THE EFFECT OF THE LEVEL OF NON-DEGRADABLE PROTEIN ON DIGESTIBILITY OF NUTRITIVE SUBSTANCES IN FATTENING LAMBS**

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Abstract: Results of the investigation of the effect of the level of non-degradable protein in concentrate mixtures on digestibility of nutritive substances in fattening lambs are presented in this paper.

Physiological research included 18 male lambs crosses Pirot Pramenka x Württemberg x Ile de France, average body mass of approx. 35,0 kg, divided into three groups. Lambs were fed iso-protein concentrate mixtures which differed in relation to share of protein non-degradable at the rumen level: 43% (I), 51% (II) and 58% (III).

Trial results indicate that the level of protein adoption was not under the influence of investigated treatment, considering that digestibility coefficients were: 52,58% : 51,30% : 55,12%. With the increase of share of non-degradable protein in concentrate mixtures (43: 51: 58%), also tendency of increase of fat digestibility was observed: 76,13 : 77,98 : 87,17%, but decrease of degree of cellulose digestion: 67,40 : 45,87: 22,39% and NFE: 83,87 : 76,05 : 82,96%.

Key words: lambs, non-degradable protein, digestibility

Introduction

Deficit of protein feeds on the market and high prices impose the need for their rational use in ruminant nutrition.

It is known that food proteins which reach small intestines in ruminants represent sum of two protein fractions: microbial protein and non-degradable

protein at the level of rumen. Micro population in reticulum-rumen degrades protein from diet to peptides, amino acids and ammonia, afterwards these substances are used for synthesis of own proteins. During each of these processes of degradation and synthesis there are certain losses which eventually means that to the digestion spot and location where proteins are being adopted or taken in the amount of amino acids is reduced (*Grubić et al.,* 1992). In order to provide optimal pool of amino acids for certain production, it is necessary to provide in diet protein fraction which avoids degradation in reticule-rumen (non-degradable protein). This is especially important in intensive fattening of lambs, considering that with the increase of genetic capacities of lambs also their needs increase, especially relating to part of protein which non-degraded passes through rumen and together with microbial protein reaches duodenum (*Ružić-Muslić*, 2006).

Material and Methods

Investigation of digestibility of nutritious substances was performed by indirect method on 18 male heads, divided into three groups, average body mass of approx. 35,0 kg, on Experimental sheep farm of the Institute for Animal husbandry, Belgrade-Zemun.

Table 1. Composition and nutritive value of concentrate mixtures, %

Feeds	Concentrate mixtures		
	I	II	III
Corn	73	79	82
Sunflower meal	23	5	7
Soy bean meal	0	12	0
Fish meal	0	0	7
Limestone	2	2	2
Salt	1	1	1
Premix	1	1	1
Dry matter	87,10	86,50	86,80
OHJ	1,20	1,20	1,20
NEM, MJ/kg	7,51	7,98	7,91
UFV(**)	0,99	1,05	1,04
Total protein	142	137	141
NP(**)	62	70	82
NP in CP (**)	43	51	58
PDIN, g/head/day	102	103	107
PDIE, g/head/day	102	112	118
Ca, g	8,40	8,20	10,60
P,g	4,60	3,70	5,00

Research included preparation period (in duration of 7 days) and collection period (in duration of 6 days). During entire period lambs received twice a day measured quantity of concentrate mixture supplemented with Cr_2O_3 as indicator, in concentration of 0,5%. Mixtures used varied in regard to the share of protein non-degradable at the level of rumen: 43% (I), 51% (II), 58% (III) which is presented in table 1.

Calculation of nutritive value was carried out based on French system recommended by INRA (1988[**]) and *Obračević (*1990[*]*)*.

During collection period, after every feeding, faeces samples were taken (in amount of 150 g), for each head and into special dish, which was bearing number of head, group, date and time of faeces collecting. After the end of trial period, samples from each dish were homogenized and a representative sample was prepared for analysis. Samples and food and faeces remains were analyzed using standard method of chemical analysis (WENDE). Data obtained by analytical method were used for calculation of digestibility of nutritive substances indirectly according to the following formula:

$$\text{Digestibility, \%} = 100 - \frac{\text{\% indic. in feed}}{\text{\% indic. in feces}} \times \frac{\text{\% nutritive substances in faeces}) \times 100}{\text{\% nutritive substances in feed}}$$

Statistical processing of obtained data was carried out using programme Stat.Soft, Inc. (2003). STATISTICA (data analysis software system), version 6, was used and standard mathematical – statistical methods applied which include variance analysis and evaluation of the significance of established differences with adequate test (Tuckey honest significant difference test).

Results and Discussion

Results presented in table 2 represent average digestibility coefficients of nutritive substances depending on the nutrition treatment.

Table 2. Digestibility of nutritive substances, %

Nutritive substances	Nutrition treatments		
	I	II	III
Total protein	52,58	51,30	55,12
Crude fat	76,13	77,98[*]	87,17[*]
Crude fibre	67,40	45,87[**]	22,39[***]
NEF	83,87	76,05[*]	82,96

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Digestibility of total proteins: Average digestibility coefficients of total proteins in lambs fed concentrate mixtures containing 43 : 51 : 58% NP were: 52,58% : 51,30% : 55,12%. In calculation of digestibility of these substances the endogenous protein fraction wasn't eliminated, so values obtained in this way represent illusory digestibility of total proteins which partially explains slightly lower values of protein digestibility coefficients. Established differences in protein digestibility between lambs on treatments I:II:III were within limits of random deviations (P>0,05). Comparing our results with results obtained by other authors, slightly lower values of protein digestibility coefficients are obvious. So, *Matras et al.* (2000), in their investigation of the digestibility of nutritive matters in lambs fed diet I based on ground barley and urea (high level of degradable protein in rumen) and diet II containing corn cracked and corn gluten meal (high level of non-degradable protein), established average coefficients of protein digestibility: 60,2% (I) and 63,5% (II). Also, *Dabiri and Thonney* (2001) established that degree of protein adoption in lambs fed soy bean and fish meal was: 75,3% and 74,2%. Difference between values of established protein digestibility coefficients in our research and literature data can be explained by the fact that the degree of absorption of material from nitrogen complex is affected by many factors: nature and structure of diet, level of protein solubility as well as ratio of protein and non-protein nitrogen in diet.

Fat digestibility: Analysis of obtained digestibility coefficients shows considerable effect of the level of non-degradable protein on the degree of fat absorption. The lowest digestibility of 76,13% was realized in lambs on treatment I and the highest (87,17%) on treatment III, whereas the fat digestibility on treatment II was 77,98%. Determined difference of 11,04 percent units between treatments I and III was statistically significant (P=0,01).Also, difference in fat digestibility between heads on treatments II and III of 9,19 percent units was statistically confirmed (P=0,02). So, with the increase of share of non-degradable proteins (43:51:58%) tendency of increase of fat digestibility was registered. Degree of fat adoption, as stated by *Pejić et al.* (1986), among other things, is caused by diameter of fat drops since only drops of certain size have sufficient energy to enter the digestion and resorption system. This is explained by Km/e which represents the micelle and emulsion stage particles and increases considerably with the reduction of the fatty acid chain.

Crude fibre digestibility: Average coefficients of crude fibre digestibility in lambs on treatments I:II:III were: 67,40%: 45,87% : 22,39%. Established

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difference in degree of crude fibre adoption/absorption of 21,53 percent units between lambs on treatments I and II was statistically very significant (P=0,006) as well as difference of 23,48 percent units between lambs on nutrition types II and III (P=0,004). At the same time, established difference in digestibility of 45,01 percent units between heads on treatments I and III was statistically highly significant (P=0,0003). It is known that growth of micro organisms and their activity depend on the amount of degradable protein and available energy. Since the level of degradable protein in our research decreased from treatment I to III, the decreasing trend of the degree of fibre digestion on analogue treatments is understandable. This was especially obvious in case of nutrition type III. In regard to the effect of energy, *Jovanović* (1972) established that increase of energy level had extremely negative trend in digestibility of crude fibre: 61,6% : 64,5% : 31,4%.

In research by *Negovanović et al.* (1983) carried out on Tsigai lambs fed diets of different energy value, similar tendency in regard to fibre digestibility was concluded: 56,0% : 50,8 : 38,49%. *Ružić* (1997) established that degree of fibre digestion in crosses PxW fed iso-protein diets of different energy values was: 57, 0% : 59,0% : 53,0%.

Also, type of nutrition with lower fibre content and higher content of light digestible carbon hydrates causes formation of greater amounts of propionic, buteric and lactic acid and decrease of pH value of rumen. Usual mechanism of pH buffering in rumen is insufficient in this case, so lower pH value inhibits the growth of cellulotic bacteria which as a consequence has depression in fibre digestion. Our results differ from those stated by *Ljumović et al.* (1967) who established that digestibility of crude fibre in lambs fed diets with different protein sources (alfalfa meal, sunflower meal in the amount of 20 and 40%) was : 48,29 : 42,50 : 37,06%.

Digestibility of nitrogen free extraction substances (NFE): Degree of adoption of NFE in lambs on nutrition treatments I:II:III was: 83,87% (I), 76,05% (II) and 82,96% (III), which indicated the presence of certain tendency of decrease of digestibility with the increase of share of NP in total proteins. Difference in NFE between lambs in groups II and I was statistically confirmed (P=0,01). In general, it can be concluded that obtained digestibility coefficients are high which is understandable if we consider that this type of nutritious substances is chemically very heterogeneous and characterized with high solubility in water and easy adoption by animal organism.

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Values of obtained results in our research are slightly lower than results obtained by *Ružić* (1997) who established that coefficients of NFE digestibility in trial with lambs fed diets with different energy content were: 88 : 87 : 86%, from the lowest to highest energy level. *Negovanović et al. (*1983) established that increase of energy level in diet was followed by decrease of the degree of NFE adoption since the following coefficients were obtained: 89,4% (I), 88,00% (II) and 86,20% (III).

Conclusion

Based on obtained results of the investigation of the effect of the level of non-degradable protein in diet on digestibility of nutritive substances in lambs in intensive fattening, the following can be concluded:

➢ Different levels of non-degradable protein (43:51:58%) had no significant effect on the level of adoption of total protein.

➢ With the increase of the share of non-degradable protein also tendency of increase of digestibility of fats was registered.

➢ Degree of fibre and NFE adoption had decreasing trend with the increase of the level of non-degradable protein.

UTICAJ NIVOA NERAZGRADIVOG PROTEINA NA SVARLJIVOST HRANLJIVIH MATERIJA KOD JAGNJADI U TOVU

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Rezime

Fiziološka istraživanja su obavljena na eksperimentalnoj farmi ovaca Instituta za stočarstvo Beograd-Zemun. Ogledom je bilo obuhvaćeno 18 muške jagnjadi meleza F_1 generacije : pirotska pramenka x virtemberg x Ile de France, prosečne telesne mase oko 35,0 kg, raspoređenih u tri grupe. Ishrambeni tretman je podrazumevao ispitivanje efekata različitih nivoa

nerazgradivog proteina u smešama koncentrata : 43 (I) : 51 (II) : 58% (III), na svarljivost hranljivih materija. Dobijeni podaci su obrađeni standardnom statističkom analizom.

Prosečni koeficijenti svarljivosti ukupnih proteina kod jagnjadi na tretmanima I:II:III su iznosili: 52,58% : 51,30% : 55,12%; masti: 76,13: 77,98: 87,17%; celuloze: 67,40 : 45,87: 22,39% i BEM-a: 83,87 : 76,05 : 82,96%.

Ova istraživanja su pokazala da su sa aspekta svarljivosti hranljivih materija, najpovoljnije rezultate ostvarila jagnjad na tretmanu sa 58% nerazgradivog proteina.

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