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CONSIGLIO PER LA RICERCA E LA SPERIMENTAZIONE IN AGRICOLTURA

Effect of different levels of crude protein and methionine or methionine + lysine supplementation on performance of dairy cows

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INTRODUCTION

- The efficiency with which the dairy cow utilizes metabolizable protein (MP) for protein synthesis is assumed to indicate how well the essential AA (EAA) profile in MP meets the profile of EAA required by the animal as well as by the total amount of EAA in MP (NRC, 2001).
- Methionine (Met) and lysine (Lys) are the first two limiting aminoacids for lactating dairy cows fed corn-based diets.
- Research has indicated that milk protein content is sensitive to changes in the adequacy of Met in MP (NRC, 2001); therefore, increasing the concentration of Met in MP may lead to increased milk protein production.
- A further benefit of using Met escaping rumen degradation to improve the profile of EAA in MP is that the overall amount of RUP in the diet can be reduced (NRC, 2001).
- Reducing the amount of dietary N may result in an overall reduction in the amount of N excreted into the environment.

AIM

Aim of two trials was to evaluate the hypothesis that a low crude protein (14% CP) diet supplemented with the isopropyl ester of the 2-hydroxy-4-(methylthio)-butanoic acid (HMBi; MetaSmart™, Adisseo Inc., Antony, France) (**Trial 1**) or HMBi + rumen protected $_L$-Lys HCl (Relys®, Vetagro S.p.A., Reggio Emilia, Italy) (**Trial 2**) would support milk production as much as a high CP (16%) diet while reducing N excretion.

MATERIAL AND METHODS trial 1

GROUP	DIET	SUPPLEMENT
LCP	14% CP on dry matter (DM)	none
LCPM	14% CP on DM	22 g/d/cow of MetaSmart
HCP	16.5% CP on DM	none

Table1- Experimental design in trial 1

Table2-Ingredient and chemical composition of diets fed to cows in trial 1

ingredient	LCP	LCPM	HCP
alfalfa hay (kg/d)	5	5	5
corn silage	24	24	24
protein-mineral mix	11	11	11
HMBi MetaSmart		22 g/d	
PG (%DM)	14	14	16,5
RUP(%CP)	36,56	36,56	39,1
RDP(%CP)	63,44	63,44	60,8
NDF(%DM)	35,3	35,4	33,6
starch(%DM)	26,8	26,8	26,4
Enl (mCal/kg)	1,64	1,64	1,67
MP(g/d)	2317	2325,1	2535
MP-Lys (g/d)	154,5	154,5	166,5
MP-Met (g/d)	48,2	56,3	50,2
MP-Lys%MP/MP-Met%MP	3.2/1	2.7/1	3.2/1

20 Italian Friesian dairy cows (130±95 DIM) were used to compare three diets with different CP content and Met supplementation:

- 14% CP on dry matter (DM) without aminoacids supplementation (LCP);
- 14% CP on DM plus 22 g/d of MetaSmart (LCPM);
- 16.5% CP on dry matter without aminoacids supplementation (HCP).
- All diets were chosen in order to fulfil Lys and Met requirements, with a Lys:Met ratios in the diets that were respectively: 3.2:1; 2.7:1; 3.2:1.
- N excretion was estimated according to (Jonker et coll. '98) utilizing milk urea content, milk yield and milk protein content.

CONCLUSIONS

- Reduction of diet CP concentration does not cause in the short period a reduction of milk production and composition.
- Met and Lys supplementation improves milk quality, because of a higher milk protein concentration.

MATERIAL AND METHODS trial 2

GROUP	DIET	SUPPLEMENT
C	14% CP on dry matter (DM)	none
M	14% CP on dry matter (DM)	22 g/d/cow of MetaSmart
ML	14% CP on dry matter (DM)	22 g/d/cow of MetaSmart and 30 g/d/cow of RP Lys (ML)

Table3- Experimental design in trial 2

Table4-Ingredient and chemical composition of diets fed to cows in trial 2

ingredient	C	M	ML
alfalfa hay (kg/d)	5	5	5
corn silage	24	24	24
protein-mineral mix	11	11	11
HMBi MetaSmart		22 g/d	22 g/d
Relys			50 g/d
PG (%DM)	14	14	14
RUP(%CP)	36,56	36,56	36,56
RDP(%CP)	63,44	63,44	63,44
NDF(%DM)	35	35	35
starch(%DM)	25,5	25,5	25,5
ENl (mCal/kg)	1,64	1,64	1,64
MP(g/d)	2317	2326,2	2337,7
MP-Lys%MP	6,7	6,6	7,1
MP-Met%MP	2,1	2,5	2,4
MP-Lys%MP/MP-Met%MP	3.2/1	2.6/1	3/1

24 Italian Friesian dairy cows (125±56 DIM) were used to compare three diets with the same CP level (14% DM); treatments were:

- no supplementation;
- 22 g/d of MetaSmart;
- 22 g/d of MetaSmart and 30 g/d of RP Lys (Relys^R-Vetagro S.p.A., Reggio Emilia, Italy).

The Lys:Met ratio in the diets were respectively: 3.2:1; 2.6:1; 3:1.

RESULTS

	LCP	LCPM	HCP	SE
milk yield (kg/d)	27,8	29,8	30,3	1.8
fat (%)	3,3	3,3	2,9	0,35
protein (%)	3,48	3,41	3,38	0,06
lactose (%)	5	5,09	5,08	0.07
fat (g/d)	890	900	890	71
protein (g/d)	940	1000	1030	63
MUN (mg/dl)	23.8^a	24.3^a	29.5^b	1,45
Titratable acidity (°SH/100ml)	7.3^b	7.5^b	6.7^a	0,17
^{a,b} within row ,with different superscript are significantly different (P<0.05);				

Table5- Milk production and composition in trial 1

In Trial 1, no differences were found between treatments on milk yield, fat, protein, and lactose contents, and milk fat and protein yield, but milk urea N concentration was significantly lower in LPC and LPM. Estimated N excretion was reduced by 15% in LPC in comparison to LPM

Table6- N balance evaluation in trial 1

	LCP	LCPM	HCP	SE
N intake* (g/d)	456^a	470^a	519^b	16.5
Milk N *(g/d)	146	156	162	9,9
faecal N loss *(g/d)	174^a	175^a	187^b	2,8
urinary N loss *(g/d)	136^a	139^a	170^b	8.3
total N loss *(g/d)	309	314	357	
total N loss *(kg/year	112	114	130	
N excretion %	-15%			
^{a,b} within row ,with different superscript are significantly different (P<0.05				
*Jonker et al.1998				

Table7- Milk production and composition in trial 2

	C	M	ML	SE
milk yield (kg/d)	30	29,8	30,8	1.02
fat (%)	3,41	3,29	3,16	0.16
protein (%)	3.42^{cd}	3.32^c	3.46^d	0.06
lactose (%)	5,16	5,13	5,15	0.02
fat (g/d)	1005	1000	940	65
protein (g/d)	1019	986	1046	44
MUN (mg/dl)	28.9^b	28.9^b	25.5^a	0.81
Titratable acidity (°SH/100ml)	6,69	6,51	6,11	0.12
^{a,b} within row ,with different superscript are significantly different (P<0.05);				
^{c,d} within row ,with different superscript tend to differ (P=0.08)				

Table8- N balance evaluation in trial 2

	C	M	ML	SE
N intake (g/d)	512	506	494	11.3
Milk N (g/d)	162	157	166	7,8
faecal N loss (g/d)	184	183	181	1,94
urinary N loss (g/d)	166^b	166^b	147^a	4.7
total N loss (g/d)	350	349	328	
total N loss (kg/year)	128	127	119	
N excretion %			-8%	
^{a,b} within row ,with different superscript are significantly different (P<0.05				
*Jonker et al.1998				

In Trial 2, no differences were found about milk yield, fat and lactose contents, and milk fat and protein yield, while protein concentration was higher and milk urea N was lower in LCP+HMBi+Lys than the other two groups. In this Trial, estimate N excretion was reduced by 8% in LCP+HMBi+Lys in comparison to LCP and LCP+HMBi .