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Truly absorbed protein in the small intestine content of alfalfa hay harvested at various blooming

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Abstract

The present study was conducted to determine chemical composition and truly absorbed protein in the small intestine (DVE) content of alfalfa hay sampled during different stage of the plant maturation. Samples of alfalfa hay were taken at initial, half and full bloom stages, then dried at 65 ^{o}C 48 h, using air forced oven, then analyzed to determine crude protein, neutral detergent fiber and acid detergent fiber. Ruminal incubations for test feeds and laboratory techniques were performed according to protocol for in situ rumen incubations published by central veevoeder bureau standards. Dry matter content of the samples were increased with the plant maturation and varied from 260 (g/kg) at the initial bloom to 280 (g/kg) in the full bloom. The NDF and ADF content of alfalfa at the initial bloom, half bloom and in full bloom were 381 and 292; 432 and 308; 511 and 327 g/kg DM, respectively. However, crude protein was decrease with the stage of growth and the value for the initial, half and full bloom was 198, 192, and 190g/kg, respectively. The value of the DVE of the samples was decline with the stage of the blooming and were 162.9, 161.3 and 156.1 g/kg for initial, half and full bloom, respectively. The present results indicated that the stage of maturity might impact on the nutritional value of alfalfa hay by altering the chemical composition and especially the protein content evaluated as truly absorbed protein in the small intestine.

Keywords: DVE/OEB, alfalfa hay, growth stage
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Introduction

Attention to forage evaluation will be one of the most critical step to successful rearing. France et al. (2000) who noted “the description of a feed for its ability to sustain different types and levels of animal performance” as feed evaluation. Several investigators noted that changing in chemical composition of forage is affected by growth stage, forage species (Griffin et al., 1994), climate (Mathison et al., 1996), planting (Hintz & Albrecht, 1994), and growing conditions (Cox et al., 1994). The objectives of this study were to determine truly absorbed protein in the small intestine content of alfalfa hay harvested at various blooming and the newly developed Dutch protein evaluation system: the DVE/OEB model (Tamminga et al., 1994) were employed.

Material and Methods

Alfalfa hays were cut and assigned to one of three stage of maturity including 1) initial blooming 2) half blooming and 3) full blooming. The DM, ash, EE and crude protein were determined. Netural detergent fiber (NDF) and acid detergent fiber (ADF) values were analyzed according to the procedures of Van Soest et al. (1991). The DVE value is calculated as follows: DVE = DVBE + DVME – DVMFE, where DVME is the microbial protein synthesized in the rumen and digested in the intestine, DVBE is the feed protein not degraded in the rumen but digested in small intestine, and DVMFE is the endogenous protein losses associated with digestion. Data were analyzed as a complete randomized design by MIXED procedures of SAS.

Results and Discussion

Chemical compositions

The effects of growth stage of alfalfa hay on chemical composition are presented in Table 1.

Table 1.chemical composition.

Item	DM	CP	NDF	ADF	Ash
			g/kg DM		
Initial bloom	260[b]	198.20[a]	381[c]	292[c]	103.80[a]
Half bloom	280[a]	192.60[a]	432[b]	308[b]	92.80[b]
Full bloom	280[a]	189.80[a]	511[a]	327.3[a]	91.20[b]
SEM	1.15	4.2	3.5	3.7	1.4

a, b and c indicate significance among treatments ($P < 0.05$).

Dry matter content increased with plant maturation ($P<0.05$) and was varied from 260 (g/kg) at the initial bloom to 280 (g/kg) in the full bloom. Both NDF and ADF contents were affected by advancement of age. Orloff and Putnam (1998) reported by delaying each day in harvesting of second cut of alfalfa, ADF and NDF increased approximately 0.4 and 0.37 percent. No maturation effect on crude protein content was observed ($P>0.05$). The lack of a significant effect of advancing maturity on crude protein content in this study may be related to alfalfa species or growing conditions. As alfalfa maturity advanced ash content declined ($P<0.05$) and decreased from 103.80 in initial blooming to 91.20 g/kg DM in full blooming.

Truly absorbed protein and degraded protein balance (DVE/OEB)

Throughout the course of the maturity, there were significant differences among truly absorbed protein in the intestine by advancement of age (Table 2). The DVE value markedly reduced during different stages of growth ($P<0.05$). The OEB that is conclude the imbalance between microbial protein synthesis from available rumen degradable CP and potential energy from anaerobic fermentation in the rumen. The optimum OEB value in a dairy ration is zero or slightly above (Tamminga et al., 1994). The OEB content reduced by advancement of age and was lowest in full blooming (-17.14). When OEB is negative, inclusion of addition fermentable OM such as

degradable starch may improve microbial protein. Stage of maturity might impact on the nutritional value of alfalfa hay by altering the chemical composition.

Table 2. Prediction of truly digested and absorbed rumen synthesized microbial (MCP) and undergraded feed protein (RUP) in the small intestine according to the new Dutch DVE/OEB.

Items	Truly digested and absorbed MCP					Truly digested and absorbed MCP			
	FOM	MCP^{DVE}_{RDP}	MCP_{FOM}	DVME	DVMFE	TPSI	DVBE	DVE	OEB
					g/kg DM				
Initial bloom	517.53[a]	69.25[a]	77.63[a]	55.15[a]	2.72[a]	174.36[a]	116.14[a]	168.56[a]	-8.38[a]
Half bloom	564.88[a]	70.30[a]	84.73[a]	54.02[a]	2.44[a]	173.27[a]	108.77[a]	161.16[ab]	-14.30[a]
Full bloom	584.75[a]	79.10[a]	87.71[a]	52.92[a]	2.39[a]	167.83[a]	105.58[a]	156.14[b]	-17.41[a]
SEM	41.37	5.13	6.20	1.42	0.038	4.76	2.82	2	6.92

FOM: organic matter fermented in the rumen, MCP^{DVE}_{RDP}: microbial protein synthesized in the rumen based on rumen degraded feed crude protein, MCP_{FOM}: microbial protein synthesized in the rumen based on available energy, DVME: Rumen synthesized microbial protein digested in the small intestine, DVMFE: endogenous protein losses in the digestive tract, TPSI: true protein supplied to the small intestine, DVBE: Digestion in small intestine of the undergraded feed protein, DVE: truly absorbed protein in the small intestine, OEB: reflects the difference between the potential microbial protein syntheses based on rumen degraded feed CP and that based on energy (rumen fermented OM) available, for microbial fermentation in the rumen

Conclusion

The present results indicated that the stage of maturity might impact on the nutritional value of alfalfa hay by altering the chemical composition and especially the protein content evaluated as truly absorbed protein in the small intestine.

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