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An observation on the contents of nutrient, fatty acid and changes of lipid peroxide in different storaged commercial pet foods for dogs and cats

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애완동물용 식품의 영양성분 및 지방산의 분석과 보관상태별 지질과산화물량의 변화 관찰

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초 록 : 동경에서 시판되고 있는 애완견 및 고양이의 식품을 시료로 하여 그 영양성분을 분석한 바, 애완견의 건조식품의 경우 단백질 22.0%, 지방 7.8%, 섬유질 5.4%, 염분 0.36%, 비타민 A 2035 IU/100g 그리고 비타민 D가 201 IU/100g 함유되고 있었고, 고양이용 식품중에는 단백질 29.8%, 지방 6.5%, 섬유질 4.5%, 염분 0.38%, 비타민 A 1543 IU/100g 그리고 비타민 D가 163 IU/100g 함유되고 있었다. 불포화지방산의 경우 애완견의 건조식품에선 59.2% 함유되어 있었고, 고양이용 건조식품에선 55.9%로서 애완견용 식품이 약간 높았으나 양측간에는 유의한 차이는 아니었다. 한편 애완견의 건조식품을 대상으로 30일간 저장시험을 통하여 지질과산화물의 농도변화를 관찰한 바 냉장(4℃)과 암실내 저장(20±2℃)에서는 별로 변화가 없었으나, 태양광선(20±2℃)에 노출시 5일후에는 실험개시에 비하여 4.9배($p<0.01$) 그리고 30일에는 10.2배가 증가된($p<0.01$) 73.6nmol/g에 달하였다. 이와같은 결과를 미루어 보아 애완동물용 식품의 안전성을 위한 저장은 반듯이 냉장이나 암실보관할 것을 제안한다.

Key words : pet foods, nutrient, fat acid, lipid peroxide.

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Introduction

Feeding is one of the most important management practices of the pet owner. The nutritional management is increasingly recognized as an integral part of both preventive health care and treatment protocols for medical and patients. Because of advances in biotechnology, i.e., enteral and parenteral nutrition, better biochemical assessment of nutritional status and "fine tuning" of macroand micronutrient needs are also focusing on nutrition[1].

The manufacture of foods prepared specially for dogs and cats has developed into a large industry over the last 30 years or sol. Most people who have a cat or a dog do not have extensive knowledge of nutrition, and do not wish to spend a lot of time on feeding their animals. Furthermore, they do not have access to cheap supplies of food items, the time or desire to prepare and cook food specially for their pets. A large proportion of the diet for pet animals is, therefore, dependent upon commercially available foods, and thus appropriate feeding with nutritionally suitable pet foods is of critical importance for cats and dogs.

The basis of any validation of the nutritional adequacy of foods for cats and dogs must embrace a knowledge of the animal's requirements for specific nutrients. Specifically, dietary fats serve as the most concentrated source of energy in the diet and lends palatability and an acceptable texture to dog and cat foods. While the content of dietary fat in the pet food is very important for the health of dogs and cats, the actual figures are not clear.

This study, therefore, was aimed at investigating on the contents of nutrient, fatty acid in dog and cat food and changes of lipid peroxide in different storaged comercially dry dog food in Japan, in order to clarify the best storage conditions for the foods.

Materials and Methods

Pet food : Nutrient contents were measured in 5 brands each of domestically produced dog and cat food purchased at a supermarket in Tokyo(Examination I). Fatty acid concentrations were also measured in 5 brands each of commercial dry dog food and dry cat food sold at a supermarket in Tokyo(Examination II). Lipid peroxide concentration was measured in 6 brands of dry dog food only(Examination III).

Examination : In Examination I, the contents of moisture (drying method), protein(modified Kjeldahl method), fat(ether extraction), fiber(modified Southgate method), ash(total mineral content) (PSJ, 1990)[2], sodium, potassium, copper, magnesium, calcium, zinc, iron, phosphorus (atomic absorption photometry method), vitamin A. vitamin D, vitamin E, biotin, folacin, niacin and pyridoxine(high-performance liquid chromatography method) were measured. In Examination II, the contents of saturated and unsaturated fatty acid(capillary gas chromatography method) (Takagi, 1982)[3] were measured. In Examination Ⅲ, the lipid peroxide concentration(thiobarbiturate method) (Itaya, *et al.*, 1987)[4] in food was measured and expressed on the basis of the malondialdehyde concentration.

Results and Discussion

Like all other living animals, dogs and cats require food to stay alive and healthy. Therefor, pet food must have appropriate nutritional composition and safety. We have conducted studies on pet food quality, considering that is indispensable for rearing health dogs and cats. We detected mercury in pet food prepared from fish materials, and reported markedly high mercury concentration in the hair of cats given raw fish and dried sardines[5].

In this study, we examined the nutritional composition of commercial pet food and evaluated how it should be stored after unsealing. The pet food examined in this study were the most popular one products on the market and had been manufactured within 3 months before testing. The moisture, protein, fat fiber, ash, mineral, and vitamin concentrations of the dry dog food and dry cat food(Table 1) were similar to the data reported down to data[6]. Also, their concentration fulfilled the nutrient requirements suggested by the National Research Council, U.S.A.[7,8]. Therefore, we suggest that the composition of each pet food examined in this study was appropriate for rearing of dogs and cats.

With regard to fatty acids, the unsaturated fatty acid con-

centration was slightly higher of dry dog food(59.2%) than that of dry cat food(55.9%), but the differences was statistically not significant(Table 2). The measured values of crude fat were in agreement with the values indicated on the packages of many pet foods.

Table 1. Nutrient contents of prepared foods for dogs and cats

Item	Dry dog food	Dry cat food
No. of Samples	5	5
Moisture (%)	12.4±0.4	13.5±1.5
Protein (%)	22.0±1.2	29.8±2.3*
Fat (%)	8.0±0.8	8.5±0.3
Fiber (%)	5.4±0.6	4.5±0.3
Ash (%)	7.3±0.4	7.3±0.3
Sodium (%)	0.36±0.05	0.38±0.03
Potassium (%)	0.58±0.02	0.70±0.07
Calcium (%)	1.22±0.07	1.20±0.04
Phosphorus(%)	0.96±0.06	1.08±0.11
Copper (mg/100g)	1.18±0.04	1.35±0.06
Magnesium (")	0.12±0.01	0.13±0.01
Zinc (")	14.6±0.4	14.8±0.3
Iron (")	24.2±1.9	24.5±1.8
Vitamin A(IU/100g)	2035±107*	1543±154
Vitamin D (")	201±10*	163±8
Vitamin E (")	1.8±0.1	1.9±0.8
Biotin (ug/100g)	13.4±0.2	15.0±1.2
Folacin (")	132±2	235±3**
Niacin (")	8.7±0.2	12.1±0.5**
Pyridoxine(")	0.9±0.1	0.9±0.1

* $p<0.05$, ** $p<0.01$
Each value represents the mean±standard error.

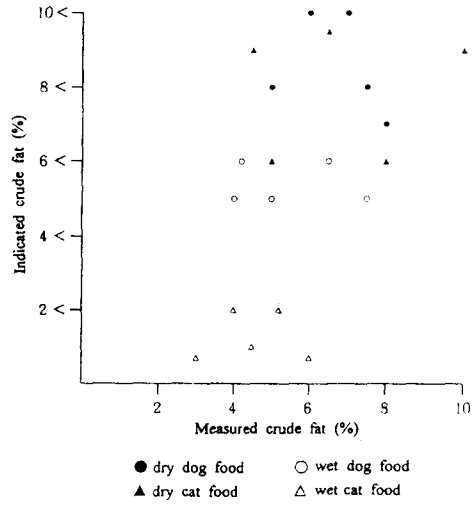

Fig 1. Correlation between indicated concentration and measured concentration of crude in different diets.

Fats and oils contained in frozen fish and animal meat used as materials for dog food are oxidized during long-term storage[9,10]. However, the concentration of lipid peroxides in dog food examined in this study was not changed after storage at 4℃ or in a dark place at 20±2℃ of room temperture for 30 days(Table 3). This was considered to be due to differences in the degree of unsaturation of fat oil and the contents of oxidization-promoting factors and antioxidant components in food. However, upon storage in sunlight at 20±2℃ of room temperture, the lipid peroxide concentration in dog food increased 4.9-fold after 5 days and 10.2-fold after 30 days as compared with that at unsealing(Table 3). Since lipid peroxide increase within a short period when food is exposed to sunlight after unsealing, the food should be stored in a refrigerator

Table 2. Crude fat and fatty acid concentrations in different diets for dogs and cats

Diets (%)	Crude Fat(%)	Fatty acid (%)					Total
		Saturated fatty acid	Unsaturated fatty acid				
			Monoenoic	Di	Poly	Sum	
Dog food:							
	7.4±1.1	40.1±2.7	45.3±3.3	11.7±4.7	2.2±1.1	59.2	99.3
Cat food:							
	6.5±0.6	43.5±2.2	43.9±1.4	9.9±0.9	2.1±0.2	55.9	99.4

Each samples of dry foods were five. Each value represents the mean±standars error.

Table 3. Lipid peroxide concentrations in dry dog food

Storage (Days)	Lipid peroxide (nmol/g)		
	Refrigerated(4℃)	Darkroom#	Exposed to sunlight#
0	7.2±1.1	7.2±1.3	7.2±1.0
5	7.3±1.1	7.3±1.1	35.3±5.3**
10	7.5±1.2	7.5±1.2	46.8±7.0**
20	7.7±1.2	7.7±1.1	57.0±8.8**
30	8.0±1.3	7.8±1.2	73.6±16.6**

Room temperture at 20±2℃, ** $p<0.01$
Each samples were 6 brands of dry dog food only.
Each value represents the mean±standars error.
Lipid peroxide was determined as malondiadehyde.
Each samples were six.

or dark place. The detection and measurement of lipid peroxidation is the evidence most frequently cited to support the involvement of free radical reactions in toxicology and in human and animal disease[11].

When methyl-linoleate hydroperoxide and its secondary oxide were administered orally to mice, necrosis and fatty degeneration occurred in the intestinal mucosa, liver, kidney, and lung[12]. When linoleat hydroperoxide was administered intravenously to rabbits, aortic endothelial cell were injured, causing thrombus formation[10,13] and when it was administered intravenously to rats, growth inhibition and diarrhea were observed[14].

Summary

While the contents of protein, fat, fiber, sodium, vitamin A, and vitamin D in dry dog food were 22.0%, 7.8%. 5.4%, 0.36%, 2035 IU/100g and 201 IU/100g, respectevely, those in dry cat food were 29.8%, 6.5%, 4.5%, 0.38%, 1543 IU/100g and 163 IU/100g, respectively. Concerning the lipid contents of pet food, the concentration of unsturated fatty acid was slightly higher of dry dog food(59.2%) than that of dry cat food(55.9%), but the differences was statistically not significant. The lipid peroxide concentration in dry dog food after storage in a refrigerator at 4℃ or dark place of room temperture at 20±2℃ for 30 days(8.0 nmol/g and 7.8 nmol/g) was not different from the value at the beginning of storage. However, upon storage in direct sunlight at 20±2℃ of room temperture, the concentration increased 4.9-fold(35.5 nmol/g) after 5 days and 10.2-fold(73.6 nmol/g) after 30 days. These results suggest that pet food may be refrigerated or stored in a dark place after unsealing.

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