

CHEMICAL COMPOSITION OF THE RUMEN CONTENTS IN ROE DEER (*Capreolus capreolus*) AS POTENTIAL QUALITY INDICATOR OF THEIR FEEDING

N. Djordjević¹, Z. Popović¹ and G. Grubić¹

Abstract: In the experiment the chemical composition of rumen contents in roe deer (*Capreolus capreolus*) was investigated in the “Barajevska Reka” hunting area. The investigations were done on 20 deer shot from May 2005 to January 2006. Experiment was done as random plan, with four treatments (seasons) and uneven distribution of subjects within treatments.

The results of chemical analysis confirmed significant influence of season on the amount of total nitrogen and crude protein, ether extract, crude fibre, ash and ammonia nitrogen ($P<0.05$). Variations in pH values, NFE, calcium and phosphorus in dry matter and total ash of the rumen contents were lower and there was no significant influence of season on those parameters.

The obtained results for total protein, calcium and phosphorus in the rumen contents in roe deer shot during the winter show significantly higher presence of those components than the usual recommendations for concentrate mixtures produced for the species. Although those results are not a real indication of the diet's chemical composition, they may be used as potential indicator of the quality of the diet and can be useful when formulating the additional feeding routine for winter months.

Key words: roe deer, rumen, contents, chemical composition.

I n t r o d u c t i o n

Roe deer (*Capreolus capreolus*) is classified as herbivore ruminant belonging to the *Cervidae* family. Based on the anatomy of their digestive organs wild ruminants are classified in three groups: browsers, grazers and those that use both methods of feeding (Hofmann, 1989). Browsers are best adapted to rapidly fermented feeds usually with lower digestibility. Grazers slowly digest plant

¹ Dr Nenad Djordjević. Associate Professor, Dr Zoran Popović. Associate Professor, Dr Goran Grubić. Professor, Faculty of Agriculture, 11081 Belgrade-Zemun, Nemanjina 6, Republic of Serbia

material, but they digest more efficiently. The third group uses many feeds and is more flexible because of that. Roe deer is classified as concentrate selector.

The energy requirements in animals grow proportionally with the increase of their metabolic weight (Kleiber, 1961). This is why roe deer (20-30 kg) require relatively more energy per unit of metabolic weight than larger animals. For the same reason they select more digestible feeds, especially dicotyledonous plants with higher amounts of soluble components of cell contents (Tixier et al., 1997). Roe deer satisfy only 50% of their energy needs with short-chain fatty acids. In order to satisfy the remaining needs, they developed mechanisms to decrease losses in ruminal microbial fermentation. One of them is their ability to directly pass feeds through forestomachs through ventricular groove, which partially or completely avoids the fermentation due to very rapid flow of digesta (Rowell-Schäfer et al., 2001). Considering that type of feeding, roe deer have relatively smaller forestomachs with larger gaps between them (Hofmann, 1989), faster digesta flow (Holand, 1994), relatively large salivary glands and higher amounts of their products (Fickel et al., 1998), and well developed ventricular groove, which remains in adults (Hofmann, 1989).

Literature Survey

Roe deer nutrition has influence on variability of their body development and the quality of their trophy (Popović et al., 2003; Popović and Bogdanović, 2002), and also on game losses (Popović and Bogdanović, 2001). Feeding roe deer in hunting area may be completely based on natural feeds, or various additional feeds may be used in order to achieve certain goals (Djordjević et al., 2005; 2006-a,b). The quality of natural feeds depends on the characteristics of the hunting area and season. The interventions in the form of additional feeds are usually done in winter time. However, roe deer do not find palatable feeds with less than 40% moisture. Also, it is very hard to precisely determine the quality of their natural feeding, and to use this information for formulating additional diet. Those problems make very hard to achieve good additional feeding.

Plant species eaten by roe deer can be detected by microscope of the rumen contents (Holišova et al., 1986) or feces (Kamler and Homolka, 2005). Based on their percent ratio and chemical composition, the composition of their diet may be approximately evaluated. But this method is unreliable due to several reasons. Chemical composition of the rumen contents or feces is different from the original diet because of the influence of mineral and nitrogenous compounds from saliva, microbiological activity in the rumen, absorption of digested matter and activity of endogenous enzymes. In the line with that, the aim of this experiment was to investigate the chemical composition of the rumen contents in roe deer, and based on the obtained results to give estimation of nutrient supply in various seasons.

Material and Methods

The investigation was done from May 2005 to January 2006 in the "Barajevska Reka" hunting area, which includes forests, land and waters on the Territory of Barajevo County, in Belgrade, Serbia. Based on the evaluation of basic ecological parameters that influence survival, development and reproduction of roe deer, this hunting area is ranked second class (Tomašević et al., 1997). Majority of the area is on the altitude between 160 and 330 m. In the total area, 15.95% are forests while 63.27% is arable land. The rest is covered with meadows and orchards.

The investigation was done on 20 roe deer with uneven distribution between seasons and months (Table 1). The samples of rumen contents were collected from freshly shot animals. Then they were frozen and analyzed in the Laboratory for animal nutrition at the Faculty of Agriculture, Belgrade University. The samples from deer shot in spring and winter consisted of macerated plant mass, while some samples taken in summer and autumn had fragments of wheat and maize grains and also of oak acorns.

Table 1. - Experimental plan

Treatment	Sampling period	Number of animals	Year	Visual properties of sample
1	April	6	2005	Macerated plant material
				Macerated plant material
2	July	3		Macerated plant material
	August	3		Macerated plant material
	September	1		Macerated plant material
3	November	1		Macerated plant material + oak acorn
		1		Macerated plant material + wheat grain
		1		Macerated plant material
		1		Macerated plant material + maize grain
4	January	3		2006

In the samples with natural moisture content the pH values were measured, and amount of total and ammonia nitrogen. In the dried samples the following analyses were done: crude protein, ether extract, crude fibre, NFE (calculation), total mineral content (ash), calcium and phosphorus (AOAC, 1984). Analyses of variance of obtained results and significance test (Tukey's) was done with Statistica (v. 6.0) software.

Results and Discussion

The amount of dry matter in all treatments was below 160 g/kg and it varied due to the season (Table 2). Roe deer prefer feeds with more than 40% moisture (Ševković et al., 1991). In spring and summer feeding roe deer

consume fresh feeds which have more than 80% moisture (Djordjević et al., 2006-a). The correct moisture content is important in the rumen to achieve normal activity of microorganisms and physiological processes, which explains the variation in this parameter regardless of the season. Compared with cows, which tend to have about 50% moisture in the rumen (Grubić and Adamović, 2003), in roe deer there is much higher moisture content, which is probably needed for faster digesta passage (Rowell-Schäfer et al., 2001).

T a b. 2. - Amounts of dry matter and chemical composition of organic matter in the rumen contents of roe deer

Treatment	Dry matter, g/kg	Organic matter, g/kg DM			
		Crude protein	Ether extract	Crude fibre	NFE
1	136.89	374.04 a	108.47 a	152.76 b	235.21
2	141.27	298.93 b	85.39 b	197.01 b	281.49
3	157.40	241.27 b	75.99 b	274.27 a	259.87
4	120.66	273.18 b	75.95 b	283.66 a	188.09
Significance, P<0.05	0.219193	0.000843	0.023585	0.000105	0.055764

Due to the change in chemical composition and selection of certain feeds, there was a significant decrease ($P<0.001$) in crude protein amount in rumen contents and increase ($P<0.001$) in crude fibre and mineral matter ($P<0.03$), which is shown in Table 3. The lower value for crude protein was recorded in the autumn period (241.27 g/kg DM), which can be explained by the increase of cereal grains in the diet. However, this value is much higher than the recommended values (14% CP) for concentrates used in the winter feeding (Ševković et al., 1991; Pavličević et al., 1999). The crude protein value in rumen contents is not an exact measure of the diet quality. The nitrogen content is also influenced by urea from saliva and from microorganisms. Kamler and Homolka (2005) did their investigation by microscoping the feces. They detected plant species and based on their percentage ratio evaluated the chemical composition of the diet. According to them, the amount of crude protein in spring, summer, autumn and winter period was 195.62; 155.0; 125.62 and 93.12 g/kg DM. Those values were much lower than the ones recorded in this investigation, particularly considering that roe deer is a concentrate selector. The obtained values can be probably explained by the local feeding resources in the north of Czech Republic, where dominant feeds from spring to autumn were plants *Rubus* spp. (80-90%), while in the winter they eat shoots of broadleaved woody and pine needles. Petersen and Strangaard (1994) analyzed rumen contents of 104 roe deer in Denmark, area Borris, and 146 in the Kalo area. In the first location they discovered that deer consumed 99 plant species and the main feeds were: heather (45%), medicinal plants (16%), grasses (19%), trees (11%), and they also discovered barley grains. In the Kalo area they consumed 51 species, among

them: anemone (21%), medicinal plants (25%), grasses (2%), trees (34%) and agricultural crops (18%). The variation in feed selection also depends on roe deer's age. Holiš et al. (1984) discovered that summer diet of two year or older roe deer includes more grains and fruits than in younger animals.

The high amounts of protein in Serbian samples may be the result of a great choice of feeds, and their higher protein content. Aside from that, roe deer prefer eat ingenuity-rich feeds during the winter, which decreases the amount of protein in the diet (Berteaux et al., 1998). Ultimately, proteins can be also used as energy source in physiological processes (Grubić and Adamidis, 2003).

Amounts of calcium and phosphorus in the ash and dry matter of the rumen contents were not very variable (Table 3). There is evident decrease of those components in later periods of the year. The amount of phosphorus was higher than calcium, which probably occurred due to feed selection and presence of cereal grains. A certain amount of phosphorus is also coming from saliva (Grubić and Adamović, 2003), which may contribute to the variability of this element regardless of the season.

T a b. 3. - Amount of ash, calcium and phosphorus in the rumen contents

Treatment	Ash g/kg DM	Ca	P	Ca	P
		g/kg ash		g/kg DM	
1	129.53 a	86.62	165.49	11.13	21.42
2	137.18 a	84.51	144.62	11.65	19.77
3	148.60 b	67.25	142.70	9.52	21.00
4	179.12 b	74.67	145.97	13.05	25.89
Significance, P<0.05	0.031313	0.724609	0.229159	0.709752	0.137519

Total nitrogen in the rumen contents includes all protein and non protein forms (Djordjević et al., 2003). For all parameters in the Table 4, the lowest values were in autumn, which can be explained by the presence of cereal grains in the diet. The amount of total and ammonia nitrogen was significantly different ($P<0.001$) between seasons.

T a b. 4. - Physiological parameters in rumen contents

Treatment	pH	Total N, g/kg DM	NH ₃ N, g/kg DM	NH ₃ N, g/kg N
1	5.48	64.31 a	0.66 a	1.01
2	5.62	52.23 b	0.42 ab	0.79
3	5.53	43.00 b	0.24 bc	0.54
4	6.20	47.61 b	0.40 ab	0.86
Significance, P<0.05	0.077995	0.001493	0.005984	0.077995

Conclusion

High amounts of crude protein in the rumen contents are not entirely from feeds, but show how highly selective feeder is roe deer. In later phases of vegetation the amount of protein decreases and the amount of crude fibre is increasing. The lowest protein values were determined in autumn, which can be explained by the presence of cereal grains in the diet. The amount of calcium and phosphorus varied regardless of the season, with domination of phosphorus. Acidity (pH) and ammonia nitrogen were not influenced by the season either.

The obtained results are very different from existing recommendations for roe deer, and for concentrate mixtures for winter feeding. Taking this into account, these investigations should be continued and the most reliable method for evaluation of the natural feeding of roe deer established. Based on that, it would be possible to formulate much better mixtures for additional feeding in winter.

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HEMIJSKI SASTAV BURAZNOG SADRŽAJA SRNE (*Capreolus capreolus*) KAO POTENCIJALNI INDIKATOR KVALITETA ISHRANE

N. Djordjević¹, Z. Popović¹ i G. Grubić¹

Re z i m e

U eksperimentu je ispitivan hemijski sastav buražnog sadržaja srne (*Capreolus capreolus*) u lovištu Barajevska reka. Ispitivanja su obavljena na uzorcima koji su uzeti od 20 odstreljenih srna u periodu od proleća 2005. (maj) do zime 2006. (januar). Eksperiment je postavljen kao slučajan plan, sa četiri tretmana (godišnja doba) i nejednakom distribucijom broja jedinki po tretmanima.

Rezultati hemijske analize ukazuju na signifikantan uticaj ispitivanog faktora (godišnje doba) na količinu ukupnog azota i sirovih proteina, masti, celuloze, pepela i amonijačnog azota ($P < 0.05$). Variranja pH vrednosti, BEM-a, sadržaja kalcijuma i fosfora u pepelu i suvoj materiji buražnog sadržaja nisu bila pod uticajem ispitivanog faktora.

Dobijeni rezultati za količinu proteina, kalcijuma i fosfora u buražnom sadržaju srna koje su odstreljene zimi, ukazuju na značajno veće prisustvo ovih sastojaka u odnosu na dosadašnje preporuke za sastav smeša koncentrata za srne. Mada ovi rezultati nisu realni pokazatelji hemijskog sastava obroka, mogu da posluže kao potencijalni indikator kvaliteta obroka u cilju korekcije sastava koncentrata za dodatnu ishranu zimi.

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¹ Dr Nenad Djordjević, vanredni profesor, dr Zoran Popović, vanredni profesor, dr Goran Grubić, redovni profesor, Poljoprivredni fakultet, 11081 Beograd-Zemun, Nemanjina 6, Republika Srbija