TREATMENT OF OBESITY – INEVITABLE FRUSTRATION ? A Review Illustrated with a Complex Case

Behandeling van Obesitas: een frustrerende aangelegenheid?

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ABSTRACT

The treatment of obesity involves dealing with the psychological aspects, manipulating the diet and increasing the activity level. The objectives of the nutritional management are to decrease energy intake, to stimulate satiety and to provide a balanced nutritional intake that is appropriate for the stage of life and/or concomitant disease. The assessment of a diet for weight reduction should take into account the daily nutrient intake in order to avoid underfeeding of essential nutrients. The treatment of obesity will be illustrated with a complicated case of obesity and renal insufficiency in a dog.

Key Words: Obesity – Dog

SAMENVATTING

De behandeling van obesitas omvat het psychologisch aspect, het verhogen van de activiteit en het aanpassen van het dieet. De objectieven van de diëtische behandeling zijn de energieopname verlagen, de verzadiging stimuleren en een uitgebalanceerd voeder voor de levensomstandigheden en/of samengaande aandoeningen voorzien. Bij het aanbevelen van een dieet voor gewichtsverlies moet ook rekening gehouden worden met de dagelijkse nutriëntenopname, zodat aan de behoefte van de essentiële nutriënten voldaan is. De behandeling van obesitas zal geïllustreerd worden aan de hand van een gecompliceerd geval, namelijk een obese nierpatiënt.

INTRODUCTION

Although prevention should always be the objective, practitioners see obese patients with increasing frequency. In 1973, R.S. Anderson reported that 9 % of 429 cats attending veterinary practices in the UK were obese or overweight. Twenty years later, Sloth (1992) found that 28 % of the cats seen in a practice in Denmark were overweight and an additional 12.5 % actually obese. A survey by Edney and Smith (1986) showed that 24.3 % of the dogs presented to veterinary surgeons were either obese (21.4 %) or gross (2.9 %). In a survey of practices by the University of Minnesota, 27% of 86,772 dogs and 26% of 42,774 cats were reported overweight or obese (Armstrong, 1997).

The practical aspects of the treatment of obesity will be discussed and illustrated with a complex case.

CASE

A 7-year-old castrated male Maltese dog was presented to the veterinary teaching hospital for early onset of fatigue, lethargy, respiratory distress and coughing. Three months earlier the dog had been put on a renal diet (A) (Table 1) after moderate renal insufficiency had been diagnosed. A treatment with digoxin, enalapril and furosemide had also been started before the dog was first presented. On echography, a slight left atrial enlargement was seen, but valvular disease could not be ruled out due to the heavy panting and the degree of obesity. Only the enalapril treatment was continued and the dog was referred to us for the treatment of obesity a week later. By the time it was presented to us it weighted 8.45 kg and had gained another 250 g during the previous week. Its body condition score (BCS) was 5 on a scale of 5 (Table 2).

Table 1. Composition of the diets*.

	Diet A[1]	Diet B[2]	Diet C[3]	75% Diet B + 25% Diet C		
	As fed	*As fed*	*As fed*	*As fed*	Dry matter	g per MJ ME
Moisture%	8.0	9.0	7.5	8.63		
Crude protein %	15.0	22.3	13.5	20.10	22.00	16.19
Crude fat %	18.0	7.7	17.6	10.18	11.14	8.19
Crude fibre %	2.0	21.3	1.3	16.30	17.84	13.13
Calcium %	0.6	0.65	0.74	0.67	0.74	0.54
Phosphorus %	0.3	0.50	0.23	0.43	0.47	0.35
Sodium %	0.2	0.29	0.20	0.27	0.29	0.22
Metabolisable energy (kJ/100g)	1699	1109	1640	1293	1415	

** Data from company brochures. [1]Canistar S3 dry (Royal Canin); [2]Prescription Diet Canine r/d dry (Hill's pet Nutrition); [3]Prescription Diet Canine k/d dry (Hill's pet Nutrition).*

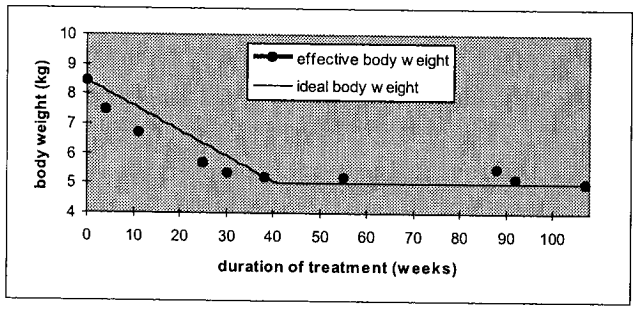

Figure 1. Evolution of body weight.

Table 2. Body Condition Score.

1	Very thin
2	Thin
3	Optimal
4	Overweight
5	Obese

A remarkable egg-sized hard mass of fat palpable in both inguinal areas was noted.

The dog was switched to a high-fibre low-fat diet (B) (Table 1), of which it received 69 g divided over three meals a day. In addition, 5 g of Camembert cheese was allowed to administer the enalapril tablets. In total, it received 820 kJ per day (290 kJ/kg$^{0.75}$).

The owners were asked to check the animal's weight once a week. Over the first 38 weeks, the dog lost 3.25 kg, which was an average of 1.01 % per week, based on the initial weight (Figure 1 and Table 3). Over the course of the treatment, it gradually became livelier and panting resolved. The fat mass in both groins progressively softened and decreased in size. Ultimately, the right groin normalised completely. At 30 weeks, a thorough cardiology exam was finally possible and no abnormality was found. The enalapril was discontinued and the energy intake was slightly increased by substituting 20 g of a dry renal diet (C) for 9 g of the reducing diet (Table 7). More than a year later, the dog's body weight has remained stable at about 5 kg, except for one bout of weight gain that peaked at week 88, at which time the body weight had risen to 5.5 kg. The dog was then switched back to its original regimen. Two months later it was allowed the less restrictive regimen again. Blood analyses are summarised in Table 4.

Table 3. Evolution of body weight.

Parameter	Week									
	0	4	11	25	30	38	55	88	92	107
Body weight (kg)	8.45	7.50	6.70	5.70	5.35	5.20	5.2	5.5	5.15	5.0
Weekly weight loss (%)		2.8	1.3	0.85	0.83	0.22	-	-	-	-
Body condition score	5	5	5	4	3.5	3.5	3.5	3.5-4	3.5	3.5

TREATMENT

The management of obesity involves dealing with the psychological aspect, increasing the activity level and manipulating the diet. Treatment may fail if all three of these aspects are not carefully taken into consideration (Lewis *et al.,* 1987).

Psychological aspect

With companion animals, the feeder and the consumer are not the same. This is important, because one-third of the owners fail to recognise that their animal is overweight (Mason, 1970) and most present their animal for a different reason than obesity (Sloth, 1992). The owner, therefore, must be willing to participate in the program and comply with it. The veterinarian has a major impact on the owner's willingness to comply and should take sufficient time during the first consultation to discuss all aspects of obesity and its treatment. An accurate diagnosis is the first step toward convincing these clients of the problem. The animal's weight can be compared with breed standards or with body weight at young adulthood. But breed standards show relatively wide ranges of optimal weights and the animal may fall outside the official standard. Body weight should thus always be evaluated against a BCS (Table 2). Pointing out signs of obesity during the BCS helps to convince the owner. It may also be good to indicate the long-term health risks of obesity and point out the beneficial effects of a proper weight loss programme. Since it was colleagues who referred the Maltese dog to us and the clinical signs, such as the inguinal fat masses, could easily be associated with obesity, it was not too difficult to convince the owners to treat their dog.

To ensure compliance until the end of the course of treatment, it is necessary to give as many details as possible about all aspects of the programme, including potential difficulties and measures to minimise them. One such problem may be excessive begging for food. It is very difficult for owners to resist when animals are begging and most are unaware that they reinforce begging by offering titbits (Campbell, 1986a). If treats have to be given, they should be offered immediately after a meal, never between meals because that would stimulate begging. The nature and quantity of the treats have to be clearly defined and the calories provided by the treats subtracted from the amount of diet.

Begging is directly proportional to the number of adults in the family (Campbell, 1986b). All members of the family should therefore be involved in the discussion and buy into the weight reduction program.

The veterinarian must give concrete instructions about the nature of the diet and the exact amounts and feeding schedule. He or she must tailor the treatment to each client's specific needs and life style. The owners must be informed about the expected length of the treatment, which is calculated on the basis of the estimated target weight and the expected weekly weight loss. The latter can vary from 0.5 to 2 % of the ***initial*** weight (Butterwick and Markwell, 1996; Burkholder and Toll, 2000) and can be as high as 3% during the first weeks of weight reduction (Lewis *et al.,* 1987). In our experience, an average weekly weight loss of 1 % of the initial body weight is a realistic target.

Either breed standards or the animal's weight at one to two years of age (assuming it was not already overweight at that time) can be used to determined the target weight. The dog was slightly larger than the standard for Maltese dogs but the owners remembered that it weighed 800 g when they got it at the age of 6 weeks. On that basis, the target weight was estimated

Table 4. Results of blood analyses.

Parameter	Week									
	Start**	4	19	25	30	55	85	106	Reference values	
Glucose	4.4	*6.08*	4	4.6	4.3	4.1	4.2	6.2	4 – 6	mmol/L
Total proteins	*82*	61.9	67	64	63	64	68	56	58 – 75	g/L
Urea	*8*	5.11	*8.3*	6.6	*7.5*	*7*	*6.8*	*7.6*	2 - 6.7	mmol/L
Creatinine	99.9	81	74.3	85.8	81.3	68	84	76		µmol/L
AST	27	29.8	16	14	16	20	22	16	15 – 30	IU/L
ALT	54	33.6	24	24	27	29	27	26	25 – 55	IU/L
AP*	*1597*	*139*	*468*	*390*	*366*	*419*	*629*	*447*	25 – 100	IU/L
Bile acids	18		*27*	13	7				< 20	µmol/L
Triglycerides		*1.9*	*4.4*	0.8	0.8	1	1.4	0.7	0.5 - 1.15	mmol/L
Cholesterol	*8.5*	5.63		5.4	5.2	7.4	8.2	6.6	2.5 – 6	mmol/L
Phosphorus	*2*	1.15			1.1	1.3	1.3	*1.9*	0.9 - 1.6	mmol/L

* AP =Alkaline phosphatase; **One month before the dog was first seen.

Table 5. Nutrition consultation.

1. Patient description
2. Nutritional history
3. Clinical examination
4. Problem listing
5. Key nutritional factors for each problem
6. Propose a proper dietary profile
7. Evaluate the new diet against the nutritional history
8. Treatment schedule

to be 4 kg (Debraekeleer, 2000). We anticipated that our patient would lose 80 to 85g per week, with the treatment lasting about 52 weeks. It is important to set the optimal body weight low enough. Otherwise the animal may not lose weight or weight loss may be too slow and the owner will lose interest and fail to comply with the treatment. It is better to stop the treatment somewhat earlier, when a good compromise is reached between the owner's willingness to continue and the potential health risk at the obtained body weight. Regular follow-up visits are necessary for compliance and to allow the veterinarian to make adjustments if needed. Over the first 38 weeks our patient lost an average 1% of its initial body weight per week, with 2.8% during the first month (Figure 1 and Table 3).

Activity

Activity should be stimulated to increase the energy expenditure, though a considerable physical effort is required to expend a significant number of additional calories (Pi-Sunyer, 1988). It has been reported that exercise stimulates the loss of fat in obese people when there is no increased food intake, whereas lean individuals increase food intake to maintain body weight (Pi-Sunyer, 1988, Albu *et al.*, 1997). Increased activity definitely stimulates the loss of body fat

when it is accompanied by a decrease in calorie intake (Pi-Sunyer, 1988) and it helps to maintain lean body mass. It is relatively easy to increase a dog's activity, but this is more difficult with cats. Exercise should be introduced gradually, because obese animals may be unwilling or unable to increase their activity level when grossly obese. The activity level required to obtain a sufficient rise in energy expenditure in dogs has been estimated to be a walk of about 5 km per day (Markwell and Butterwick, 1994). Before treatment, the Maltese dog refused to walk at all and was not capable of climbing the stairs or jumping into a couch. After one month of treatment, the dog had regained these capabilities and two months later it made a brisk daily walk of 5 to 6 km.

Dietary management

To ensure a comprehensive nutritional evaluation and an optimal treatment plan, we always follow the same protocol in working up nutritional cases (Table 5).

Patient description

The patient description gives information about breed predisposition and specific nutritional needs. Being a castrated 7-year-old male dog, our patient matched the typical profile of obesity in dogs. Castrated male dogs are about twice as likely to be overweight than are intact males (Edney and Smith, 1986) and the incidence of obesity in dogs peaks around 7 years of age, the age at which up to 50% of the animals may be affected (Armstrong, 1997).

Nutritional history

The nutritional history should always provide very detailed information about type of food, brand and exact quantities fed, as well as information about treats and table scraps. Details such as who is feeding the animal, when the animal is fed and how the animal behaves at home and how the owners react to it, are important for optimising the treatment.

Although the Maltese dog had been gaining weight more rapidly over the previous few months, the owners claimed that it had not been eating much. To treat the chronic renal disease, the dog received 100g per day of diet A (Table 1). In addition, some table scraps were given, as well as a piece of Camembert cheese for administering the enalapril tablets.

Problem list

The early onset of fatigue, lethargy, panting and coughing could have been attributed either to the extreme degree of obesity or to cardiac insufficiency, which could not be ruled out due to the obesity. In addition, the dog had been diagnosed with early stage-renal disease (see blood chemistry Table 4). These three conditions had to be taken into account in determining the key nutritional factors and designing the dietary profile. With a body weight exceeding the optimal level by more than 100%, obesity was clearly an important problem in our patient. Obesity may cause tachycardia, sodium retention and hypertension (Rocchini *et al.*, 1987, Rocchini *et al.*, 1989, Joles 1995). Sodium and water retention increase the preload and left atrial pressure (de Morais, 2000), which could have been the cause of the reversible left atrial enlargement. Hypertension can cause left ventricular hypertrophy and stimulate the development of renal disease. On the other hand, hypertension can itself be caused by chronic renal disease (Littman, 1990). Obesity may aggravate the clinical signs of heart disease either directly or through the existing hypertension. In addition, obesity and hyperphagia may contribute to the more rapid development of early-onset renal disease (Johnson *et al.*, 1997).

Key nutritional factors

The nutritional factors listed in Table 6 are to be considered in the treatment and must take into account the following conditions: hypertension, cardiac disease, chronic renal disease and obesity. Obesity was considered the most important, because treating the obesity also helps to improve the other conditions. The dietary management of obesity has three objectives: 1) to decrease the energy intake, 2) to stimulate satiety and 3) to provide balanced nutrition in terms of the life stage. L-carnitine helps to reduce body weight and to increase or maintain lean body mass (Center, 1997; Owen, 1997). As for the renal insufficiency, we were mainly concerned about the phosphorus and protein intake to slow the evolution because the blood urea tended to be high (Polzin *et al.*, 1989, Brown *et al.*, 1991, Finco *et al.*, 1991). Sodium intake should be moderate because of the hypertension that may be caused by chronic renal disease and obesity and because of the potential valvular disease which had not yet been ruled out.

Table 6. Key Nutritional Factors*.

	Obesity	Chronic renal disease	Hypertension/Heart disease
Energy intake	↓	Normal	Normal
Protein	Maintenance level	Reduced	Maintenance level
Fat	↓	N	
Fatty acids	Maintenance level	N-3 fatty acids ↑	Maintenance level
Phosphorus	Maintenance level	↓	
Potassium	Maintenance level	↑	Maintenance level
Sodium	Moderate	Moderate	Moderate
L-carnitine	↑		N to ↑

* Intake levels

Propose a proper dietary profile

• Reduce energy intake

The daily energy intake should definitely be restricted. Equations for energy restriction have been based on obese body weight as well as on the target or optimal body weight (Burkholder and Toll, 2000). We always calculate the energy requirements on the basis of the optimal body weight because body fat is metabolically less active and energy expenditure is more related to lean body mass (Blaxter, 1989).

Different levels of energy restriction have been suggested for weight reduction in dogs, varying from 40 to 75 % of the maintenance energy requirements at target body weight (Lewis *et al.*, 1987; Markwell *et al.*, 1990; Laflamme *et al.*, 1997; Burkholder and Bauer, 1998). Excessive energy restriction should be avoided because rapid weight loss has been associated with greater loss of lean body mass and a decrease in resting energy expenditure (REE) (Burkholder and Bauer, 1998; Butterwick and Hawthorne, 1998). The latter would work against the goal of maintaining the highest metabolic rate possible to stimulate weight loss (Burkholder and Bauer, 1998). In addition, excessive energy restriction increases the risk of hepatic lipidosis in cats (Biourge *et al.*, 1993) and may stimulate rebound weight gain and weight cycling after optimal body weight is reached (Laflamme *et al.*, 1997).

We use resting energy requirements (RER, 290 $kJ/kg^{0.75}$) to calculate the energy requirements for both dogs and cats (Burkholder and Toll, 2000). It allows us to use the same equation for both species and corresponds well with previous recommendations of about 60% of the MER for dogs and 70 to 75% for cats. Whatever method is used, it should always be explained to the owners, that this is only a starting point and that food intake may have to be adjusted if no weight is lost.

• Increase satiety

Satiety is a complex matter involving gastric distention, neuro-endocrine mechanisms and nutrient uptake (Ruckebusch *et al.*, 1991; Guyton and Hall, 1996). The regulation of food intake can be divided into short-term regulation, which is concerned primarily with the prevention of overeating during a meal and long-term regulation, which is related to long-term maintenance of normal energy stores in the body (Guyton and Hall, 1996). Data indicate that in dogs, distension of the stomach causes an early pre-duodenal stimulus for satiety, which is independent of the caloric intake (Meyer *et al.*, 1980;

Table 7. Daily energy requirements (DER) for evaluation and treatment schedule.

	Maintenance	Weight loss	Prevention
Ideal BW	4 kg	4 kg	4 kg
Metabolic weight (kg $^{0.75}$)	2.8284	2.8284	2.8284
Energy allowance	480 kJ/kg $^{0.75}$	290 kJ/kg $^{0.75}$	350 kJ/kg $^{0.75}$
DER	1358 kJ/day	820 kJ/day	990 kJ/day
Type and amount of food*	80 g of renal diet (A)	74 g [69 g of reduction diet (B) + 5 g of Camembert]	80 g [75% (60g) of reduction diet (B) + 25% (20g) of renal diet (C)] + 5 g of Camembert

* Amount of food needed to meet the energy requirements during that particular period. In the later stage of the treatment (prevention), a combination was given of the reduction diet (75% of the amount) and a renal diet (25% of the amount).

Koch-Erhorn, 1987; Pappas *et al.*, 1989). In this way a diet high in insoluble fibre helps to stimulate satiety and decrease food intake (Jewell and Toll, 1996). Butterwick *et al.* (1997) have questioned the satiety effect of dietary fibre. But their results may have been the consequence of the small meal size due to the severe energy restriction and the relatively low fibre content of the diets in the study, resulting in a low bulk intake (7-9 g dry matter/kg BW). Data suggest indeed that the dry matter intake should be at least twice as high to generate a satiety effect (Meyer *et al.*, 1980; Pappas *et al.*, 1989). Providing a larger meal has the additional psychological benefit that the owner does not have to give less food than before.

Diets high in insoluble fibre or other indigestible material decrease the overall daily energy intake and help to enhance weight loss in dogs (Koch-Erhorn, 1987; Borne *et al.*, 1996). In one study, iso-caloric energy restriction (60% of MER) resulted in a significantly greater decrease in body fat, mean arterial pressure and total cholesterol in dogs when feeding a high-fibre low-fat diet compared to a low-fibre high-fat diet (Borne *et al.*, 1996).

Long-term satiety is regulated by the energy stores of the body. When these fall below normal, the feeding centers of the hypothalamus and other areas become very active and the animal exhibits increased hunger and searching for food (Guyton and Hall, 1996). In the second phase of the treatment it is often seen that the dogs get hungrier and satiety becomes more difficult to achieve.

Balanced nutrition

A diet must always ensure that all nutrients are provided in sufficient amounts to meet the nutritional requirements for the life stage. Despite the energy restriction imposed for weight loss, the need for the other nutrients remains unchanged (Burkholder and Bauer, 1998). As the same amount of nutrients is offered within smaller package of energy; the concentration in the diet must be raised. For weight reduction, only 60% of the maintenance energy requirements (MER) is given to dogs and about 75% to cats. To correctly assess the nutritional profile of a weight reduction diet, the absolute nutrient intake must be taken into account. This can be done by evaluating the nutrient content of the weight reduction diet on 60 % of the dry matter for dogs or 75 % for cats and comparing this with 100% of the dry matter recommended for the disease or life stage. The same is true when the assessment is made on an energy basis: nutrient levels per 0.6 MJ or 0.75 MJ in the reducing diet should be evaluated against levels normally recommended per MJ (Table 8). For example, in studies showing a beneficial effect of phosphorus restriction in dogs with chronic renal disease, an effect was seen with diets containing 0.3-0.4% phosphorus in the DM (Lopez-Hilker *et al.*,

Table 8. Composition of the reduction diet. (company data).

	as fed	dry matter basis	g per MJ of ME	g per 0.6 MJ ME
Moisture	9.0 %			
Crude protein	22.3 %	24.5 %	20.1	12.0
Crude fat	7.7 %	8.5 %	6.9	4.2
Crude fibre	21.3 %	23.4 %	19.2	11.5
Crude ash	5.0 %	5.5 %	4.5	2.7
Calcium	0.65 %	0.71 %	0.59	0.35
Phosphorus	0.50 %	0.50 %	0.45	0.27
Sodium	0.29 %	0.29 %	0.26	0.16
Metabolisable Energy	1109 kJ/100 g	1218 kJ/100 g		

1990; Brown *et al.*, 1991). We selected the reduction diet with the lowest phosphorus content (0.5% DM). When given at 60% of the MER, this corresponds to the intake obtained with a renal diet containing 0.3% phosphorus and given at 100 % of MER. The other nutrients, such as protein and sodium, can be evaluated in the same way.

For weight reduction, a fat level of maximum 10% in the dry matter has been recommended (Hand, 1988). When a low fat diet is used, which is justified because fat supplies more than twice as much energy as protein or carbohydrate, a source of essential fatty acids, (e.g. linoleic acid) needs to be available in the food (e.g. in the form of vegetable oil).

High-fibre diets are often considered less tasty (Meyer *et al.*, 1978; Biourge *et al.*, 1987) but we have not encountered any palatability problem in the dogs treated so far. High levels of dietary fibre may reduce the nutrient digestibility by 2 to 8% and increase the frequency of defecation (Bartges and Anderson, 1997; Burkholder and Toll, 2000). However, insoluble fibre such as cellulose has only marginal impact on the digestibility of minerals and trace elements compared to other fibre sources (Wedekind *et al.*, 1995; Wedekind *et al.*, 1996). It is important to tell the owner to monitor water intake when switching to a high-fibre diet, because fibre binds considerable amounts of water and might cause constipation if water intake is not monitored.

Evaluation of the diet

Clearly the Maltese dog received too much energy, even though the owners believed it was not eating enough. With the 100 g of renal diet A alone, the Maltese dog was receiving 1700 kJ per day (Table 1), while the MER for a 4 kg dog averages about 1358 kJ per day (480 kJ/kg$^{0.75}$) (Debraekeleer, 2000), and the recommended intake for weight loss is 820 kJ (290 kJ/kg$^{0.75}$) per day. In addition, if renal diet A had been given to meet the daily energy requirements for weight reduction, the daily protein intake would only be 7.24 g or 2.56 g crude protein per kg$^{0.75}$, which is below the minimum requirements for healthy adult dogs (Gesellschaft für Ernährungs, 1989). At 60% of MER, the prescribed reducing diet provided 5.44g/kg $^{0.75}$. Recommendations for chronic renal disease have been 2 - 2.2 g protein per kg BW, corresponding with about 4.5 g crude protein/kg$^{0.75}$ (Polzin *et al.*, 1989).

Practical feeding plan

Body weight and condition scores should be recorded at the first visit and at each check-up. Energy requirements are calculated on the basis of the animal's

ideal body weight. Our calculations were based on an ideal weight of 4 kg. The daily intake is calculated on the basis of RER or 290 kJ/kg$^{0.75}$. Dividing the energy intake over several meals a day raises postprandial thermogenesis. Serving four meals a day instead of 1 doubled the postprandial thermogenesis in dogs (Leblanc and Diamond, 1985). Serving several small meals per day rather than a single meal may also help to decrease food intake (Ruckebusch *et al.,* 1991).

We discourage the giving of snacks, but if necessary for the owner's compliance or for administering medication, it is better to allow it and to take it into account when calculating the daily ration. The owner was only able to administer the enalapril with a piece of cheese, the calories of which we deducted from the total energy. The Maltese dog only needed 820 kJ per day, including the Camembert cheese needed to administer the enalapril. Since Camembert provides about 55 kJ/5 g, the reducing diet had to provide 765 kJ, or 69g, which was given in three meals of 23 g.

The animal should receive food-including snacks and table scraps - only in its usual bowl. This will encourage the owner to make a greater effort to maintain the practice.

When concomitant diseases are present, the nutrients that are important for treating the various diseases should be defined to ensure that the diet is adapted. In case of contradictory recommendations for certain nutrients, the most life-threatening disorder should take priority. The nutrient content should be evaluated on the basis of 60 % of the dry matter or metabolisable energy (per 0.6 MJ) for dogs and 75% (per 0.75 MJ) for cats (Table 2).

Nutrition upon achievement of the target weight

When a balance is reached between the owner's willingness to continue the regimen and the body condition, the energy intake can be increased. Nevertheless, the nutritional and activity habits taught during the weight loss program should be maintained after the target weight has been achieved. In general, food intake can be increased to 350-400 kJ/kg$^{0.75}$, though a number of dogs may have to remain at an intake of 290 kJ/kg$^{0.75}$ (LaFlamme *et al.*, 1997) and should stay with the reduction diet to maintain body weight.

When the dog reached a BW of 5.2 kg, it was very alert and fatigue and respiratory distress had completely disappeared, though the blood urea had the tendency to increase slightly. Its body condition was 3.5 on a scale of 5 and we decided that this was a good moment to relax the energy intake and to put a little more emphasis on the renal function. A combination of the reducing diet (75%) and a renal diet (25%) was prescribed and the daily energy intake was increased to 375 kJ/kg$^{0.75}$ (Table 7). The owner gave more cheese and some small snacks, however, and the body weight again rose to 5.5 kg. When the original regimen was reinstated, the body weight returned to 5 kg. The owners learned their lesson and strictly maintained the regimen of 75% reducing diet, 25% renal diet (Table 7), and the dog's body weight remained stable at 5 kg.

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