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Influence of Different Balance of Protein in the Rumen (BPR) on the Utilization of Dietary Nutrients by Cows and Rams

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Introduction:

BPR is a term which express protein needs of the ruminants. There is an opinion, that BPR gives great opportunity for better control of the rumen conditions for normal digestibility and maximum synthesis of microbial protein. It is necessary to make a test of the possibilities to regulate rumen conditions by nutrition.

Purpose

To verify is the Balance of Protein in the Rumen (BPR) correct indicator for optimal utilization of dietary nutrients and can we use it only without crude protein by composition of daily rations for ruminants.

Experimental Protocol

- Total 14 trials in two series (Physiological and Balance) with 4 fistulated cows and 4 rams were carried out.
- The protein levels (in % of DM) were:

  8, 10, 12, 14 (I series) and

  8, 12, 16 (II series).
- The BPR (in g) were between:

-54÷0 (cows) and 10÷30 (rams) (I series)

-190÷130(cows) and -19÷30 (rams) (II series)

Experimental Protocol 2

Nutrition:

- Meadow hay, sunflower meal, barley and mineral-vitamins mixture (I series)
- Corn silage, alfalfa hay, straw, conventional compound feeds (II series)

Experimental Protocol 3

Investigated parameters:

- Feeds chemical composition
- Rumen NH3-N levels (0,1,2,3,4h)
- BU-N levels (0,1, 4h)
- N balance and retention
- *Total in vivo* digestibility

Experimental Protocol 4

Methods:

- Analytical methods of feed used – in accordance with international standards (AOAC).
- NH3-N in the rumen (Conway)
- BU-N (Bernt & Bergmeyer)
- Standard statistical processing of the obtained results incl. correlation coefficients (BPR: all investigated traits)

RESULTS

Chemical composition of the dietary ingredients (in% DM)

Feedstuffs	DM, %	CP	EE	CF	Ash
Meadow hay	85,06	8,91	3,08	33,76	6,34
Alfalfa hay	79,68	16,40	2,40	31,30	8,15
Corn silage	21,38	9,70	2,69	28,35	8,94
Wheat straw	82,04	5,00	0,88	41,96	8,70
Sunflower meal	84,34	38,43	4,06	20,47	7,16
Corn	79,82	10,80	3,41	3,43	1,71
Barley	82,04	11,39	2,31	6,18	3,15
Wheat bran	80,40	17,86	4,39	10,44	5,55

RESULTS 2

Daily feed intake

Trials	DM,kg	CP, % in DM	BPR	NE, MJ/kg DM	ME, MJ/kg DM
I series, cows, 1	5,770	8,16	-54	5,31	9,77
2	5,600	10,11	-14	5,31	9,79
3	5,340	11,70	0	5,31	9,90
4	5,430	13,82	4	5,49	10,43
Rams, 1	0,940	8,04	10	5,07	9,76
2	0,923	10,55	18	5,01	9,77
3	0,928	12,30	25	5,25	10,05
4	0,911	14,22	29	5,55	10,54
II series, cows, 1	6,95	8,82	-189	4,35	7,6
2	6,25	12,86	-32	4,18	7,94
3	7,22	16,00	128	4,23	8,76
Rams, 1	0,582	8,99	-18,9	3,46	7,6
2	0,677	12,62	-3,2	3,82	8,10
3	0,704	16,45	12,8	4,12	8,57

RESULTS 3

NH3-N (mM) levels in the rumen of cows with different BPR

BPR / Item	0h	1h	2h	3h	4h
- 54	2,93	6,05	4,31	2,37	1,53
- 14	3,67	7,12	5,15	2,77	1,42
0	5,67	9,13	7,52	4,59	2,88
4	6,02	10,02	12,02	5,73	2,96
- 189	3,54	8,00	7,18	4,35	1,90
-32	3,77	9,48	10,55	8,49	5,52
128	3,99	11,60	13,24	12,24	11,68

RESULTS 4

BU-N (mM) levels in the rumen of cows and rams

BPR / Item	0h	1h	4h
- 54	2,27	2,28	1,69
- 14	2,06	2,70	2,69
0	2,21	2,10	2,39
4	2,10	2,88	2,85
10	2,47	2,47	2,38
18	2,95	3,86	2,97
25	4,71	4,77	5,17
29	4,83	5,95	5,42
- 189	2,76	2,72	2,58
-32	1,50	2,23	2,24
128	2,34	2,93	3,50
- 19	2,76	3,36	3,48
- 3	3,32	3,72	4,15
13	5,73	5,85	5,68

RESULTS 5

N balances (g/d) at rams with different BPR

BPR / Item	N intake	Urinary N	Retained N	Digested N
10	12,09	2,99	1,58	1,41
18	15,59	4,87	3,43	1,44
25	18,28	5,85	5,32	0,53
29	20,74	6,08	8,03	- 2,22
- 19	8,38	2,92	0,70	2,22
- 3	11,27	4,69	2,04	2,65
13	18,56	8,02	5,08	2,94

RESULTS 6

Total in vivo digestibility by rams

Trials		DM	OM	CP	CF
I series,	1	61,58	63,71	37,59	46,09
	2	65,44	67,20	53,27	50,89
	3	65,70	67,58	57,20	52,30
	4	72,10	74,38	69,30	58,60
II series,	1	49,57	52,74	43,16	47,03
	2	51,54	53,57	59,75	52,33
	3	58,40	61,29	70,69	52,92

Conclusions:

- The relationship between BPR and NH3-N in the rumen of both cows and wethers is positive with high level of significance.
- Higher BPR is certain sigh for higher BU-N in cows only 4 h after nutrition. It was found that BPR is more correct indicator for BU-N in wethers and their relationship is positive with high level of significance.
- The negative BPR led to stimulate in vivo digested N in the whole GIT. It was found negative correlation BPR:digested-N with middle level of significance (R=-0,66)

Thank You

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