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INVESTIGATIONS ON NUTRIENTS DIGESTIBILITY OF TRADITIONAL AND COMMERCIAL DIET IN GERMAN SHEPHERD DOGS

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Introduction

The knowledge in the field of rational dog feeding has changed significantly in recent years (Barteczko 2004 a, 2004 b). Dog feeding of traditional dog food, so that is ration consisted of succulent feed, prepared usually at home, is usually very laborious and more costly (determination and preparation of daily ration and calculation of amount of certain components), in comparison to dried commercial feed (Barteczko 1999; Grünbaum 1988; Meyer, Zentek, 2001). The food market offers many commercial feeds now (Barteczko 2001; Leibetseder 1980). Such dried commercial feeds for dog have many advantages: it suit feeding standards for energy, food ingredients and active biological nutrients, components present high nutritive value, and are many times long-lasting in comparison to fresh and are easy in preparation, and in addition to can be controlled according to conformity of formula and microbial purity (Barteczko 1993, 2002, 2003; Göcke 1970).

Feed value depended on content of nutrients and their digestibility as well as testiness. Dog feeding should require standards of energy, nutrients also mineral and vitamins requirements (Barteczko 1987, 1997; National Research Council 2006).

Digestibility coefficient of nutrients depends on: type and way of food preparation, type and nutrients content, the speed of chyme movement through alimentary canal, and on body weight, age and individual traits of dog. (Barteczko 1992).

The protein digestibility of animal origin change due to temperature action (digestibility of raw milk protein is 86%, and boiled milk – 42%), (Lambert 1975). In a cooked meat come into being protein-sugar compounds restive to digestive function of proteolysis enzymes (Barteczko, Meyer, Zentek 1991). The protein of non-boiled hen egg is less digested by 30% in comparison to the boiled – 88% (Barteczko 2006). Carbohydrates are better digested after boiling (Keller 1979). It looks that milk and milk products, similar like meat is better to be feed non boiled but hen eggs after boiling, and all plant feeds - carbohydrates (groats, flours and others) need to be boiled, cooked, roasted or baked. The fodders of animal origin are much better digestive in comparison to fodder of plant origin due to easier accessibility of digestive enzymes to nutrients (Riklin, Meyer 1975; Schmidt 1977).

The aim of investigations was definition of basic digestive level of basic nutrients, of traditional full-compound dog food (home-made prepared) and commercial full-compound dog food (dry, extruded) in adult German shepherd dogs.

Material and methods

Investigations of nutrients digestibility of traditional full-compound dog food (home-made prepared) and commercial full-compound dog food was conducted on German shepherd dogs reared at the Provincial Police Department in Krakow. For experiment 8 dogs were selected (2 groups x 4 dogs) at the age 3 – 3,5 years and body weight from 27 – 33 kg. All dogs were at good health and condition, dewormed before experiment and inoculated against rabies, distemper and parvovirus.

During experiment dogs were in individual pens consisted of sleeping-place and run place of 6 m^2 surface. The dog feeding was once a day, always at the same time (usually about 11 am).

Traditional dog food was a mixture home-made prepared, like a dense soup consistency (tartar), of temperature 25 – 30^{o}C. Dogs of group I were fed with traditional food, and included: boiled pearl barley making 45,5 % of food and lean beef (38,9 %) and fish- mackerel amount of 5.5%. The presence of carrot and beets (1:1) in the food was 6.5% and premix and mineral additives 1.5%. To compensation energetic deficiency vegetable fat 2.1% in the form of soy oil was added to the feed ration. The food was prepared daily. Ground meat was boiled together with pearl barley about 2 hours. Blended vegetables (the source of vitamins) were given un-boiled. Prepared in such way traditional food was based on guidelines of Provincial Police Department, regarding feed rations used in police dog feeding.

The doge of group II were fed of commercial extruded dry food, and content: 38.0% meat-and-bone meal (fatty), 45,0 % barely pearl, 8,3 % vegetable oil (soy oil), 2,4 % dried vegetables (carrot and beets), 3,8 % premix and mineral additives. This food was assigned for dogs of large physical activity after finishing growth period. The food was given to dogs as a dry in the amount 532 g/day/dog average with permanent access to the clean water.

The investigation on digestibility was made using indicator method. During digestibility investigations dogs received for 5 days of preliminary period and 5 days of proper period traditional mixture food (group I) and dry commercial food (group II). The samples of food mixtures and collected at proper period faeces from each of the dog was collected and stored at -16^{o}C. In all collected samples the basic nutrients content were analyzed according to Weenden method. As an indicator "Celit 545" was used, determined by the method of insoluble ash in 10 % HCl in the amount of 1.5% of dry matter, which was mixed precisely with food. The chemical analyses of food and dog faeces were measured at the Department of Animal Nutrition, University of Agriculture in Krakow (AOAC. 2000).

Digestibility coefficients were calculated based on results of chemical analyses of food samples and faeces, according to the formula:

$$\%\ DC = 100 - \left[100 * \left(\frac{\%\ \text{indicator in food}}{\%\ \text{indicator in faeces}} * \frac{\%\ \text{component in faeces}}{\%\ \text{component in food}} \right) \right]$$

Calorimetric value of food and faeces were determined in calorimetric unit KL-10 and next digestible energy was evaluated and next based on formulas of multiple regression – metabolizable energy.

Data were evaluated statistically by the one way analysis of variance using SAS (1996). Differences between means treatment were tested using Duncan's test. Results between which statistical significant differences were observed (P<0,05), were marked with this same small letters.

Results and discussion

The experiment was conducted according to the thesis in methods. Obtained results are presented in 5 tables. Table 1 presents content of tarditional home-made food (group I) and commercial food (group II).

Table 1

Food component content [%]

Content	Group	
Barley pearl-boiled	I Traditional food	II Commercial food
Barley pearl	45,5	--
Beef meat	--	45,0
Meat-and-bone meal	38,9	--
Fish (mackerel)	--	38,0
Fish meal	5,5	--
Fresh vegetable (carrot + beets, 1:1)		2,5
Dried vegetables	6,5	---

Vegetable fat	---	2,4
Limestone	2,1	8,3
Dicalcium phosphate	0,6	1,4
Vitamins + mineral additives (Premix M)	0.5	1,0
Total	0,4	1,4

Chemical composition of food presents table 2, which show that protein content in traditional food is 7.40% and is higher from recomended minimum level – 3,5 % (Meyer, Zentek 2001). Crude protein content (24,31 %) in dry food is also similar to recomended which is according to (Grünbaum 1988) 20-22 %.

Table 2

Chemical composition of food [%]

Content	Group			
	I		II	
Dry matter	28,25	100	95,50	100
Crude ash	1,29	4,57	5,23	5,47
Organic matter	26,96	95,43	90,27	94,52
Crude protein	7,40	26,19	24,31	25,45
Crude fat	4,15	14,70	13,79	14,44
Crude fibre	0,82	2,90	2,70	2,83
Nitrogen free extract	14,59	51,65	49,47	51,80

A higher content of crude fat in commercial food (13,79 %) in comparison to traditional food (4,15 %) also according to requirenments for dry foods fat should be at 5 -22 % and for moist foods 1,5 % (Meyer, Zentek 2001).

The content of crude fibre in traditional food was 0,82 % and was lower from recommended. It is due to not sufficient amount of vegetables in ration. In the case of dry food it is correct (2-3 %) [Grünbaum,1988].

Maximum values for digestible carbohydrates in feeding ration are 65 % for dry food and 20 % for traditional food [Grünbaum, 1988]. Presence of carbohydrates is correct.

From calculated ratio of investigated component to the parameter in consumed food as well as in extracted faeces digestibility coefficient was calculated for respectives feed components, and are shown in table 3. The highest digestibility coefficients were for total proteins in group I (88,33 %). Average digestibility coefficient for proteins was observed in dogs from group II and was 83,38 %. Differences between these coefficients are statisticaly significant ($P<0.05$). Protein digestibility in group I was higher from tabular coefficients which according to Grünbaum (1988) for traditional food (succulent feed) are at the level 85 %, and for commercial dry food 86,2 %, (tab. 3).

Table 3

Digestibility coefficients of food components [%].

Content	Group	
	I Traditional food	II Commercial food
Dry matter	76,82 b	72,71 a
Organic matter	81,91 a	80,23 a
Crude protein	88,33 b	83,38 a
Crude fat	90,82 a	91,50 a
Nitrogen free extract	90,82 b	85,02 a
Gross energy	85,77	84,05

Note: Means marked with different letters differ (a, b, c) significantly ($P<0,05$).

The results from chemical analyses can assure that objective food is characterized by high total protein content with simultaneous high content of digestible protein. It is important to mention that the use of high temperatures during production of extruders can give a reaction which resulted in lowering of aviability of lysine by about 10–30 %.

Investigations on digestibility of crude fat indicated that it is about 90,82 % in the group I and insignificantly higher in group II – 91,50 % (P<0,05). The digestibility coefficients of crude fat of tarditional food and dry commercial in Grünbaum (1988) investigations were alike and respectively: 90 and 91 %.

Table 4

Food energy value

Content	Group			
	I		II	
	Traditional food		Commercial food	
Dry matter [%]	28,25	100	90,50	100
Gross energy [kcal/kg] [MJ/kg]	1615,7 6,76	5719,3 23,93	4902,4 20,51	5417,0 22,66
Digestible energy [kcal/kg] [MJ/kg]	1385,8 5,80	4905,5 20,52	4120,6 17,24	4553,1 19,05
Metabolizable energy [kcal/kg] [MJ/kg]	1252,9 5,24	4435,3 18,56	3737,3 15,63	4130,6 17,28
Metabolizable energy [kcal/kg] [MJ/kg]	1252,9 5,24	4435,3 18,56	3737,3 15,63	4130,6 17,28
Ratio of digestible protein [g]/ MJ digestible energy	11,3	-	11,7	-

Noticeable differences in components digestibility between groups, were observed for dry matter (group I – 76,82 %, group II – 72,71 %) (P>0,05), organic matter (group I – 81,91 %, group II – 80,23%) and nitrogen free extract (group I – 90,80%, group II – 85,02%) (P<0,05). According to Grünbaum (1988) digestibility coefficient of nitrogen free extract is 65 % in succulent feed, and 88,5 % in pelleted commercial feed.

Table5

Presence of digestible energy of respective digestible components

Group	Component	Digest. nutrient	Digestibility coefficient of energy	Digestible energy	Energy contribution
		[g/kg]	[kcal/g]	[kcal]	[%]
I Traditional food	Crude protein	65,36	5,7	372,6	26,89
	Crude fat	37,69	9,5	358,0	25,83
	Nitrogen free extract	156,01	4,2	655,2	47,28
	Total	--	--	1385,8	100
II Commercial food	Crude protein	202,70	5,7	1155,4	28,04
	Crude fat	126,18	9,5	1198,7	29,09
	Nitrogen free extract	420,59	4,2	1766,5	42,87
	Total	--	---	4120,6	100

Mean digestibility coefficient of gross energy of food from group I (traditional food) was 85,77%, but somewhat higher in dogs from group II (commercial food) and was 84,05%.

Table 5 presents percentage presence of digestible energy of particular digestible components of ration, which was calculated based on energy equivalents (Barteczko 1983) for respective components (kcal/g): for digestible fat – 9,5; digestible protein – 5,7; nitrogen free

extract – 4,2. The presence of digestible energy coming of digestible protein of traditional food was 26,89 %, of crude fat 25,3 %; but of nitrogen free extract 47,28 %.

Conclusions:

1. It was affirmed that food component of traditional dog food and commercial dog food were digestible on a high level; total protein - 88.33 and 83.38%, fat – 90.82 and 91.50%, but nitrogen free extract – 90.82 and 85.02%. Digestibility of protein and nitrogen free extract in dogs fed of traditional food was significantly ($P<0.05$) higher in comparison to commercial food.
2. The chemical analyses conducted showed that protein content and other components contained in foods confirmed that they were made of high quality food components.
3. The results allow for general statement, that objective food assigned for active dogs, is of high energy value: traditional food contain 1385,8 kcal digestible energy/ kg and 1252,9 kcal of metabolic energy/kg, but commercial dog food contain 4120,6 kcal of digestible energy/kg and 3737,3 kcal metabolic energy/kg.

Summary:

The aim of performed experiment was determination of digestibility coefficient of nutrient contents of full-component traditional food (home-made way) and commercial food (dry, extruded) in adult German shepherd dogs. The investigations were carried out on 8 dogs (2 groups x 4 dogs) at the age about 3 years old and body weight 27–33 kg, reared at the Provincial Police Department in Krakow. The dogs of group I, were fed with traditional dog food, but group II with commercial dog food. Based on conducted experiments we concluded that nutritive components of traditional and commercial foods are digested very well. Protein digestibility and nitrogen free extract in dogs fed traditional food was significant ($P<0.05$) higher in comparison to commercial food.
The results allowed us for general statement that mentioned foods contain high energy value (per dry matter), designated for active work of police dogs.

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ДОСЛІДЖЕННЯ ПЕРЕТРАВЛЮВАНОСТІ ПОЖИВНИХ РЕЧОВИН В ТРАДИЦІЙНИХ ТА КОМЕРЦІЙНИХ РАЦІОНАХ НІМЕЦЬКИХ ВІВЧАРОК

Р е з ю м е

Метою проведеного досліду було визначення коефіцієнту перетравності поживного вмісту повноцінних традиційних кормів (виготовленої в домашніх умовах) та комерційних кормів (сухих, стиснутих) у дорослих німецьких вівчарок. Дослідження проводилися на 8 собаках (2 групи по 4 собаки) віком приблизно 3 роки вагою 27–33 кг, виведених в Відділі поліції у Кракові. Собак групи I годували традиційним кормом, а собак групи II — комерційним кормом. З проведених дослідів ми зробили висновок, що поживні компоненти традиційних та комерційних кормів перетравлювалися дуже добре. Перетравлюваність протеїну та вільного екстракту азоту у традиційному живленні собак була значно ($P<0.05$) вищою порівняно з комерційними кормами. Одержані результати дозволили зробити висновок, що вказані корми містять високу енергетичну цінність (на суху речовину), що важливо для активної роботи поліцейських собак.

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ИССЛЕДОВАНИЕ ПЕРЕВАРИВАЕМОСТИ ПИТАТЕЛЬНЫХ ВЕЩЕСТВ В ТРАДИЦИОННЫХ И КОММЕРЧЕСКИХ РАЦИОНАХ НЕМЕЦКИХ ОВЧАРОК

А н н о т а ц и я

Целью проведенного эксперимента было определение коэффициента перевариваемости питательного содержания полноценных традиционных кормов (изготовленых в домашних условиях) и коммерческих кормов (сухих, сжатых) у взрослых немецких овчарок. Исследования проводились на 8 собаках (2 группы по 4 собаки) возрастом приблизительно 3 года весом 27–33 кг, выведенных в Отделении полиции в Кракове. Собак группы I кормили традиционным кормом, а собак группы II — коммерческим кормом. Из проведенных мы сделали вывод, что питательные компоненты традиционных и коммерческих кормов переварювались очень хорошо. Перевариваемость протеина и свободного экстракта азота в традиционном кормлении собак была намного ($P<0.05$) выше в сравнении с коммерческими кормами. Полученные результаты позволили сделать вывож, что указанные кормы имеют высокую эненргетическую ценность (на сухое вещество), что важно для активной работы полицейских собак.

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