatment of obesity in companion animals. *Journal of the American Veterinary Medical Association* **202**, 728-732.
- R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>
- RAFFAN, E., DENNIS, R. J., ODOVANO, R. J., BECKER, J. M., SCOTT, R. A., SMITH, S. P., WITHERS, D. J., WOOD, E. J., CONCI, E., CLEMENTS, D. N., SUMMERS, K. M., GERMAN, A. J., MELLERSH, C. S., ARENDT, M. L., IYEMERE, V. P., WITHERS, E., SÖDER, J., WERNERSSON, S., ANDERSSON, G., LINDBLAD-TOH, K., YEO, G. S. H. & ORAHILLY, S. (2016): A deletion in the canine POMC gene is associated with weight and appetite in obesity-prone Labrador retriever dogs. *Cell Metabolism*, **21**, 1-8.
- ROBERTSON, I.D. (2003): The association of exercise, diet and other factors with owner-perceived obesity in privately owned dogs from metropolitan Perth, WA. *Preventive Veterinary Medicine*, **58**, 75-83.

SANDOE, P., PALMER, C., CORR, S., ASTRUP, A. & REINHARD BJORNVAD, C. (2014): Canine and feline obesity: a one health perspective. *Veterinary Record*, **175**, 610-616.

WHITE, G.A., HOBSON-WEST, P., COBB, K., CRAIGON, J., HAMMOND, R. & MILLAR, K.M. (2011): Canine obesity: is there a difference between veterinarian and owner perception? *Journal of Small Animal Practice*, **52**, 622-626.

YAISSLE, J.E., HOLLOWAY, C. & TONY BUFFINGTON C.A. (2004): Evaluation of owner education as a component of obesity treatment programs for dogs. *Journal of American Veterinary Medical Association*, **224**, 1932-1935.

## **Acknowledgments**

I would like to thank firstly Professor István Hullár from the Nutrition Department. He trusted me in the choice of the topic of my thesis and encouraged me in my work. I became very much interested in dog clinical dietetics during the nutrition lectures hold by him and his colleagues.

Thank then to Mister Zsolt Abonyi-Tóth who had the patience to process with the statistical analysis of my data and to explain the results obtained. I would like to thank them both for their availability during all these months.

Many thanks to Doctor Philippe Zeppa and to Doctor Alain Choplain who accepted to distribute the questionnaires among their clients. They are both excellent veterinarians that made me love the job even more when working with them in different occasions.

I should not forget to thank my father without the financial and emotional support of who, the whole Budapest adventure would not have been possible and this thesis work either consequently.

Eventually, thanks to my mom. Even if I did not fully estimate it when I was younger, she made me work hard to get what I deserve.