

NUTRITIONAL REQUIREMENT OF DOGS AND NUTRITIONAL COMPOSITION OF THEIR COMMERCIAL FEEDS

Do Thi Phuong Thao^{1*}, Nguyen Thi Quyen¹,
Nguyen Xuan Viet¹, Vu Thanh Mai², Hoang Minh Son³

¹Faculty of Agro-Forestry and Aquaculture, Hung Vuong University, Phu Tho, Vietnam

²Department of Academic Affairs, Hung Vuong University, Phu Tho, Vietnam

³Faculty of Veterinary Medicine, Vietnam National University of Agriculture, Hanoi, Vietnam

Received: 02 December 2020; Revised: 18 December 2020; Accepted: 18 December 2020

Abstract

The article reviews the nutritional requirements of dogs base on the recommendation of the Association of American Feed Control Officials (AAFCO), National Research Council (NRC), The European Pet Food Industry Federation (FEDIAF). The typical information published by these organizations for dogs which on each stature and ages consuming different diets and nutrition. The basic energy is the requirement for small stature dogs round about 400kcal GE/100gDM, crude protein in a ration that depends on the carbohydrate content of the diet and the ages about 18% to 25%. Besides, the nutritional contents of Vietnamese commercial dog feeds were discussed. Most of the dog feeds which had dialy feed intake from 50g to 150g/per head illustrated the variety of diets and quantity nutrition provided.

Keyword: *Pet, dog, nutritional requirement, dog feeds.*

1. Introduction

A study result in biological evaluation by scanning method (FMRI - Function magnetic resonance imaging) between dog and the human nervous system showed that they had have similar brains and nervous systems [1]. Besides, the dog's sensory system is also very sensitive, so pet dog feed has a high demand for nutritional value, taste, and healthy micronutrients. The diets could affect on appearance, digestive physiology, biochemical

index of blood, brain function, and pathological of the dogs. However, the studies on the clinical, nutrition and feed of pet dogs have been limited [2]. In Vietnam, 3489 kinds of commercial feed produced were listed, but most of them used for poultry, swine, ruminant cattle, and aquatic. The studies on the nutrition requirements of pet dogs are necessary to the development of domestic pet production. This synthesis of the following information is intended to refer to the

*Email: dpthao@hvu.edu.vn

nutritional requirement, and the composition of several feeds for dogs in Vietnam.

2. Methods

The result was referred to the pet dog feed control association, the nutritional requirements standard for pet dogs, about the diet of dogs and cats in each stage of development announced by the European federation of pet feed industries FEDIAF, 2016 (Fédération européenne de l'industrie des aliments pour animaux familles, The European Pet Food Industry Federation).

Some nutritional parameters refer to the minimum needs of pet dogs: Basic nutritional requirement, recommended energy levels, daily intake of dry matter according to the needs of dogs. Nutrition in some pet dog feeds on the Vietnamese market through information published on the product packaging. Synthesize nutrition requirement information for pet dogs.

3. Results and discussion

3.1. The amount of daily feed intake of dogs

Table 1 shows the recommended energy and dry matter intake of FEDIAF and commercial feed producers. Nutritional recommend and daily feed intake were the same for Classicpet, Gonador, Smart heart. The feed intake for adult dogs ranges from 110g to 150g per head with 378 kcal to 386kcal ME/100gDM.

Besides, FEDIAF recommended feed intake adult dogs ranging from 180g to 210g with 400kcal GE/100gDM. If estimating value convert between gross energy and metabolism energy round about 80% because of losing 20% at urine, fecal and digestive gas, it would be 320kcal ME/100g DM. Therefore recommend dry matter daily intake of FEDIAF was lower because it was dependent on the digestively of dogs.

Table 1. Recommend dry matter daily intake in dog feeds

Feed intake	The energy levels in the ration of dog feeds (Kcal /100g DM)	Source
181g - 210g	400 kcal GE	FEDIAF, 2016*
80g - 150g	378 kcal ME	Classic pet – Perfect Thailand
33g - 112g	386 kcal ME	Gonador – Gyomarch Vietnam
50g - 110g	378 kcal ME	Smart heart – Perfect Thailand

Source: FEDIAF, 2016 and results of the survey from packaging information dog feeds

*Recommend for 15kg dog (adult dog)

The energy requirements in FEDIAF recommendation to the dogs varied between ages of dog (addendum 1). The expanding growth process of dogs was divided into 4 phases according to weight. The energy requirement level of newborn puppies with 300-500g of body weights was recommended

at 25 kcal/100g body weight. This energy can provide enough in the milk of their bitches. At the weaning stage, the energy requirement could accounted for 50% of the adult weight. Each unit of the metabolism of the dog's body weight consumes 210kcal, and they need the highest energy in their life at this

stage. At the next of ages, energy requirement requires from 175kcal and 140kcal for adult because of slowly and remain stable growth.

3.2. Basic nutrition information in diets for dogs

Table 2. The complete nutrition value of several adult dogs feeds in the market in Viet Nam

Feeds	Hu	ME	CP	Fat	Ash	Ca/P
Unit	%	Kcal/kg	% DM	% DM	% DM	-
Gonador	10	3300	21	10	-	1.1/0.8
Classic pet	10	3400	27	8,0	10	1.0/0.8
Smart heart	12	3400	23	8,0	10	1.6/1.1
Royal Canin	12	-	31	20	7,7	0.8/0.7

Source: packaging information of some feeds for a dog that adult body weight under 15kg
Hu = humidity, ME = metablism energy, CP = crude protein, Ash = total mineral

In this study, four commercial feeds were investigated. Crude protein ranged from 21% to 31%. The Royalcanin, Gonador, and Smart heart feed had a similarly protein level, wherever, Classicpet was in the medium when it stood at 27%. The recommended NRC total protein for adult dogs was 25g/1000kcal [3], however, in this study, the diets had high protein digestibility and energy intake, around 130kcal/kgW^{0.75}. In addition, FEDIAF recommended diets with lower protein levels ranging from 18 to 21g/100g DM, and energy intake ranging from 95 to 110kcal/ kgW^{0.75}.

The crude protein level was the requirement of FEDIAF for maximum nitrogen retention around 25 percent of dry matter for newly weaned puppies, whereas it was about 20 percent of dry matter for puppies over 14 weeks of age. Total protein requirement for reproduction depends on the carbohydrate content. If carbohydrate is absent or deficient, the protein requirement is much higher (addendum 2). The crude

protein for dog under 6 months old with maximum of 15 kg of adult body weight was recommended from 45g to 62.5g. This protein level was 2.5 times higher than that of puppies with lower adult body weight (addendum 3).

The high crude fat in feeds unbeneficed for dog health, in constrast only Calssicpet and Smart heart produced in safety threshold at 8%. At 20%, the crude fat of Royalcanin feed was approximately 3 times more than that of their counterparts. Metabolism energy range from 3300 to 3400 kcal/kgDM. The crude fiber in dog feed under 6%, total mineral up to 10%. They were suitable for all dog ages. Total fat (in all life dogs stages) recommend by FEDIAF: Dogs are fed foods containing usual levels of protein tolerate higher levels of fat. However, the diets with very high-fat foods and very low protein content could have adverse effects on dogs. The diet should provide 5.5g fat/100gDM with the same energy level in diet from 95 to 110kcal/ kgW^{0.75}, but they needed to have at 8.5g

fat/100g DM for growth and reproduction over 14 weeks of ages (addendum 2). A similar total fat needs to be provided when recommended by great dogs from 13.75g to 21.25g, and that is more 2.45 to 2.5 times than small of stature dogs (addendum 3).

Calcium for puppies ranges from 0.5-0.58g/100g DM for growing dogs. However, this level has been reported to be marginal for some breeds, particularly during the fast-growing phase. FEDIAF(2016) recommended that the calcium level in pet food for early growth should be at least 1g/100g DM. During the whole late growth phase, pet foods for dogs of small and medium-size breeds may contain less calcium (minimum 0.8% DM), and the calcium-phosphorus ratio can be increased to 0.8-1/0.7. The recommendation of Calcium/phosphorus rate differ between dog breeds, and also differ amongs growth stages in a breed. In the most dog diets, the calcium/phosphorus ratio was usally at 1/1. But this ratio for adult dog, early growth and reporduction period, and the late growth phase were 2/1, 1.6/1, and 1.8/1, respectively.

Calcium requirement for dogs with under 15kg of adult body weight was 1.25g and 1.45g. The level was twice or 3 times higher for dogs with higher body weight. However, the high intake of calcium may be harmful to skeletal development in large breed dogs, particularly during the early growth phase. Therefore, a strict nutritional maximum is recommended for foods intended for large breed puppies. During late growth, it is recommended that large breed and giant breed puppies continue to be fed a pet food containing 2.5g calcium until about 6

months of age. Calcium/phosphorus ratio recommended from 1.1/1 to 1.5/1.

Some of the essential micronutrients for dogs that have not been announced on feed product packaging, but they have been recommended by FEDIAF (addendum 2, 3 and 4) about sodium and vitamin as follows:

The studies in dogs have demonstrated that a reasonable ration of safe sodium nutrition was about 0.55g or 0.72 to 1.38 per 1000kcal of metabolizable energy [4]. Sodium requirement ranges from 0.12g to 0.22g for all life dog stages which have under 15kg of body weight. However, sodium should not be over 0.55g per 100g DM.

Vitamins are extremely important and essential for dogs, especially vitamins A, D, E. They were recommended in addendum 4.

There is no evidence for the difference between vitamin requirements for puppies and adult dogs. This value has been used in this guide for at least 10 years and has never given rise to any problems in growing dogs [5,6]. With small body weight dogs, vitamin A requirement was arranging from 500 to 702 UI, and that was increased up to more than 1250 UI in bigger body weight dogs. In some studies supported by the pet food industry, no adverse effect has been observed in puppies of different breeds when they were fed the food containing 40,000 IU of vitamin A per 100g DM (4kcal/g or 16.74kJ/g) [7, 8]

Since information on the maximum safety of vitamin D intakes for adult dogs and breeding bitches round about 50 to 55.2 UI, FEDIAF recommends the same nutritional maximum for other life stages as those indicated for puppies at an energy level

110kcal/W₀.75 of rations. Therefore, based on differences in cholecalciferol metabolism between giant breed and small breed puppies [9] below 64 IU/100g DM can be considered a safe nutritional maximum for small breed puppies but not under 50 UI.

The vitamin E requirements of dogs depend on the intake of polyunsaturated fatty acids (PUFA) and other antioxidants. An increasing level of vitamin E may be required if the intake of PUFA is high, particularly from fish oil [10]. So recommend vitamin E for all life dog stages from 3.6 to 12.5 UI. There was a difference among adult-based on MER of energy in ration dogs. If higher

energy provides, the vitamin E requirements of dogs would be reduced.

4. Conclusions

The information on pet dogs' nutritional requirements was published by reputable pet nutrition research organizations and compared with the information of feed produced by some companies for pet dogs. These pieces of information can be used to referent and study on building a dog's diet. The small stature dog can use synthesis information in table 3 to building ration.

Table 3. Synthesize basic information on nutrition requirement for small pet dogs that body weight adult under 15kg

Requirements nutritional information	Unit	Recommended
Gross energy in the ration (GE)	Kcal/kg KP	4000
Metabolism energy (ME)	Kcal/kg KP	3400
Dry matter (DM)	%	88
Crude protein (CP)	g/100g CK	23
Feed daily intakes (FI)	g/con/ngày	50-150
Metabolism energy provide daily according to diet	Kcal/con/ngày	150-449

ADDENDUM

Addendum 1. Average energy requirements during growth in dogs

Puppies	Age	Energy requirement
Growth	Newborn puppies	25 kcal/100g BW
	Up to 50% of adult weight	210 kcal/kg W ^{0,75}
	50 to 80% of adult weight	175 kcal/kg W ^{0,75}
	80 to 100% of adult weight	140 kcal/kg W ^{0,75}

Source: FEDIAF, 2016

Addendum 2. Minimum recommended basic nutrient levels for Puppies of dog breeds with adult body weight up to 15 kg during the whole late growth phase ≥ 14 weeks

(Unit per 100 g dry matter - DM)

Basic nutrient	Unit	Minimum recommended			
		Adult-based on MER of		Early growth (<14 weeks) & reproduction	Late growth (≥ 14 weeks)
		95kcal/W ^{0,75}	110kcal/W ^{0,75}		
Protein	g	21,0	18,0	25,0	20
Fat	g	5,50	5,50	8,50	8,5
Calcium	g	0,58	0,50	1,00	0,8-1,0
Phosphorus	g	0,46	0,40	0,90	0,7
Sodium	g	0,12	0,10	0,22	0,22
Chloride	g	0,17	0,15	0,33	0,33

Source: FEDIAF, 2016

Addendum 3. Minimum recommended basic nutrient levels for puppies of breeds with adult body weight over 15 kg, until the age of about 6 months

(Unit per 1000kcal of metabolizable energy - ME)

Basic nutrient	Unit	Minimum recommended			
		Adult-based on MER of		Early growth (<14 weeks) & reproduction	Late growth (≥ 14 weeks)
		95kcal/W ^{0,75}	110kcal/W ^{0,75}		
Protein	g	52,1	45,0	62,5	50,0
Fat	g	13,75	13,75	21,25	21,25
Calcium	g	1,45	1,25	2,50	2,0-2,5
Phosphorus	g	1,16	1,00	2,25	1,75
Sodium	g	0,29	0,25	0,55	0,55
Chloride	g	0,43	0,38	0,83	0,83

Source: FEDIAF, 2016

Addendum 4. Minimum recommended Vitamins A-D-E levels for dogs

Nutrient	Unit	Minimum vitamins A-D-E recommended			
		Adult-based on MER of		Early growth (<14 weeks) & reproduction	Late growth (≥14 weeks)
		95kcal/W ^{0,75}	110kcal/W ^{0,75}		
For Puppies of dog breeds with adult body weight up to 15kg during the whole late growth phase ≥14 weeks. Unit per 100 g dry matter.					
Vitamin A	UI	702	606	500	500
Vitamin D	UI	63,9	55,2	55,2	50,0
Vitamin E	UI	4,17	3,6	5,0	5,0
For puppies of breeds with adult body weight over 15kg, until the age of about 6 months. Unit per 1000kcal of metabolizable energy.					
Vitamin A	UI	1754	1515	1250	1250
Vitamin D	UI	159	138	138	125
Vitamin E	UI	10,4	9,0	12,5	12,5

Source: FEDIAF, 2016

References

- [1] Andics A. & Miklósi Á. (2018). Neural processes of vocal social perception: Dog-human comparative fMRI studies. *Neuroscience & Biobehavioral Reviews*, 85, 54-64.
- [2] Di Cerbo A., Morales-Medina J. C., Palmieri B., Pezzuto F., Cocco R., Flores G. & Iannitti T. (2017). Functional foods in pet nutrition: Focus on dogs and cats. *Research in Veterinary Science*, 112, 161-166.
- [3] Sanderson S. L., Gross K. L. & Ogburn P. N. (2001). Effects of dietary fat and L-carnitine on plasma and whole blood taurine concentrations and cardiac function in healthy dogs fed protein-restricted diets. *American Journal of Veterinary Research*, 62, 1616-1623.
- [4] Boehmke W., Palm U., Kaczmarczyk G. & Reinhardt H. W. (1990). Effect of high sodium and high water intake on 24 h-potassium balance in dogs. *Z. Versuchstierkd*, 33 (4), 179-185.
- [5] Schweigert F. J., Ryder O. A., Rambeck W. A. & Zucker H. (1990). The majority of vitamin A is transported as retinyl esters in the blood of most carnivores. *Comparative Biochemistry and Physiology A*, 95, 573-578.
- [6] Schweigert F. J. & Bok V. (2000). Vitamin A in blood plasma and urine of dogs is affected by the dietary level of vitamin A. *International Journal for Vitamin and Nutrition Research*, 70, 84-91.
- [7] Morris P. J., Salt C. & Raila J. (2012). Safety evaluation of vitamin A in growing dogs. *British Journal of Nutrition*, 108, 1800-1809.
- [8] Zentek J., Kohn B. & Morris P. (2009). Effect of dietary vitamin A on plasma levels and urinary excretion of retinol and retinyl esters and clinical parameters in puppy dogs. *Proceedings of the 13th Congress of the ESVCN* (p. 97). 15-17 October, Oristano, Italy.
- [9] NRC (2006). Chapter vitamin D in nutrient requirements of dogs and cats. *The National Academic Press*, Washington, DC.
- [10] Hall J. A., Tooley K. A. & Gradin J. L. (2003). Influence of dietary n-6 and n-3 fatty acids and vitamin E on the immune response of healthy geriatric dogs. *American Journal of Veterinary Research*, 64(6), 762-772.

NHU CẦU DINH DƯỠNG CỦA CHÓ VÀ THÀNH PHẦN DINH DƯỠNG TRONG MỘT SỐ THỨC ĂN CỦA CHÓ CẢNH

Đỗ Thị Phương Thảo¹, Nguyễn Thị Quyên¹,
Nguyễn Xuân Việt¹, Vũ Thanh Mai², Hoàng Minh Sơn³

¹Khoa Nông Lâm Ngư, Trường Đại học Hùng Vương, Phú Thọ

²Phòng Đào tạo, Trường Đại học Hùng Vương, Phú Thọ

³Khoa Thú y, Học viện Nông nghiệp Việt Nam, Hà Nội

Tóm tắt

Bài báo đưa ra tổng quan các yêu cầu dinh dưỡng của chó dựa trên khuyến nghị của Hiệp hội các quan chức kiểm soát thức ăn chăn nuôi Hoa Kỳ (AAFCO), Hội đồng Nghiên cứu Quốc gia (NRC), Liên đoàn Công nghiệp Thực phẩm Vật nuôi Châu Âu (FEDIAF). Các thông tin tiêu biểu do các tổ chức này công bố dành cho chó ở các tầm vóc và lứa tuổi sử dụng khẩu phần ăn và chế độ dinh dưỡng khác nhau. Nhu cầu năng lượng cơ bản đối với chó tầm vóc nhỏ khoảng 400kcal GE/100gDM, protein thô trong khẩu phần phụ thuộc vào hàm lượng carbohydrate trong khẩu phần và lứa tuổi khoảng 18% đến 25%. Ngoài ra, các thành phần dinh dưỡng trong thức ăn cho chó thương mại của Việt Nam đã được thảo luận. Hầu hết các loại thức ăn cho chó có sự đa dạng về khẩu phần và hàm lượng chất dinh dưỡng, và lượng thức ăn cung cấp hàng ngày từ 50g đến 150g/con.

Từ khóa: *Thú cưng, chó, nhu cầu dinh dưỡng, thức ăn cho chó.*