

The Effect of Different Rice Straw and Concentrate Content of The Ration on Hemicellulase Activity in The Rumen Fluid of Carabao, Cattle, Goat and Sheep

Z. Bachrudin, L.M. Yusiati, R. Utomo, W. Asmara and E.W. Cahyono

Faculty of Animal Husbandry, GMU, Yogyakarta

ABSTRACT: This study was conducted to analyze the enzyme activity of Hemicellulase in the rumen fluid of the ruminants. Various ruminants were used in this study is carabao, cattle, goat and sheep. The kinds of rations as treatment for this study were ration I of 25% concentrate and 75% rice straw, and ration II of 100% rice straw. The result of this study showed that the hemicellulase activity of the rumen fluid of carabao (1.29 $\mu\text{g xylosa/mg}$

protein/60') was higher than other ruminants. It was also being showed that the hemicellulase activity of the rumen fluid which were treated by the ration containing 100% rice straw were 2.23, 0.21, 0.23 and 0.24 ($\mu\text{g xylosa/mg protein/60'}$) for carabao, cattle, goat and sheep respectively. The conclusion of this study was that the carabao have more tolerant to rice straw crude fiber as treatment than other ruminants.

Key Words: Hemicellulase, Ruminants, Rumen Fluid, Rice Straw.

Introduction

One of the factors that influence the abilities of ruminant to degrade lignocellulosic material is the quality of rumen microorganism, including their enzyme activities. Usually carabaos possess the ability to survive more than the other ruminants although they receive poor quality ration. It may be suggested that microorganism in rumen fluid of carabaos have higher qualities than those in other ruminants.

Asian buffalo has a reputation for utilizing fibrous forage more efficiently than tropical cattle (Chalmers, 1974; Van Soest, 1982; Devendra, 1983 cited by Kennedy et al, 1992)

Ichpopani, et al, (1962) stated that the ability of Murah Carabao to degrade cellulose were higher than Indian Cattle. They also reported that carabaos rumen fluid activities were higher than Haryana Cattles', which were shown by cellulose digestibility and free fatty acid being produced.

Nutrient content of Napier grass could be digested 2-5% faster by carabaos than by cattle (Escano, et al, 1983), and according to Lopez et al, (1983) nutrient *In vitro* digestibility using carabaos rumen fluid were higher than using rumen fluid from other ruminants.

This experiment was conducted to assess the hemicellulase activity of microorganism in carabaos

rumen fluids. Comparison would be made with hemicellulase activities from sheep, goat and cattle. It was expected that microorganism in carabaos rumen fluids have hemicellulase activity higher than those in other ruminants, especially under poor feeding.

Experimental Procedures

General. This study employed various ruminants including cattle, carabaos, goats and sheeps. Rice straw of the same variety was used in this study, it came from areas around Yogyakarta.

The ruminants being used in this study received two types of rations. The first ration containing 25% concentrate and 75% rice straw (R1) while the second rations containing 0% concentrate and 100% rice straw (R2). Cross over design were used in this experiment with four kinds of animals and two types of rations. Feeding trials took one month period for each type of ration.

At the end of the feeding trial, rumen fluid were taken from each experiment animals for hemicellulase activity analyses as well as the amount of microorganism content either for bacteria or fungi. Sample were taken approximately 4-5 hours after moving feeding.

Enzyme analysis. Hemicellulose was used as the substrat with rumen fluids as the enzyme soon as. The hemicellulase activities were estimated by measuring reducing sugar released from the substrat (Williams and Withers, 1985)

Total Microorganism. Total colonies of hemicellulolytic rumen microorganism (bacteria and fungi) were determined by Hungate roll tube methode, that have been modified by Bachrudin (1985), Habson and Mann (1971), Teunissen et al

(1991). Nitrogen gas were flowed down to get the anaerobic condition.

Result and Discussion

Hemicellulase activities of the various rumen fluids are showed in Table 1 and Figure 1. Rumen fluids which were taken from carabaos have the highest hemicellulase activities, followed by those from sheep, goat and cattle. Hemicellulase activity of carabaos rumen fluids is about 4-6 time greater than those of other ruminants.

Table 1. Hemicellulase activity of rumen fluid having rice straw as basal ration (µg xylosa/mg protein/45')

Species	Feed		Mean
	75% Rice straw 25% Concentrate	100% Rice straw 0% Concentrate	
Carabao	0,34	2,23	1,29 ^a
Cattle	0,21	0,21	0,21 ^c
Goat	0,38	0,23	0,30 ^b
Sheep	0,46	0,24	0,35 ^b
	0,35 ^e	0,73 ^d	

^{abc} values within columns with different superscript are significantly different at P<0.01
^{de} values within rows with different superscript are significantly different at P<0.01

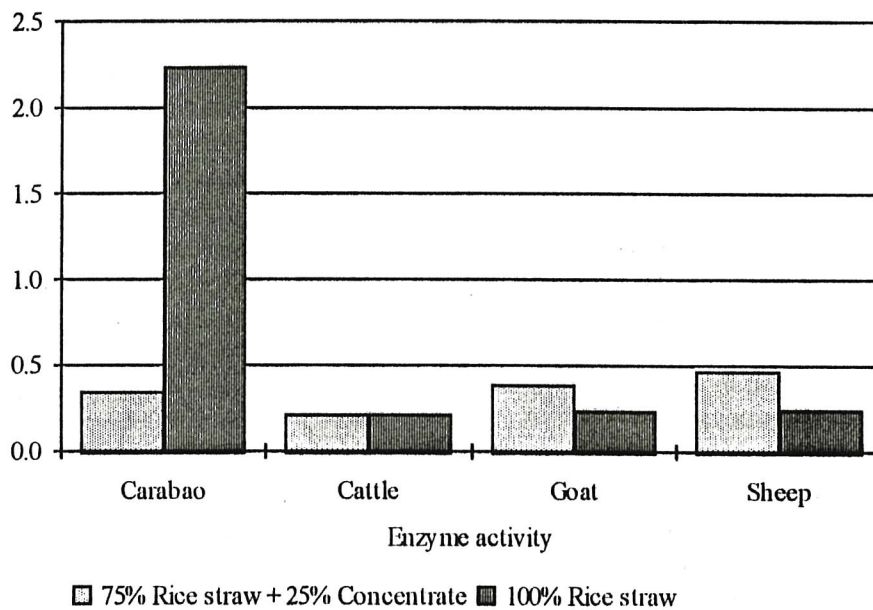


Figure 1. Hemiselulase activity of rumen fluid having rice straw as basal ration

Reducing concentrate feed from animals feeding will increase hemicellulase activity of microorganism in carabaos rumen fluids, although there was decreasing numbers of the total hemicellulolytic bacteria colonies lived in the

carabaos rumen fluids (Table 2 and Figure 2). It seemed that increasing straw lead to the m\increase of hemicellulase. The quality of hemicellulase being produced by rumen bacteria.

Table 2. Total colonies of hemicellulolytic rumen fluid bacteria of various ruminant under rice straw feeding (CFU/ml)

Species	Feed		Mean
	75% Rice straw 25% Concentrate	100% Rice straw 0% Concentrate	
Carabao	50.7x10 ⁵ A	39.7x10 ⁵ B	45.2x10 ⁵ a
Cattle	26.0x10 ⁵ C	15.3x10 ⁵ D	20.7x10 ⁵ c
Goat	11.3x10 ⁵ D	50.0x10 ⁵ A	30.7x10 ⁵ b
Sheep	6.0x10 ⁵ E	12.3x10 ⁵ D	9.5x10 ⁵ d
	23.7x10 ⁵ b	29.3x10 ⁵ e	

abcd values within columns with different superscript are significantly different at P<0.01

ef values within rows with different superscript are significantly different at P<0.01

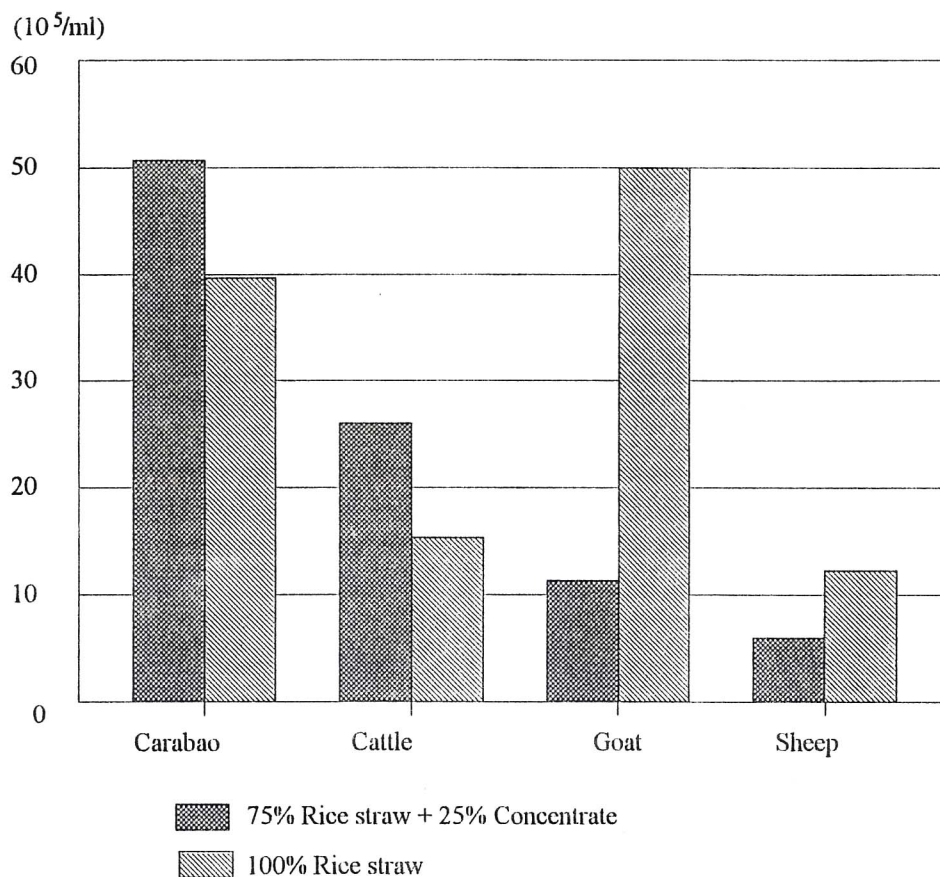


Figure 2. Total colonies of hemicellulolytic rumen fluid bacteria of various ruminant under rice straw feeding

It was also suggested that the increasing hemicellulase activities caused by the increase of hemicellulolytic fungi (Table 3 and Figure 3).

hemicellulolytic activity of microorganism in rumen of cattle, sheep and goat were non considerably different.

Although there was inconsistency of the total hemicellulolytic bacteria and fungi being cultivated,

Table 3. Total colonies of hemicellulolytic rumen fluid fungi of various ruminant under rice straw feeding (per ml)

Species	Feed		Mean
	75% Rice straw 25% Concentrate	100% Rice straw 0% Concentrate	
Carabao	27.7x10 ² B	39.7x10 ² A	33.7x10 ² a
Cattle	17.2x10 ² C	16.3x10 ² CD	17.2x10 ² b
Goat	3.0x10 ² E	1.0x10 ² F	2.0x10 ² d
Sheep	1.7x10 ² E	8.7x10 ² DE	5.2x10 ² c
	12.6x10 ² b	16.4x10 ² a	

abcd values within columns with different superscript are significantly different at P<0.01

ab values within rows with different superscript are significantly different at P<0.05

ABCD values within columns with different superscript are significantly different at P<0.05

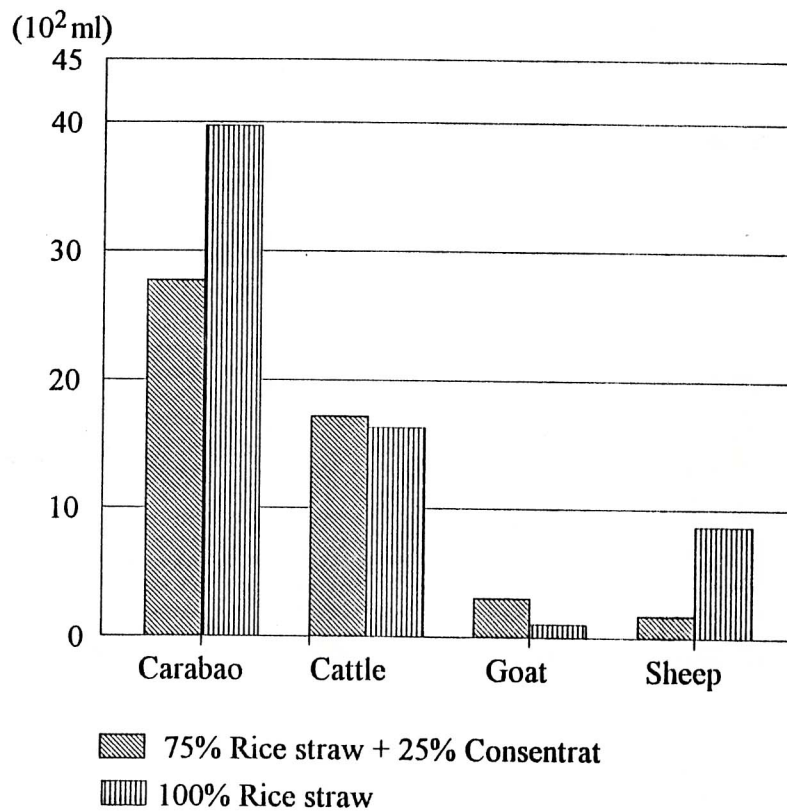


Figure 3. Total colonies of hemicellulolytic rumen fluid fungi of various ruminant under rice straw feeding (CFU/ml)

Conclusion

The result of this experiment indicated that carabaos were more tolerant to rice straw because their rumen microorganism were capable of producing more hemicellulose of higher activities, even in poor feeding condition. Cellulase activity and carabaos performances should be determined to obtain final conclusion with better scientific explanation.

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