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Content and apparent ileal digestibility of nutrients in diets fed to breeding polar foxes over the non-mating season*

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ABSTRACT

The objective of the experiment was to determine whether failure in polar fox reproduction may be related to diet quality. In two diets fed during the non-mating season on farm A having very good, and on farm B having very bad records, the contents of total and ileal digestible nutrients were determined. Diet A had a more diversified ingredient composition and higher contents of total and digestible dry matter and carbohydrates, total protein and ash. However, the ileal digestibility of dry matter, protein and fat was higher in diet B, probably because of its lower ash content.

KEY WORDS: polar fox, reproduction, feed quality, non-mating period

INTRODUCTION

The failures in reproduction of polar fox observed over 10-15 years in Poland were ascribed mainly to viral, bacterial and pathogenic infections (Mizak et al., 1998; Śmielewska-Łoś et al., 1999). A comprehensive explanation of these disorders lacks evaluation of the quality of nutrition.

The objective of the study was to compare the contents of total and ileal digestible nutrients in diets fed during the non-mating season on two farms differing widely in reproductive performance in the preceding breeding cycle.

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MATERIAL AND METHODS

Two polar fox farms were selected: farm A with the best (8.1 kits per female) and farm B with the worst (1 kit per female) reproduction results in the 1999/2000 season. Two batches of complete diets fed on each farm in the two periods: 15.07.-15.09. and 15.09.- 01.12., covering the non-mating period were prepared. Representative samples of diets were taken daily, stored frozen until analysis, pooled and analysed. The diets used in digestibility experiments were homogenized and mixed with 0.5% of chromic oxide (Szymeczko and Burlikowska, 1996).

Table 1. Composition of diets fed to polar foxes on farm A (diet A1 and A2) and B (diet B1 and B2) over the non-mating period, g kg^{-1} as fed

Period	15.07. – 15.09.		15.09. – 01.12.	
Diet	A1	B1	A2	B2
Beef offal		699		783
Poultry offal	420		440	
Fish offal	299		294	
Meat meal	70		74	
Blood and feather poultry meal			29	
Milk powder	20		10	
Rapeseed oil			12	
Extruded cereals	150		89	
Precooked barley		300		216
Fibre mixture (Norpol)	40			
Wheat bran			22	
Vegetables			29	
Vit.-min. mixture (Ewomix Fur 0.05%)		0.5		0.5
Vit.-min. mixture (Polfamix LN 0.1%)	1.0		1.0	
Taiga Fur Iron 0.05%		0.5		0.5

The digestibility experiments were carried out on five one-year-old polar fox males of a mean body weight 6.2 kg with surgically prepared end-to-end ileorectal anastomosis (Szymeczko, 2001). The foxes were fed at the approximate maintenance level (90 kcal ME/kg body weight; NRC, 1982), once a day, at 08.00. Each diet was fed for 8 days, in the last four days collection of digesta was performed continuously during 96 h. The digesta were stored at -25°C, pooled, freeze-dried, milled and analysed.

RESULTS AND DISCUSSION

The composition of diets used on farm A and B in the period 15.07.-15.09. and 15.09.-01.12. (diets A1 and A2, B1 and B2, respectively) is given in Table 1. In both periods the composition of diets A was more diversified than diets B. Both

diets were supplemented with vitamin-mineral mixtures that met the requirements of reproductive foxes over the non-mating period for vitamins and microelements (NRC, 1982; Jarosz, 1994).

Table 2. Chemical composition (g kg^{-1}) and apparent ileal digestibility of nutrients (%) in diets fed to polar foxes on farm A (diet A1 and A2) and B (diet B1 and B2)

Period	15.07. – 15.09.			15.09. – 01.12.		
Diet	A1	B1	P≤	A2	B2	P≤
Total content, g kg^{-1} DM						
dry matter	333	218		327	244	
crude protein	124	77		130	105	
crude fat	74	53		73	76	
crude carbohydrates	72	67		65	45	
starch	49	64		43	40	
ash	58	12		54	14	
Gross energy, cal g^{-1}	1900	1300		1800	1600	
Digestibility, %[1]						
dry matter	66.6 ± 1.3	75.6 ± 1.0	0.05	63.8 ± 1.9	83.4 ± 1.4	0.05
protein	78.3 ± 1.2	86.4 ± 0.5	0.05	74.6 ± 2.2	90.6 ± 0.7	0.05
fat	92.9 ± 1.8	95.6 ± 0.7	0.05	93.7 ± 1.1	96.9 ± 0.5	0.05
carbohydrates	69.9 ± 3.5	64.7 ± 1.8	0.05	67.3 ± 1.9	66.4 ± 4.0	NS[3]
starch	87.7 ± 1.3	73.4 ± 0.9	0.05	84.7 ± 1.9	80.7 ± 2.1	0.05
ash	11.4 ± 3.1	23.5 ± 3.8	0.05	13.9 ± 1.6	33.3 ± 3.2	0.05
energy	82.6 ± 1.6	81.9 ± 0.8	NS	80.9 ± 1.3	89.2 ± 1.0	0.05
Metabolizable energy, cal g^{-1}[,2]	1300	1000		1300	1300	

[1] digestibility results expressed as mean ± SD; [2] calculated; [3] not significant

The content of total and digestible nutrients in diet A did not differ between the periods to a great extent, while in diet B the concentration of total and digestible protein and fat increased in the second period (Table 2). Due to that, differences between diets A and B were found mainly in the first period. Accordingly, diet A1 contained more total and digestible dry matter, protein, and fat than diet B1. The content of nutrients in diets A was in agreement with the levels recommended for reproductive foxes over the non-mating period (NRC, 1982; Jarosz, 1994).

The greatest differences between the diets concerned ash content since in both periods diet A contained about four times more crude ash and about twice as much digestible ash than diet B. The higher crude ash content could be the reason for the considerably lower ileal digestibility of dry matter, protein, fat, fibre and ash in diets A (Sławoń, 1987; Rouvinen and Kiiskinen, 1991).

In both periods, the content of total carbohydrates, particularly starch, was higher in diets A than B and, in contrast to other nutrients, carbohydrates from diets A were also more efficiently digested. This could result both from differences in the cereal components in the diets, and from different treatment and degree of

grinding cereals, which affect nutrient availability (Ljøkjel and Skrede, 2000). The carbohydrate sources in diet A were extruded wheat, maize and powdered barley meal, while in diets B the source was pre-cooked, roughly ground barley with a high proportion of whole seeds. In polar foxes, a high fat diet with an insufficient level of digestible carbohydrates can lead to acetonaemia (Sławoń, 1987).

The results of the experiment show that the nutritional value of diet B, particularly B1 fed in the earlier part of the non-mating season, was inferior to diet A in terms of a lower concentration of dry matter, energy, and total and digestible nutrient content. It can be assumed that these differences may be at least partly responsible for the substantial differences in the level of reproduction between farm A and B observed in the preceding season. The possible consequences of a very low content of mineral matter in diet B should be investigated in greater detail.

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STRESZCZENIE

Zawartość i pozorna strawność jelitowa składników pokarmowych w paszach dla hodowlanych lisów polarnych w okresie spokoju płciowego

Celem badań było wyjaśnienie czy niepowodzenia w rozrodzie lisów polarnych są związane z jakością diety. Określono zawartość oraz pozorną jelitową strawność składników pokarmowych w dwóch dietach stosowanych w czasie spokoju płciowego na fermie A i B, uzyskujących odpowiednio najlepsze i najgorsze wyniki hodowlane. Dieta A zawierała więcej ogólnej i strawnej suchej masy i węglowodanów oraz białka ogólnego i popiołu, jednakże, strawność jelitowa suchej masy, białka i tłuszczu była większa u lisów żywionych dietą B. Mogło to być to spowodowane mniejszą zawartością popiołu w diecie B.