

Dietary intake in a dog population measured by a validated questionnaire

Marie Sallander¹, Åke Hedhammar², Margareta Rundgren¹ and Jan Erik Lindberg¹

¹Department of Animal Nutrition and Management and ²Department of Small Animal Clinical Sciences, Swedish University of Agricultural Sciences, Uppsala, Sweden.

Abstract

A validated mail and telephone questionnaire was used in a survey to investigate baseline data on feeding patterns and dietary intake of a Swedish dog population. Randomly selected pure-bred dogs between 1 and 3 years of age in the largest insurance database of Sweden were included in the study, and 461 dog owners completed the survey.

This study has given data on dietary patterns, feed intake and previous diet in a defined population of dogs. A typical dog was fed restricted amounts twice a day, and the feeding patterns were seldom changed after the age of 6 months. The main constituent of the meals was dry feed with a topping of table foods, most commonly meat, sausage, pasta and bread. Few dogs were fed canned feed and home-made diets, although smaller dogs consumed canned feeds more often than larger individuals.

Table foods generally supplied a higher content of fat and a lower content of carbohydrates than commercial feeds. Small breeds had a lower proportion of their total feed intake from commercial products than larger breeds (% of total diet as fed), and as a result small breeds had significantly lower fractions of their total intakes of protein, fat and carbohydrates from commercial products than did larger dogs.

It was concluded that the validated questionnaire could provide reliable data on feeding patterns and dietary intake in free-living dogs. Further, this type of information could be used in future epidemiological studies on the importance of dietary factors on health and specific diseases.

Introduction

Non-optimal nutrition has a critical influence on health and many of the common diseases in both man (Hansson, 1993) and dogs (Joles, 1998). However, to be able to establish causative relationships between certain diseases and environmental factors such as dietary intake, it is important to have reliable methods to record these data. There is a tradition to use dietary questionnaires, weighed records, 24-hour recalls or biological markers to measure and validate dietary intake in humans (Bingham *et al.*, 1995). In dogs, there have been few reports of validated dietary questionnaires (Slater *et al.*, 1992; Sonnenschein 1988), and also few studies on biological markers for specific nutrient assessment (Balleve *et al.*, 1994; Frankel and Bell, 1994; Speakman *et al.*, 2001).

In Sweden, data on morbidity, mortality (Bonnet *et al.*, 1997; Egenvall *et al.*, 2000) and the genetic background to some diseases (Swenson *et al.*, 1997) has been described. However, limited national baseline data are available on important environmental factors, such as diet and exercise. Such data are important in order to identify and later to be able to study factors that might have an influence on health and disease in canine populations. On an individual basis, it would be useful to have a validated tool to register the dietary patterns and intake of dogs, as it would then be possible to give advice on how to correct a possible malnutrition.

The aim of the present study was to estimate the patterns of feed intake and the levels of nutrient intake in privately owned dogs by using a validated questionnaire (Sallander *et al.*, paper II).

Materials and methods

The study population was a simple random sample of 680 pure-bred dogs between 1 and 3 years of age registered in the largest insurance company of Sweden (Agria) during 1997 (the register has 240,000 dogs totally).

The data were collected by using a combined mail and telephone survey as described earlier by Sallander *et al.* (paper I). The questionnaire included questions about feeding patterns, appetite, amount, frequency and proportion of commercial feeds, table foods and home-made diets. Owners were also asked questions about treats and vitamin- and mineral supplements. A list of 26 table foods was presented together with pictures of portion sizes of several foods, a method which was earlier evaluated for human nutritional studies by Calmer *et al.* (1993). Included in the survey were also inquiries about previous and total number of commercial feeds eaten by the dogs in question. If the owner had additional animals to this individual dog the respondents were asked if any other animal consumed the food intended for the dog selected for the study. All dog owners were asked whether the dog was served food from any other source than the owner, and finally if the dog was given treats from any persons in the family or visitors. The majority of questions was of multiple choice type or was formulated in order to register continuous data. In addition, some questions were open, to give the possibility of adding specific information. All questions referred to the current situation, except the ones concerning previous diets.

Descriptive data were summarised. The answers were coded "yes" if a specific type of feed, table food, supplement or treat was given at least once a month. The daily feed and nutrient intake of each dog was calculated from the commercial feeds and other ingredients reported to be given, using a commercial computer-based program (Animal Nutritionist, 1987). The database was updated and modified to suit Swedish conditions with data both on table foods (National Food Administration, 1996), as well as data on commercial feeds used. The guaranteed

analysis of commercial products was used in calculations, and these values were validated by proximate analysis of 50 of the most commonly used feeds (Sallander *et al.*, paper V).

One outlier (a male German Shepherd) was excluded from the nutrient calculations. The data was analysed using Microsoft Excel (Microsoft Software, 1999) and the SAS statistical package (SAS Institute Inc., 1999).

Results

In total, 461 owners completed the questionnaire, which gave a response rate of 76% for the persons possible to contact (461/608). The overall response rate was 68% (461/680). The reasons why dog owners selected for an interview did not participate were in descending order: that they were not willing to participate, that the persons were not reachable during the study, incorrect addresses, and that the dog had died.

As reported earlier (Sallander *et al.*, paper I), the dogs in this investigation were of 124 different breeds and were by design born in the years 1993-1995. Male dogs were slightly more numerous than bitches (54 and 46%, respectively). The most common breeds were Dachshund (n=34), Golden retriever (n=32), German shepherd (n=29), Labrador retriever (n=21), English cocker spaniel (n=16), and Swedish elkhound (n=13). The average body weight (BW) for the dogs was 22.1 kg (SD 13.5). A majority (99%) of the dogs was not castrated. The average age of the dogs when the owner bought them was 3.8 months (SD 4.9), and 91 % of the dogs were at their owners at latest at the age of 6 months.

Feeding patterns

The majority (83%) of the dogs consumed a restricted amount of food, and 65% of these were fed twice per day. Almost every fifth dog had free access to food during the whole day, and these were fed dry dog feed in every case except one (Table 1). The first meal was served between 6 and 9 hours for 60% of the dogs, while 16 % of dogs were served the first meal between 9 and 12 hours. If served, the second meal was most commonly offered between 15 and 18 hours (51%), but 16% were served the second meal between 18 and 21 hours. Most dogs did not get a third or fourth meal.

The appetite of the dogs was considered to be very good or good in most cases (39% and 47%, respectively), and only 13% and 1% of the owners regarded their dog as having a poor or very poor appetite, respectively.

Type of food consumed

Dry dog feed was given to 95% of all dogs, and represented a high proportion of the total diets. Almost half (44%) of the dogs consumed dry feeds (DM 92.8%) as a major part (>65%) of the diet on an as-fed basis (g as fed). A high proportion (93%) of all dogs was given table foods or/and home-made diets, mainly in addition to dry dog feed. A low proportion of the dogs consumed canned dog feeds (14%), while only a few individuals were reported to eat frozen or semi-moist dog food (1%). Home-made or table foods, canned, frozen or semi-moist dog feed only contributed with a smaller part of the total diet for most of the dogs that were given these foods (Table 2).

The total daily feed intake (g DM/kg BW) for all dogs in the study, ranged from 3.3 to 58.9. The fraction of the dry matter intake originating from commercial feeds was on average three quarters. The amount of feed consumed per kg BW was similar for male dogs and bitches. Also, the proportion of the diet originating from dry and canned feed was similar between the sexes. Total intakes per kilo BW were lower for larger (10.6 g DM/kg BW) than for smaller (29.2 g DM/kg BW) individuals, but there was a large variation within each size of dog. The larger the dog the higher the proportion of the feed consisting of dry dog feeds, and the lower the proportion of canned feeds (Table 3).

Nutrient content of total diets

On average, the total diets contained 25% crude protein, 16% crude fat, 47% NFE, 6% ash, and 6% crude fibre on a DM-basis. The ranges in nutrient content of the individual diets were 11-53% for protein, 3-37% for fat, and 9-75% for NFE on a DM-basis. The non-commercial part of the diet had a significantly ($P<0.001$) higher fat and a lower protein content than the commercial part (Table 4). The average levels of calcium and phosphorus were 1.0 and 0.9%, respectively. The corresponding figures for vitamins A, D and E were 15,300, 1,100 and 140 IU/kg DM, respectively.

The nutrient intakes ranged between 5 and 562 g/d for protein, 9 and 854 g/d for fat, and 9 and 854 for NFE. The average daily intakes per kilo BW of protein, fat and NFE were 3.7, 2.3 and 6.9 g, respectively. Small dogs consumed higher amounts of protein, fat and NFE per kg BW compared to larger dogs. For dogs of the same size, German shepherds were fed higher amounts of protein, fat and NFE per kg BW than Labrador and Golden retrievers, due to a higher feed and energy consumption (Table 5).

Seventy percent of the dogs had protein intakes that ranged from 20 to 30% of DM. Also, for 70% of the dogs, fat intakes ranged from 10 to 20% of DM (Table 6). Small dogs, Dachshunds and large hunting dogs had a higher proportion of individuals consuming diets with both higher and lower content of protein on a

DM basis than large breeds, and Golden and Labrador retrievers. A quarter of all German Shepherds consumed diets with more than 30% protein on a DM basis, which was a higher proportion than for “other large breeds”. There was a large variation of the proportion of dietary fat content between breed, size and individual.

Commercial feeds

Almost all (98%) of the dogs were served some type of commercial feed. In total, 164 commercial products and 72 commercial brands were represented. Most dogs (82%) were served only one commercial feed, while 16% were given two products at the time of the interview.

Generally, dry dog feed was consumed in larger amounts than other foods on a dry-matter (DM) basis. Commercial feed sources contributed on average 74% of the total DM intake (Table 3), and 77, 67 and 77% of the daily intake of protein, fat and NFE, respectively (Table 5). Dogs of low BW (≤ 10 kg) differed significantly from larger sizes of dogs, and Dachshunds differed significantly to German shepherds, Labrador and Golden retrievers in the proportion of protein, fat, and NFE that originated from commercial feed sources. The tendency was that with increasing BW a larger proportion of the daily intake originated from commercial feed sources. For example, the average Dachshund received only 61% of its protein intake from commercial sources, while the corresponding figure for Labrador retrievers was 88% originating from commercial sources (Table 5).

Table foods and beverages

Above one third (34%) of the dogs consumed sour milk at least once a month, and a quarter (24%) consumed it weekly (Table 7). Fresh milk was consumed to a lesser extent, although more than every tenth (12%) dog drank this food item at least once a week. Other types of beverage consumed even more seldom were yoghurt, broth, cream, juice, blueberry soup, rose hip soup, fruit-syrup and gruel. More than 60% of the dogs were given meat, sausage, pasta and bread at least once a month, while 50-54% of the dogs were served rice, potatoes, cheese, pancakes, eggs and meat balls. Foods given to 30-49% of the dogs at least once a month were vegetables, sauce, chicken, lard, tallow, butter, margarine and vegetable oil. Between 15 and 30% of dogs were given fruit, black pudding, biscuits, sponge cakes, ice cream and chocolate at least once a month. Other foodstuffs fed to less than 15% of the dogs were marrow bones, blood, chips, cheese doodles, corn flakes, soup, porridge, lard sausage, peanut rings, cookies, corn, wheat, liver, kidney, heart, popcorn, sugar, garlic, rumen and pig feed.

The average table food was given 6 times per month, with an amount of on average 6 g per occasion as fed. Among dogs that were given table foods, an

average individual consumed 185 g (SD 214) per day as fed. The most commonly fed food items were vegetable oil, bread, meat and slaughter residues and sour milk (Table 7).

Treats

More than six out of ten dog owners (62%) gave the dog commercial treats. The average intake for individuals fed treat was 10.2 g (SD 11.9) per day as fed. The most frequently used type of treats was dry feeds (35%), biscuits (25%), dried pigs' ears (8%), chewing bones (10%) and dog chocolate (5%). Two commonly used brands made up almost 40% of the market for treats. The treats that were fed most frequently and in largest amounts met the nutrient requirements for dogs (AAFCO, 2000), but many products could be considered to have little nutrient value.

Vitamin- and mineral supplements

Approximately every fourth (24%) owner indicated that they gave vitamin- or mineral supplements to their dogs. For dogs that did consume supplements, three out of four (73%) were given this daily, while every seventh (14%) and eighth (13%) dog received it weekly and monthly, respectively. Dogs consuming 50% table foods or more of the total diet had a significantly higher proportion of individuals fed supplements than those that were consuming lower levels of table foods (23 and 18% of individuals, respectively). Most nutrient supplements were given as combined multimineral- and vitamin products (49%), or as vitamin B (11%), vitamin C (11%), and vitamins A, D, and E (10%).

Other sources of feed intake

One third of the dogs found food by themselves; they consumed slaughter residues, hunted live animals, found food in garbage cans or stole food elsewhere. Every eighth dog found food as indicated more than once per week, while others did it more seldom.

When families were having coffee, 40% of dogs had a piece of cake to taste. One third of the dogs were given tidbits to taste every day, while 38% had it once or a few times a week.

Previous diets

Fifty percent of the dogs continued on the same type of feed from the age of three months. Three out of four dogs had consumed the same type of diet since the age of 6 months or earlier and only 11% had changed the type of feed after the age of 12 months.

The feed type used by the breeder was known by 75% of the dog owners. There was no significant difference in the proportion of dog owners who remembered the breeder's diet between dogs that were one, two or three years of age. Approximately half of the dog owners stated that the breeders served only dry dog food to the puppies, while the remainder gave dry dog food plus a home-made diet. The home-made part most commonly consisted of minced meat, egg yolks, rice, sour milk, gruel, vegetable oil, vitamins and minerals.

After arrival at the owner seven out of ten dogs were fed only dry dog food, while nine percent of the dog owners did not remember or did not know the feeding at that stage of life. Others were mainly served dry dog food plus a home-made diet, where the content was similar to the food the breeder had given.

Fourteen percent of the dogs had been served the same brand of commercial feed from puppyhood until the time of the interview, while 54% had consumed between 2 and 3 commercial products during their life. A quarter of the dogs had been given between 4 and 6 commercial feeds up to the age of between 1 and 3 years, and only 4% of the dogs had eaten more than 7 products. The average number of feeds that had been consumed by the dogs was 3.1 (SD 1.8).

Discussion

This study has given baseline data on dietary patterns, feed intake and previous diet in a defined population of dogs. The typical dog was fed in restricted amounts twice per day, and the feeding patterns were seldom changed after the age of 6 months. The main constituent of the meals was dry feed with a topping of table foods, most commonly meat, sausage, pasta and bread. Few dogs were fed canned feed and home-made diets, although smaller dogs consumed canned feeds more often than larger individuals. The results of the study indicate that puppies are fed the same type of feed from an early age, and that dietary patterns often remain similar for long periods of their lives.

Only a few studies on feeding patterns in dogs have been presented earlier. Campell (1986) reported that slightly below half (46%) of the American dogs examined were fed once daily, 42% twice per day, and every eighth (12%) dog was given food at least 3 times daily. In another American study, Slater *et al.* (1992) reported that every fifth dog was fed once, half of the dogs twice, and every eleventh dog three times daily and, as in the present study, every fifth dog had access to feed all day. Obviously, this is a reflection of different traditions on how to feed dogs in different countries or regions of the world. Also, the studies have been performed with an approximately ten year's interval, and dietary patterns might have changed over time.

In the present study most dogs were fed dry foods, which agrees with the findings of Slater *et al.* (1992; 1995). The proportion of dogs consuming table foods has been shown to be very variable in different studies. A range between 29 and 90%

of the dogs were served table foods in previously published studies (Edney & Smith, 1986; Slater *et al.*, 1992 & 1995, Sonnenschein 1988). The fact that 25% of Swedish dogs are used for hunting (Egenvall *et al.*, 1999) might result in a relatively high proportion of dogs given slaughter offals, compared with some other populations of dog. Dogs in the present study also consumed vitamin and mineral supplements to a greater extent compared to values presented in other studies (12-18%; Slater *et al.*, 1992 & 1995).

When a large part of the diet is table foods, the total diet may become very energy dense, as table foods have a higher content of fat than commercial feeds. This will increase the risk for over-consumption of energy which might result in overweight and obesity. Adding a high proportion of table foods or vitamin and mineral supplements to a balanced commercial feed might also result in imbalance of the protein, mineral and vitamin contents of the total diet.

In this study, the average dog consumed a diet with 25% protein, 16% fat, 47% NFE and 1,611 kJ/100 g DM. AAFCO (2000) states that adult dogs have a minimum nutrient requirement of 18% protein and 5% fat on a dry matter basis, and these values are based on a diet with approximately 1,470 kJ/100 g DM. The NRC (1985) states that there should be a minimum of 5% total fat on a DM basis, while the corresponding figure for protein is not stated (only the amino acid requirements). Only 28 dogs out of 460 (6%) consumed diets with lower levels of protein than recommended by the AAFCO (2000), and 1% of the individuals consumed less or equal to 15% protein on a DM basis. Two individuals consumed lower amounts of fat than suggested by the feeding standards. A large number of dogs in the present survey were served diets that exceed the AAFCO and NRC minimum recommendations for protein and fat. For protein more than 15% of the dogs were given a diet which contained more than 30% crude protein in the DM. Correspondingly, almost 20% of the dogs were served a diet which contained more than 20% crude fat in the DM. These observations merit further studies on the possible long term influence of consuming diets with differences in the content of protein and/or fat. Although the working dog has been shown to need and tolerate diets high in both protein and fat (Reynolds *et al.*, 1994 & 1995) this might not be the case in sedentary or moderately exercised dogs. Further, a high dietary fat content will increase the risk of energy overconsumption and could increase the risk of obesity.

There was a considerable variation in nutrient intake levels, as well as in the energy proportions of protein, fat and carbohydrates, between breeds and individuals of the same size. The same observations were made when comparing different sizes of dogs. Also, within breed, the German shepherds and the Dachshunds showed a large variation in the intakes of protein, fat and NFE (g/kg BW), while the Labrador and Golden retrievers had a narrower range.

In this study, we have also estimated the intakes of calcium, phosphorus, vitamins A, D and E. While most dogs consumed these nutrients in the recommended ranges, 8% of the individual dogs consumed levels of calcium that were below the recommended minimum levels by the AAFCO (0.6% of DM). Correspondingly for phosphorus, 5% of the individuals had dietary intakes below the recommended minimum level (0,5% of DM). Only one of the dogs consumed levels that were higher than the recommended maximum levels for calcium (>2,5 % of DM) and phosphorus (>1,6 % of DM).

Vitamins A, D and E were also shown to be consumed in recommended amounts for most individuals. However, 11, 8 and 6% of the dogs consumed too low levels of vitamins A, D and E, respectively. No dogs consumed too high levels of vitamin A, while 3 and 1 % of the individuals had intakes above recommended maximum levels for vitamin D and E, respectively. Diets that did cause deviations from recommended levels, were those consisting of only table foods (too low levels of vitamins and minerals) or commercial feeds supplied with extra vitamin and mineral supplements (too high levels of vitamins and minerals).

The present study has shown that relevant data on dietary feeding patterns and nutrient intake in a dog population are possible to obtain by using a well designed survey protocol and technique. Further studies on the influence of dietary patterns on health and specific diseases, might consider factors measured in the present study, such as dry or canned commercial diets versus home-made foods, treats, and vitamin and mineral supplements. In future epidemiological research, the effects of the variation in the proportions between major nutrients, should be studied in more detail.

References

- AAFCO. 2000. *Official publication*. American Association of Feed Controls Officials. Atlanta, Georgia.
- Animal nutritionist. 1987. *Version 2.5, N-squared Inc & Durango Software*. Silverton, Oregon.
- Balleve, O., Anantharaman, G., Gicquello, P., Piquet-Welsh, C., Thielin, A. -L. & Fern, E. 1994. Use of the doubly-labelled water method to assess energy expenditure in free living cats and dogs. *Journal of Nutrition* 124, 12S, 2594-2600.
- Bingham, S. A., Cassidy, A., Cole, T. J., Welch, A., Runswick, S. A., Black, A. E., Thurnham, D., Bates, C., Khaw, K. T., Key, T. J. A. & Day, N.E. 1995. Validation of weighed records and other methods of dietary assessment using the 24 h urine nitrogen techniques and other biological markers. *British Journal of Nutrition* 73, 531-550.
- Bonnet, B. N., Egenvall, A., Olson, P. & Hedhammar, Å. 1997. Mortality in insured Swedish dogs: rates and causes of death in various breeds. *Veterinary Record* 141, 40-44.
- Callmer, E., Riboli, E., Saracci, R., Akesson, B. & Lindegarde, F. 1993. Dietary assessment methods evaluated in the Malmö study. *Journal of Internal Medicine* 233, 53-57.
- Campbell, W. E. 1986. Effects of training, feeding regimens, isolation and physical environment on canine behaviour. *Modern Veterinary Practice* 239-241.

- 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.
- Egenvall, A., Hedhammar, Å., Bonnet, B. N. & Olson, P. 1999. Survey of the Swedish Dog Population: Age, gender, Breed, Location and enrolment in Animal Insurance. *Acta Veterinaria Scandinavica* 40, 231-240.
- Egenvall, A., Bonnet, B. N., Olsson, P. & Hedhammar, Å. 2000. Gender, age, breed and distribution of morbidity and mortality in insured dogs in Sweden during 1995 and 1996. *Veterinary Record* 146, 18, 519-525.
- Frankel, T. L. & Bell, C. J. 1994. The practicalities of measurement and interpretation of field metabolic rate in dogs. *Journal of Nutrition* 124, 12S, 2614-2615.
- Hansson, L.-E. 1993. Occurrence and Causes of Gastric Cancer in Sweden. Doctoral Thesis 430, *Comprehensive Summaries of Uppsala Dissertations from the faculty of Medicine*. Acta universitatis Upsaliensis, Uppsala, Sweden.
- Joles, J. A. 1998. Obesity in dogs: Effects on renal function, blood pressure, and renal disease. *Veterinary Quarterly* 20, 117-120.
- Microsoft Corporation. 1999. *Microsoft Excel. Version 5.0*. Microsoft Corporation, Redmond, California.
- National Food Administration. 1996. *Food composition table – Energy and nutrients*. Uppsala, Sweden.
- NRC. 1985. National Research Council. *Nutrients Requirements of Dogs*. National Academy Press. Washington DC.
- Reynolds, A. J., Fuhrer, L., Dunlap, H. L., Finke, M. D. & Kallfelz, A. 1994. Lipid metabolite responses to diet and training sled dogs. *Journal of Nutrition* 124, 2754S-2759S.
- Reynolds, A. J., Fuhrer, L., Dunlap, H. L., Finke, M. D. & Kallfelz, A. 1995. Effect of diet and training on muscle glycogen storage and utilisation in sled dogs. *Journal of Applied Physiology* 79, 5, 1601-1607.
- SAS Institute Inc. 1999. *SAS® User's Guide I+II*. Version 6.12. SAS Institute Inc., Cary, NC, USA.
- Slater, M., Scarlett, J., Donogue, S. & Erb, H. 1992. The repeatability and validity of a telephone questionnaire on diet and exercise in dogs. *Preventive Veterinary Medicine* 13, 77-91.
- Slater, M., Robinson, L., Zoran, D., Wallace, K. & Scarlett, J. 1995. Diet and exercise patterns in pet dogs. *Journal of American Veterinary Medical Association* 207, 186-190.
- Sonnenschein, E. G. 1988. A case-control study of nutritional factors and spontaneous breast cancer in pet dogs. *Doctoral thesis, University of Pennsylvania*. Philadelphia, PA.
- Speakman, J. R., Perez-Camargo, G., McCappin, T., Frankel, T., Thomson, P. & Legrand-Defretin, V. 2001. Validation of the doubly-labelled water technique in the domestic dog (*Canis familiaris*). *British Journal of Nutrition* 85, 75-87.
- Swenson, L. L. & Hedhammar, Å. 1997. Prevalence and inheritance of and selection for hip dysplasia in seven breeds of dogs in Sweden and benefit: cost analysis of a screening and control program *Journal of American Veterinary Medical Association* 210, 207-214.

Table 1. *Type and number of feedings per day (n= 460 dogs)*

| Parameter | Proportion | |
|---|------------|------------|
| | Mean (%) | 95 % C. I. |
| <i>Type of feeding</i> | | |
| Meal-feeding | 83.3 | 79.9-86.7 |
| <i>Ad libitum</i> feeding | 16.7 | 13.3-20.1 |
| <i>Number of feedings per day for meal-fed dogs</i> | | |
| One | 8.9 | 6.3-11.5 |
| Two | 65.5 | 59.5-71.5 |
| Three | 7.6 | 5.2-10.0 |
| Four | 0.6 | 0.5-0.7 |

Table 2. *Distribution of different types of dog feed consumed; type and amounts, g as fed (n=460 dogs)*

| | Given to (% of dogs) | Proportion of total diet (%) | | | | |
|------------------------------|----------------------------|------------------------------|------------------|------------------|------------------|-----|
| | | ≤ 15 | $15 < x \leq 35$ | $35 < x \leq 65$ | $65 < x \leq 99$ | 100 |
| Dry dog feed ¹ | 95 | 6 | 13 | 32 | 38 | 6 |
| Table food or home-made diet | 93 | 16 | 28 | 33 | 14 | 2 |
| Canned or frozen dog feed | 14 | 3 | 5 | 2 | 4 | 0 |

¹The DM content of the dry feeds consumed was 92.8%, the mean of 45 analysed values.

Table 3. *Daily intakes (g DM/kg BW) of total diets, dry and canned feeds (n=460 dogs)*

| | Total intake | | | Dry feeds ¹ | | | Canned or frozen feeds ² | | |
|-----------------|--------------|------|-----------|------------------------|------|----------|-------------------------------------|------|----------|
| | n | Mean | Range | n | Mean | Range | n | Mean | Range |
| All dogs | 460 | 14.8 | 3.3-58.9 | 438 | 10.0 | 0.3-46.4 | 48 | 2.6 | 0.1-13.3 |
| Male dogs | 248 | 14.8 | 3.5-58.9 | 235 | 9.9 | 0.3-44.7 | 24 | 0.5 | 0.01-5.4 |
| Female dogs | 212 | 14.8 | 3.3-56.5 | 203 | 10.2 | 0.4-46.4 | 24 | 0.4 | 0.1-4.0 |
| Dogs 1<x≤5 kg | 27 | 29.2 | 10.0-58.9 | 24 | 14.8 | 1.5-34.0 | 7 | 6.3 | 0.4-16.1 |
| Dogs 5<x≤10 kg | 85 | 17.8 | 4.8-51.5 | 81 | 11.0 | 0.4-46.4 | 17 | 3.8 | 0.2-12.4 |
| Dogs 10<x≤20 kg | 115 | 14.9 | 4.9-40.6 | 111 | 10.1 | 0.3-35.3 | 10 | 2.5 | 0.3-7.7 |
| Dogs 20<x≤30 kg | 125 | 12.3 | 4.3-28.1 | 120 | 9.2 | 1.6-26.2 | 10 | 1.6 | 0.2-5.0 |
| Dogs 30<x≤40 kg | 73 | 12.0 | 3.5-51.9 | 67 | 9.3 | 1.6-18.6 | 2 | 1.6 | 1.4-1.9 |
| Dogs 40<x≤50 kg | 20 | 10.7 | 6.2-19.4 | 20 | 8.7 | 3.0-17.5 | 1 | 0.4 | - |
| Dogs >50 kg | 15 | 10.6 | 3.3-19.3 | 15 | 8.1 | 3.1-12.1 | 1 | 0.3 | - |

¹ The dry matter content of the dry feeds consumed has been estimated by the mean of 45 analysed values (DM 92.8 %).

² The dry matter content of canned feeds consumed has been estimated by the mean of 6 analysed values (DM 24.2 %).

Table 4. *Daily nutrient intake from commercial and non-commercial feed sources (n=460 dogs)*

| | Total diet | | Commercial feed | |
|-----------------|------------|--------------|-----------------|-----------|
| | Mean | Range | Mean | Range |
| Protein (g) | 70 | 5 - 562 | 56 | 0 - 547 |
| Fat (g) | 43 | 2 - 272 | 29 | 0 - 157 |
| NFE (g) | 135 | 9 - 854 | 107 | 0 - 842 |
| Calcium (mg) | 3,140 | 69 - 21,850 | 3085 | 0 - 64262 |
| Phosphorus (mg) | 2,452 | 180 - 17,932 | 2192 | 0 - 17636 |
| Vitamin A (IU) | 4,449 | 14 - 80,011 | 3671 | 0 - 60500 |
| Vitamin D (IU) | 309 | 17 - 4,547 | 262 | 0 - 4538 |
| Vitamin E (IU) | 28 | 1 - 454 | 41 | 0-979 |

Table 5. Daily nutrient intake of protein, fat and NFE from the total diet (g/kg BW, day), and proportion (%) originating from commercial feed sources

| | n | Total diet (g/kg BW, day) | | | | | | Commercial feed | | |
|--------------------|-----|---------------------------|----------|------|----------|------|----------|--------------------------------|-------------------|-------------------|
| | | Protein | | Fat | | NFE | | Proportion of total intake (%) | | |
| | | Mean | Range | Mean | Range | Mean | Range | Protein | Fat | NFE |
| All dogs | 460 | 3.7 | 0.7-16.0 | 2.3 | 0.2-11.3 | 6.9 | 1.3-28.0 | 75.7 | 65.2 | 73.9 |
| Male dogs | 248 | 3.7 | 0.8-16.0 | 2.4 | 1.6-11.3 | 6.8 | 1.3-28.0 | 74.9 ^a | 62.5 ^a | 73.5 ^a |
| Bitches | 212 | 3.6 | 0.7-16.0 | 2.2 | 0.2-10.7 | 7.1 | 1.4-25.9 | 77.5 ^a | 65.0 ^a | 75.3 ^a |
| Dogs 1<x≤5 kg | 27 | 7.3 | 2.2-13.1 | 4.9 | 2.0-11.3 | 12.9 | 3.8-28.0 | 64.4 ^b | 55.1 ^b | 57.4 ^b |
| Dogs 5<x≤10 kg | 85 | 4.4 | 0.8-16.0 | 3.0 | 0.2-10.7 | 8.0 | 1.3-27.1 | 70.5 ^a | 56.7 ^a | 68.7 ^a |
| Dogs 10<x≤20 kg | 115 | 3.6 | 1.1-8.0 | 2.3 | 0.5-5.8 | 7.1 | 2.2-22.8 | 75.0 ^a | 60.9 ^a | 76.1 ^a |
| Dogs 20<x≤30 kg | 125 | 3.0 | 1.0-7.8 | 1.9 | 0.4-6.3 | 6.0 | 1.4-16.2 | 80.0 ^a | 63.1 ^a | 78.3 ^a |
| Dogs 30<x≤40 kg | 73 | 3.2 | 0.8-16.0 | 1.8 | 0.3-5.6 | 5.6 | 1.7-24.4 | 81.2 ^a | 72.2 ^a | 83.9 ^a |
| Dogs 40<x≤50 kg | 20 | 2.5 | 1.4-4.2 | 1.5 | 0.7-3.0 | 5.3 | 2.3-11.8 | 88.0 ^a | 73.3 ^a | 77.3 ^a |
| Dogs >50 kg | 15 | 2.6 | 0.7-4.5 | 1.6 | 0.4-3.6 | 5.2 | 1.9-9.0 | 88.5 ^a | 68.7 ^a | 90.4 ^a |
| Dachshund | 34 | 4.6 | 0.8-13.0 | 3.0 | 0.2-9.5 | 8.3 | 1.3-25.9 | 60.9 ^b | 53.3 ^b | 62.6 ^a |
| German shepherd | 28 | 3.5 | 1.4-16.0 | 1.7 | 0.3-4.8 | 6.2 | 2.5-24.4 | 82.9 ^a | 82.4 ^a | 85.5 ^a |
| Golden retriever | 32 | 2.4 | 1.2-4.8 | 1.5 | 0.8-4.4 | 5.3 | 1.4-10.4 | 83.3 ^a | 66.7 ^a | 77.4 ^a |
| Labrador retriever | 21 | 2.6 | 1.2-4.3 | 1.4 | 0.6-3.4 | 5.7 | 2.0-11.8 | 88.5 ^a | 78.6 ^a | 87.7 ^a |

^{a, b} Means with different letters in the same column and group differ significantly (p<0.001)

Table 6. *Proportion of dogs consuming different levels of protein and fat*

| | All dogs (%) n=46 0 | German shepherd (%) n=28 | Labrador retriever (%) n=21 | Golden retriever (%) n=32 | Dachs-hund (%) n=34 | Other small breeds (%) ¹ n=133 | Large hunting dogs (%) ² n=25 | Other large breeds (%) ³ n=187 |
|-----------------------|---------------------------|-----------------------------|--------------------------------|------------------------------|------------------------|--|---|--|
| <i>Protein (% DM)</i> | | | | | | | | |
| ≤20 | 13 | 10 | 5 | 13 | 20 | 22 | 20 | 11 |
| 20<x≤30 | 71 | 66 | 86 | 78 | 62 | 63 | 60 | 79 |
| >30 | 16 | 24 | 9 | 9 | 18 | 15 | 20 | 10 |
| <i>Fat (% DM)</i> | | | | | | | | |
| ≤10 | 10 | 14 | 19 | 9 | 12 | 12 | 20 | 15 |
| 10<x≤20 | 70 | 79 | 71 | 75 | 73 | 70 | 68 | 73 |
| >20 | 20 | 7 | 10 | 15 | 15 | 18 | 12 | 12 |

¹ Includes Affenpinscher, American cocker spaniel, Australian terrier, Australian kelpie, Basenji, Basset griffon vendeen petite, Beagle, Bedlington terrier, Bichon fris , Bichon havanais, Boston terrier, Cairn terrier, Cavalier king charles spaniel, Chihuahua, Chinese crested, Danish-Swedish farmdog, Drever, English cocker spaniel, English springer spaniel, Finnish lapphound, Finnish spitz, Foxterrier, German hunting terrier, Griffon bruxellois, Japanese spitz, Lancashire heeler, Lhasa apso, Miniature poodle, Norfolk terrier, Norwegian buhound, Phalene, Pug, Pumi, Schipperke, Scottish terrier, Swedish lapphound, Tibetan spaniel, Tibetan terrier, Welsh corgi pembroke, Welsh terrier, West highland white terrier, Whippet, V stg ta spitz and Yorkshire terrier.

² Includes Finnish st vare, Hamilton st vare, J mthund, Karelian bearhound, Norwegian elkhound and Schillerst vare.

³ Includes Afghan hound, Airdale terrier, Berner sennenhund, Borzoi, Boxer, Briard, Collie, Dalmatian, Doberman pinscher, English pointer, Flatcoated retriever, German pointer, German shepherd, Giant poodle, Golden retriever, Gordon setter, Grand danois, Great pyrinees, Greyhound, Groenendael, Irish setter, Irish wolfhound, Labrador retriever, Leonberger, Newfoundland dog, Old english sheepdog, Polski owczarek niziny, Rhodesian ridgeback, Riesenschnauzer, Rottweiler, Saint bernard and Tervueren.

Table 7. *Type and amount of table foods consumed (n=460 dogs)*

| | Consume this food item at least once a week (% of dogs) | Average number of servings per month ¹ | | Intake per day (g DM) ^{1,2} | |
|-----------------------------|---|---|----|--------------------------------------|----|
| | | Mean | SD | Mean | SD |
| Meat and slaughter residues | 65 | 12 | 15 | 9 | 15 |
| Bread | 55 | 17 | 14 | 8 | 13 |
| Cheese | 47 | 13 | 13 | 4 | 7 |
| Potatoes | 45 | 9 | 9 | 7 | 12 |
| Sausage | 44 | 6 | 7 | 4 | 6 |
| Pasta | 41 | 6 | 7 | 7 | 12 |
| Rice | 32 | 7 | 12 | 4 | 13 |
| Vegetable oil | 26 | 18 | 17 | 12 | 17 |
| Sour milk | 24 | 13 | 17 | 7 | 11 |
| Lard/tallow | 11 | 5 | 6 | 4 | 7 |
| Fish | 6 | 6 | 6 | 2 | 2 |

¹Means and standard deviations calculated for the individuals that did consume the table food in question.

²Dry matter values from the Swedish Food Composition Table (SLV, 1996)