KUALITAS FERMENTASI SILAGE JERAMI YANG MENDAPAT PERLAKUAN PENAMBAHAN ENZIM SELULASE DAN DAYA CERNANYA PADA TERNAK DOMBA

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INTISARI

Tiga jenis silase telah dibuat dari bahan jerami barley dengan perlakuan penambahan enzim selulase atau glukosa yang diinkubasikan kedalam silo berkapasitas 150 kg. Jenis perlakuan silage adalah kontrol (UT), penambahan glukosa (GL) serta penambahan selulase dan glukosa (CLG). Semua silase disimpan selama 2 bulan. Masing-masing silase kemudian diuji-cobakan pada 3 ekor domba dewasa. Sebagai sumber protein pada uji coba pakan ditambahkan ampas bir dengan perbandingan 60 % silase dan 40 % ampas bir (% BK). Hasil analisis menunjukkan bahwa semua silase berkualitas baik dengan rendahnya pH dan tingginya kandungan asam laktat. Kandungan NDF dan ADF silase CLG terlihat lebih rendah dibanding dengan UT. Daya cerna BK dan BO silase CLG lebih rendah dibanding silase GL akan tetapi tidak berbeda dibanding dengan silage UT. TDN silase yang mendapat tambahan ampas bir kering adalah masing-masing 53.6, 52.2 dan 57.7 % untuk UT, CLG dan GL silase.

(Kata kunci: Kualitas, Silase jerami, Cellulase, Sheep)

FERMENTATION QUALITY OF STRAW SILAGE TREATED WITH CELLULASE AND IT'S DIGESTIBILITY IN SHEEP

ABSTRACT

Three silages made from barley straw ensiled into 150 kg capacities silos with and without additive application. The treatments were control untreated (UT), glucose (GL) and cellulase+glucose (CLG). All samples were ensiled then opened after two months storage period. Each silage was fed to three mature wether sheep supplemented with dry brewer' grain (60 % silage : 40 % brewer' grain, DM bases). All silages were well preserved in term of low pH values and high lactic acid concentration. NDF and ADF contents of CLG silage were lower than those of UT silage. Apparent digestibility for DM and OM of CLG silage were lower that those of GL silage and were similar with those UT silage. The TDN of silages supplemented with brewer's grains was 53.6, 57.7 and 52.2 respectively for UT, GL and CLG silages.

(Keywords: Quality, Straw silage, Cellulase, Sheep)

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Introduction

Cellulase addition was capable to breakdown cell wall component, both in grass and in straw silages (Jaakkola, 1990, Jacob and McAllan, 1991, Ridla and Uchida, 1993). However, the reducing fiber component due to cellulase addition was not followed by the improving silage digestibility. Van Vuuren et al. (1989) observed that enzyme additive produced the carbohydrate fraction more readily available (RAC) in the rumen fermentation. In turn, it could give a potential for improving the digestion in the rumen by providing energy and protein balance. Degradation of cell wall component by cellulase action in this experiment is expected to provide more RAC, on the other hand, brewers grain may supply ready available N, which could give advantages for microbial growth and digestion in the rumen. Jacobs and McAllan (1992) noticed that DM and OM digestibility in the enzyme-treated silage were increased by protein supplementation of either rapeseed or fishmeal. The present experiment was designed to evaluate the use of brewer's grain as protein supplement on digestibility of barley straw silage treated with cellulase.

Materials and Methods

Silage production

The barley straw materials after being chopped into about 1.3 cm length were lacerated until nearly smash. Samples were ensiled into silos with capacities 150 kg, with or without additive. The treatments were untreated (UT), treated with with 1% glucose (GL) or 0.1 % cellulase + 1 % glucose (CLG) in fresh matter bases. After months of storage the silages were fed to animals and analyzed.

Chemical analysis

Procedures for sampling and chemical analysis of all samples were the same as those described by Ridla and Uchida (1993). In summary, dry matter content of straw and silages was determined by vacuum freeze-dryer. Organic matter, crude protein, crude fiber and crude fat were measured by AOAC method (1992). Cellulose, hemicellulose, NDF, ADF and lignin determined by Goering and Van Soest method (1970). WSC was evaluated by the method of Deriaz (1961) and organic acids and ethanol were determined by gas chromatography (GC-14A, Shimazu).

Results and Discussion

The chemical composition of barley straw and brewers grain materials used in this experiment is shown in table 1 and the fermentation quality and chemical composition of silages are shown in table 2.

Silage composition

All silages were well preserved as indicated by low pH values and high lactic acid content. The lactic acid content of the CLG silage was higher than that of UT silage, but lower than that of GL silage. The fermentation quality of treated silages was better than that of untreated silage. This data

Table 1. Chemical Composition of Barley Straw and Brewer's Grain Materials

	Barley straw	Brewer's grain
Dry matter (%)	36.91	90.04
Organic matter (% DM)	92.37	96.45
Crude protein (% DM)	2.85	31.51
Crude fiber (% DM)	42.14	12.88
NDF (% DM)	72.96	65.03
ADF (% DM)	49.09	22.09
Hemi cellulose (% DM)	23.09	41.93
Cellulose (% DM)	40.15	16.05
Water soluble carbohydrate (% DM)	3.31	5.85

Table 2. Fermentation Quality and Chemical Composition of Produced Silages

	Silages		
	UT	CLG	GL
Dry matter (%)	36.09	36.53	37.09
pH	3.91	3.82	3.66
Lactic acid (% DM)	2.16	2.44	2.62
Acetic acid (% DM)	0.32	0.40	0.25
Butyric acid (% DM)	0.07	0.06	0.04
Valeric acid (% DM)	0.18	0.33	0.22
Ethanol	0.14	0.28	0.20
Organic matter (% DM)	91.65	91.95	91.91
Crude protein (% DM)	2.55	2.59	2.69
Crude fiber (% DM)	43.50	42.23	43.09
NDF (% DM)	80.00	74.74	75.09
ADF (% DM)	52.33	48.96	50.80
Hemi cellulose (% DM)	27.67	25.78	24.29
Cellulose (% DM)	42.01	40.26	40.66
Water soluble carbohydrate (% DM)	2.59	2.83	2.63

might indicate that both cellulase and glucose addition provided more fermentable substrate for silage fermentation. Concentration of both NDF and ADF were lower in CLG silage than those in UT and in GL silages. The hemi cellulose and cellulose content in CLG silage were lower than those in UT silage, but were similar compared with GL silage. The decrease in cell wall components of CLG silage might indicate that the cellulase was capable in breaking down of fibrous materials.

Silage digestibility

Apparent digestibility, digestible crude protein (DCP) and TDN of silages are presented in table 3. There were no differences between CLG and UT silages in apparent digestibility of dry matter (DM) and organic matter (OM). However, apparent digestibility DM and OM of the CLG silage were significantly lower ($P<.0.01$) than those of the GL silage. Compared with UT and GL silages, apparent digestibility NDF, ADF, cellulose and hemi cellulose of CLG were low ($P<0.01$). It might indicate that the most digestible material was loss during ensilage due to

Table 3. Apparent Digestibility Values, Total Digestible Nutrient (TDN) and Digestible Crude Protein (DCP) of the Diets

	Diets		
	UT	CLG	GL
Dry matter (%)	45.4 ± 2.4[a]	45.3 ± 1.0[a]	52.6 ± 0.5[b]
Organic matter (%)	48.9 ± 1.7[a]	48.2 ± 1.2[a]	54.5 ± 0.3[b]
Crude protein (%)	71.9 ± 0.8[a]	70.1 ± 0.5[a]	72.4 ± 1.5[a]
Crude fiber (%)	42.8 ± 1.7[a]	39.1 ± 1.4[a]	49.0 ± 1.7[b]
NDF (%)	48.8 ± 1.6[a]	45.6 ± 1.2[b]	52.3 ± 0.6[c]
ADF (%)	38.6 ± 1.8[a]	34.0 ± 1.4[b]	42.2 ± 1.2[b]
Hemi cellulose (%)	63.3 ± 1.8[a]	58.6 ± 1.1[b]	64.6 ± 0.4
Cellulose (%)	47.7 ± 1.9[a]	43.9 ± 1.4[b]	50.5 ± 0.6[b]
TDN (%)	53.6 ± 1.5[a]	52.2 ± 1.2[b]	57.7 ± 0.4[b]
DCP (%)	10.4 ± 0.3[a]	10.0 ± 0.2[b]	10.3 ± 0.6[a]

cellulase addition and left a less digestible material (Jacoba and McAllan, 1991). The effect of cellulase addition on silage digestibility was inconsistent since many researcher reported many different results. Lower digestibility DM and OM of cellulase treated silages than those of untreated or formic acid treated silages were reported by Jaakkola and Huhatanen (1990). In addition, the absence of digestibility differences between cellulase treated and untreated silages were also reported either in sheep (Jaakkola, 1990) or in cattle (Jacobs and Mc Allan, 1992a). There no significantly differences in apparent digestibility crude protein (CP) and DCP among silages. This result might reflect that the characteristic of brewers grain supplement as protein source. The positive effect was noticed with rapeseed meal as protein supplement to enzyme-treated silage resulted in greater microbial protein synthesis (Jacobs and McAllan, 1992b). The TDN silages supplemented with brewer's grains were 53.6, 52.2 and 57.7 respectively for UT, CLG and GL silages.

Conclussion

The present experiment showed that the addition of cellulase capable of hydrolyzing cell wall components and produced a good fermentation. Supplemen-tation with brewers grain as protein source to barley straw cellulase-treated silage produced a similar DM and OM digestibility with untreated silage and was lower than that of glucose treated silage. Compared with UT and GL silages, apparent digestibility NDF, ADF, cellulose and hemi.

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