



## The Feed ADF and NDF Digestibility of Goat Fed Four Difference Diets

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### ABSTRACT

Goats generally have the ability to utilize carbohydrate sources from forages in the form of cellulose, hemicellulose, and pectin obtained from plant cell walls. Generally, forage contains relatively high crude fiber content which can be indicated by the contents of neutral detergent fiber (NDF) and acid detergent fiber (ADF) of the forage. The aim of this study was to examine the level of the feed consumption and digestibility of NDF and ADF of 4 different local forages fed to goats. This study was designed based on the Latin Square Design which consisted of 4 dietary treatments with 4 replications in each dietary treatment. A total of 4 male goats, with relatively the same weight and age, were randomly assigned to an individual metabolic cage fed with 4 diets including Elephant grass (R1), Mini elephant (ME) grass (R2), *Panicum maximum* (PM) grass (R3) and *Brachiaria decumbens* (BD) grass (R4). Each diet added 20% of rice bran. The results indicated that a diet containing Mini elephant grass had relatively higher digestibility of ADF and NDF compared to that of the other 3 diets. In contrast, a diet containing *Panicum maximum* grass had lower ADF and NDF digestibility than other diets. In conclusion, adding rice bran to the diet based on Mini elephant grass, Elephant grass, and BD grass resulted in higher ADF and NDF consumption and digestibility compared with a diet based on PM grass.

Keywords: Digestibility, NDF, ADF, local grasses, goat.

### INTRODUCTION

Roughage contains cellulose and hemicelluloses which potential as source of carbohydrate in the diet of goat. Goats have ability to utilize cell wall of the roughage which contains the cellulose and hemicelluloses [1]. Production of goat depends on the quality of the diet consumed by goat. The diet of goat usually consists of about 80% roughage as basal diet and 20% concentrate. In Indonesia, goat commonly fed roughages known as Elephant grass,

Mini elephant grass, *Panicum maximum* (PM), and *Brachiaria decumbens* (BD). These four grasses contain relatively high acid detergent fiber (ADF) and neutral detergent fiber (NDF). The high fiber content of the grasses will be degraded and fermented by rumen microbes in the rumen of goat [2]. Elephant grass contains 13% crude protein (CP) with about 60% digestibility [3]; [4]; [5]; [6]. Mini elephant grass contains CP around 12% [7]; [8], whereas *Panicum maximum* contains 6% CP [9]; [10] ), and *Brachiaria decumbens* contains 9% CP with about 70% digestibility [11]; [12]. Concentration of ADF of those Elephant grass, Mini elephant grass, *Panicum maximum*, and *Brachiaria decumbens* were 38%, 34%, 40% and 44%, respectively. Whereas NDF content of those Elephant grass, Mini elephant grass, *Panicum maximum*, and *Brachiaria decumbens* were 70%, 54%, 63% and 64%, respectively [8];[13]; [14].

It is known that the high the content of ADF and NDF is good as feed for ruminant; however it should be noted that high fiber in the dietary decrease the digestibility of the diet. Cell wall of the grasses usually contains not only cellulose and hemicelluloses but also lignin which is resistant to microbial fermentation in the rumen [15]. Therefore, it is important to continuously examine the level of degradability and fermentability of those 4 local grasses in order to maximize their utilization as feed for goat.

## MATERIALS AND METHODS

Latin square experimental design (4x4) [16] was employed to examine the level of feed ADF and NDF digestibility of 4 local grasses namely Elephant grass, Mini elephant grass, *Panicum maximum*, and *Brachiaria decumbens*. These 4 grasses were harvested in relatively the same age of 70 days old. These four grasses were planted in the same area and there was no fertilizer applied to those four grasses. In Indonesia those of four grasses are well known to be fed to ruminant including goat, cattle, and buffalo. Four male goats were allocated in individual metabolism crate fed with 4 treatment diets with 4 replications in each treatment. The level of feed ADF/NDF consumption and feed digestibility was then measured using total collection method in 4 observation periods. The ADF and NDF contents of the grass were analyzed using method of [17]. Goats were fed with mixed diet 80% grass and 20% rice bran (on the dry matter basis). Four diets offered were:

- R1: 80% Elephant grass+20% Rice bran.
- R2: 80% Mini elephant grass+20% Rice bran.
- R3: 80% *Panicum maximum*+20% Rice bran.
- R4: 80% *Brachiaria decumbens*+20% Rice bran.

Table 1. Allocation of Goat and Diets in 4 Period of Observation

Period	Goat			
	A	B	C	D
I	R1	R2	R3	R4
II	R3	R4	R2	R1
III	R2	R1	R4	R3
IV	R4	R3	R1	R2

Note: A, B, C, and D is the names of goat.

Parameters studied were ADF and NDF digestibility of four grasses by goat. The ADF and NDF digestibility were measured using method of total collection. The results of chemical analysis of four grasses studied were presented in Table 2 in result section. Data of ADF and NDF digestibility were organize according to Latin Square design then analyzed using statistical analysis of variance (Anova) followed by Duncan's test to examine the differences between the treatment diet [18].

## RESULTS AND DISCUSSIONS

Nutrient content of grasses studied was analyzed using a proximate method and the results of the analyzes are shown in Table 2.

Table 2. Nutrient Content of Grasses Studied

Nutrients	Grasses			
	Elephant grass	Mini elephant grass	<i>Panicum maximum</i> grass	<i>Brachiaria decumbens</i> grass
Dry matter (%)	28.02	26.29	23.63	33.04
Organic matter (%)	83.23	82.82	88.41	90.81
Crude protein (%)	14.79	12.13	11.19	15.31
Crude fiber (%)	31.84	27.44	33.42	31.02
Crude fat (%)	3.95	6.00	5.75	4.65
Ash (%)	16.77	17.18	11.59	9.19
Nitrogen free extract (%)	32.65	37.25	33.50	39.83
NDF (%)	66.22	62.71	68.14	68.24
ADF (%)	41.23	36.90	42.24	39.70
Cellulose (%)	36.17	32.80	35.36	35.36
Hemicellulose (%)	24.99	25.81	25.90	28.54
Lignin (%)	2.08	2.05	3.30	2.66

As shown in Table 2, the nutrient contents of all grasses studied are almost similar between one and another. The dry matter (DM) content ranged from 26% for Mini elephant grass to 33% for *Brachiaria decumbens* (BD). Crude protein content was little bit varied from 11% for *Panicum maximum* to 15% for BD. Crude fiber content was almost similar ranging from 27% for Mini elephant grass to 33% for *Panicum maximum*. Similarly for other nutrient content such as organic matter (OM), fat, ash, NDF, ADF, cellulose, hemicelluloses, lignin, and Nitrogen free extract (NFE) varied only about 3%. The results of this proximate analysis of all grasses studied were within the range of nutrient values of previous studies [6]; [11]; [19]; [20]; [21]; [22]; [23].

An experiment *in vivo* was conducted to examine the level of feed ADF/NDF consumption and digestibility of the diet treatment. The result of the *in vivo* experiment is shown in Table 3.

Table 3 indicates that there was significantly difference ( $p < 0.05$ ) in the level of feed NDF consumption, but there was no significantly difference ( $p > 0.05$ ) in the level of feed ADF consumption between 4 diets studied. The feed NDF consumption of Mini elephant grass was 340g/head/d than that of 3 other dietary treatments, whereas the feed NDF consumption of *Panicum maximum* was lower compared to that of BD grass, elephant grass, and Mini elephant grass. This might be due to the protein content (11%) of *Panicum maximum*, which was tended to be lower than 3 other grasses. Whereas the crude fiber, ADF and NDF contents of *Panicum maximum* were tended to be higher than 3 other grasses. The result of this trial was suggested that the diet containing Mini elephant grass added with rice bran tended to be higher in the level of feed ADF and NDF intake compared to that of 3 other dietary treatments. This might be caused by nutrient content such as dry matter, crude protein, organic matter content, and also feed palatability of Mini elephant grass which tended to be higher than that of *Panicum maximum* grass [24]; [25]; [26]; [27]. As matter of the fact that goats take longer time to consume *Panicum maximum* grass and left more feed residue compare to 3 other dietary treatments.

Table 3. The ADF/NDF Intake and Digestibility of Four Diets by Goats

Parameter	Diets Treatment			
	R1	R2	R3	R4
NDF intake (gr/head/d)	316.2 ± 33.5 <sup>b</sup>	340.5±7.5 <sup>b</sup>	253.9±35.1 <sup>a</sup>	327.9±24.7 <sup>b</sup>
ADF intake (gr/head/d)	196.8±20.8	200.3±4.4	157.4±21.7	190.7±14.3
NDF digestibility (%)	54.3±4.6 <sup>b</sup>	60.6±1.0 <sup>c</sup>	44.5±8.2 <sup>a</sup>	66.4±8.2 <sup>c</sup>
ADF digestibility (%)	34.5±7.7 <sup>a</sup>	47.7±5.4 <sup>b</sup>	27.5±7.8 <sup>a</sup>	48.9±12.7 <sup>b</sup>

Note: Different superscripts in the same row are significantly difference ( $p < 0.05$ ).

R1: 80% Elephant grass+20% Rice bran.

R2: 80% Mini elephant grass+20% Rice bran.

R3: 80% *Panicum maximum*+20% Rice bran.

R4: 80% *Brachiaria decumbens*+20% Rice bran.

Table 3 indicates that the levels of feed NDF/ADF digestibility of diet containing *Brachiaria decumbens* grass added with rice bran were significantly higher ( $p < 0.05$ ) than that of Elephant grass, Mini elephant grass, and *Panicum maximum* grass. In contrast, the feed NDF/ADF digestibility of diet containing *Panicum maximum* grass added with rice bran were significantly lower than those of other 3 diets. The feed NDF digestibility of the diet containing *Brachiaria decumbens* grass, Mini elephant grass, Elephant grass, and *Panicum maximum* grass were 66%, 60%, 54%, and 44%, respectively. This digestibility of *in vivo* trial (Table 3) suggested that adding rice bran to those grasses studied resulted in BD grass was the best value in the level of feed ADF/NDF digestibility followed by Mini elephant grass, Elephant grass and *Panicum maximum*. *Panicum maximum* was being the lowest digestibility value. This feed digestibility values tended to be in line with the values of the feed intakes as well as the nutrient values of each grass studied as described by several previous studies [25]; [28]; [29]; [30]; [31]; [32]; [33].

## CONCLUSIONS

It is concluded that adding rice bran (20%) in the diet containing Elephant grass, Mini elephant grass, *Panicum maximum* grass, and *Brachiaria decumbens* grass increased the values of the feed NDF/ADF intakes and digestibility. Adding rice bran to the diet containing *Brachiaria decumbens* resulted in the highest values of feed ADF/NDF digestibility compared to that of Elephant grass, Mini elephant grass, and the *Panicum maximum* grass. In contrast, the feed NDF/ADF digestibility of *Panicum maximum* grass was the lowest one. In general, the values of feed NDF/ADF intake and digestibility of the 4 grasses studied can be ranked as follows (from highest to lowest) *Brachiaria decumbens*, Mini elephant grass, Elephant grass, and *Panicum maximum*.

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