Effect of Difference Tropical Fibrous Feeds on Feed Intake and Digestibility in Swamps Buffaloes Compared to Ongole Cattle

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Abstract. This research was aimed to examine the effect of difference fibrous feeds on feed intake and digestibility in swamps buffaloes compared to ongoles cattles. Twelve ongole and twelve buffaloes were used in in vivo digestibility. Ten feeds were used in this experiment, namely Peanut Haulm (PH), King Grass (KG), Corn stover (CS), Elephan Grass (EG), Rice Straw (RS), Soja Straw (SS), Corn Straw (CST), Glyricidea (Gli), and Caliandra (Cal). The observed variabels were intake of DM, OM, CP, NDF. The results showed that DM and OM intakes were significantly influenced by feed stuffs origin ranged from the lowest (Gli) of 29.55 g DMI/kg$^{0.75}$ to the highest (CS) of 94.88 g/kg$^{0.75}$. OM intake of buffaloes was higher than that of ongole cattle supported by organic matter (OM) digestibility data (61.51 vs 59.51). The digestibility of nutrient was significantly influenced by feed stuffs origin. OM digestibility of SS were lowest while the highest were CST of 54.56 and 71.66% respectively. Digestibility of CP was also significantly influenced by feed stuffs origin. The lowest Digestible Crude Protein was CST and the highest was PH of 44.10 and 67.99% respectively. The digestibility of NDF and ADF were significantly influenced by feed stuffs. The lowest NDF and ADF digestibilities were Cal of 40.84 and 33.19% and the highest digestibility of NDF and ADF were CST of 68.53 and 63.57%. It can be concluded that there were an important variation of feed compositions and digestibility of fibrous feeds. Buffalo were better than cattle on capacity of ingestion and utilization of fibrous feed.

Key Words: fibrous feeds, intake, digestibility, ongole cattle, buffaloes

Introduction

Ruminant production in Indonesia, particularly large ruminant production based on fibrous feeds. Feed resources are scarce in both quantity and quality especially during the long dry season which results in low productivity of livestock. The major objective measurements to define fodder quality were agreed to be dry matter (DM), metabolisable energy (ME) and crude protein (CP), with a prediction of voluntary intake. It is important to know the intakes and digestibility of the fibrous feed as sole feed in order to have a better understanding of the way it functions as a dietary component. As mention by Anne Pearson (1994) that considerable attention is now being given locally by scientists to enhance the quality of the diets availabilities to draught animals and other animals on the farms.

Davendra (1983) reported that Nitrogen utilization in swamp buffalo was found to be more efficient than that in Malaysian cattle. Wanapat (2010) reported that buffalo had different rumen microorganisms than those cattle and have the ability to recycle nitrogen to the rumen. The superiority off buffaloes may be explained by differences in the nature of rumen microbial population which would affect the type of fermentation. Thus, any variations between cattle and buffalo in the proportions and numbers of ruminal bacteria, protozoa and fungi might attribute to the explanation of differences in digestive capability due to fermentation end-products available for absorption and utilization by ruminants.

This type of research was expensive and time-consuming, but it was essential to establish whether the rank between fibrous feeds in intake and digestibility remains the same for cattle and buffaloes. The objective of this proposed research was to measure and compare of cattle and buffaloes in intake and digestibility of tropical fibrous feeds

Materials and Methods

Twelve ongole cattle and twelve buffaloes were used in in vivo digestibility, aged between 1 to 1.5 years with initial live weight ranging

from 150-200 kg. The experiments carried out at Department of Animal Nutrition and Feed Science, Faculty of Animal Science, Gadjah Mada University. Ten feeds were used in the experiment, namely Peanut haulm (PH), King Grass (KG) and Corn stover (CS), Elephan Grass (EG), treated rice straw (RSA) (4% urea, 40 % moisture content and 3 week fermentation long), untreated Rice Straw (RS), Soja Straw (SS), Corn Straw (CST), Glyricidea (Gli), and Caliandra (Cal).

The twelve ongole cattle and twelve buffaloes were allocated into 2 groups of six. The experiments were carried out in two periods, consist of 15 days adaptation period and 15 days experimental period. Ten feeds were evaluated to the twenty four animals.

The animal was housed in metabolic pens in a well stable ventilated and was allowed to free access of water (ad libitum). Feeds given ad libitum to the animal both during adaptation (15 days) and experimental periode (15 days). Feeds offered twice a day (07.00 h and 17.00 h). Representative samples of each feed was taken at the beginning, in the middle and the end of each experimental period for Dry Matter (DM), and chemical analyses. Fresh forages samples collected every 3 days to monitore changes in DM and digestibility of feeds. Refusal feed was recorded and sampled daily for chemical analysis. Gross Energy (GE) was measured using oxygen bombe calorimeter. Dry Matter Intake (DMI) was measured daily for 10 days for each individual animal. The animals weighed at the begining and the end of collection/experimental period.

Apparent digestibility was measured at the end of experimental period for each feed using the same animal groups of six animal for each feed. The experimental diets were offered approximately 1.2 time of the ad libitum level of intake during an adaptation period of 15 days. Total collection of faeces was done for 7 days. Collected faeces were thoroughly mixed and bulked and representative samples (2%) were used for the determination of the apparent digestibility of DM (DMD), organic matter (OM) (OMD) and Neutral-detergent fiber (NDF) (NDFD). DM was determined by drying feed samples at 60^{o}C for 48 h. Ash content was determined by ashing at 550^{o}C for 4 h (AOAC, 1990). Neutral-detergent fiber (NDF), Acid Detergent Fiber (ADF) were determined according to the method of Goering and Van Soest et al. (1991). DMI, OMDI, NDFDI, digestibility of DM, OM and NDF were reported as intake per kg metabolic body weight ($W^{0.75}$). Statistical analyses were made according Statistical Analyses System (1987).

Results and Discussion

Forages Chemical composition

Chemical composition and nutrient content of ten feed stuffs namely Peanut Haulm (PH), King grass (KG), Corn stover (CS), Elephant grass (EG), Ammoniated Rice Straw (RST), Untreated Rice Straw (RS), Soybean Straw (SS), Corn Straw (CS), Glyricidea (Gli) and Calliandra (Cal) were summarized in Table 1.

Neutral Detergent Fiber (NDF) content in all feed stuff used were above 50% and the lowest was PH (51.73%) while the highest was RS (78.83%). The ADF content ranged from the lowest of Gli (25.12%) to the highest of RS (49.34%). From fiber content point of view showed that all feed stuffs used in this experiment have a good energy content for ruminant even though some of them have low crude protein content even for support only requirement for maintenance (RS: 6.13% CP and CS: 5.78% CP).

Nutrient intake

The mean daily of DM and OM intake/kg metabolic bodyweight were shown in Table 2. Analyses of variance showed that DMI and OMI were significantly ($P<0.01$) influenced by feed stuffs origin ranged from the lowest (Gli) of 29.55 g DMI/kg MBW to the highest (CS) of 94.88 g/kg MBW. The lowest intake of Gli might be due to high content of cumarin content and given as sole feed since in practical experiences using Gli as protein supplement in the ration did not give any effect on feed intake.

Digestible Dry Matter Intake (DDMI) and Digestible Organic Matter Intake (DOMI) were significantly ($P<0.01$) affected by feed stuffs origin. The lowest DDMI was Gli of 0.75 g/kgMBW and the highest was CS of 4.93 g/kgMBW while Gli have lowest DOMI of 0.75 g/kg MBW and the highest was CS of 4.59 g/kg

Table 1. Chemical composition and nutritive value of fibrous feed

Variables	Forage									
	PH	KG	CS	EG	RSA	RS	SS	CStw	Gli.	Cal.
DM (%)	20.35	14.20	22.40	12.47	48.58	52.28	83.46	13.27	23.65	68.90
OM (%)	80.20	85.29	90.65	84.32	73.02	72.51	93.22	76.65	90.84	93.20
EE (%)	1.75	1.27	2.00	0.96	0.82	0.96	1.26	0.93	2.31	1.96
CP (%)	13.80	8.60	8.49	7.68	7.40	6.31	8.77	7.13	23.53	21.30
NDF (%)	43.80	71.93	71.20	70.32	73.41	78.83	70.83	72.35	35.00	70.32
ADF (%)	32.59	40.65	39.00	42.38	49.03	49.34	44.43	47.56	21.80	42.38
EB(Cal/kgDM)	3.849	3.886	4.128	3.815	2.710	2.610	3.320	2.983	3.328	-

PH: Peanut haulm; RS: Rice straw; KG: King grass; SS: Soybean straw; CS: Corn stalk; CStw: Corn straw; EG: Elephant grass;
Gli : Gliricidea sp.; RSA: Rice straw ammoniation; Cal : Caliandra sp.

Table 2. Nutrients intake in Ongole cattle and buffaloes fed (%DM)

Variables	Forage									
	PH	KG	CS	EG	RSA	RS	SS	CStw	Gli.	Cal.
DMI (g/KgMBW)										
Cattle	56.92a	65.07	82.65	52.57	71.58	61.35	62.72	87.50	32.46	68.16
Buffaloes	82.02	75.43	79.94	79.83	90.09	71.60	74.62	99.96	24.33	77.01
DMDI (Kg/day)										
Cattle	3.29	3.87	5.04	3.55	3.70	3.13	3.24	3.13	0.81	1.69
Buffaloes	5.02	4.45	4.97	4.82	5.41	4.29	4.42	4.06	0.73	2.19
OMI (g/KgMBW)										
Cattle	51.61	58.22	75.74	42.90	52.90	57.48	43.53	86.01	29.57	66.37
Buffaloes	75.19	70.01	75.34	69.36	69.99	63.49	56.01	101.73	26.64	76.63
OMDI (Kg/day)										
Cattle	2.99	3.46	4.62	2.90	2.74	2.94	2.25	3.20	0.77	1.76
Buffaloes	4.63	4.13	4.68	4.18	4.21	3.81	3.31	4.29	0.70	2.24

PH: Peanut haulm; RS: Rice straw; KG: King grass; SS: Soybean straw; CS: Corn stalk; CStw: Corn straw; EG: Elephant grass;
Gli : Gliricidea sp.; RSA: Rice straw ammoniation; Cal : Caliandra sp.

MBW. It can be seen that CS has the highest DM and OM beside have a good palatability.

The high OM intake of CS was reflected by relatively high of digestibility of OM and microbial N synthesis than Gli (65.54 vs 54.56% and 7.02 vs 0.12 g/kg OMDR) and also pH rumen liquor in CS were lower than that of Gli of 6.42 vs 7.24 as reported by Budhi et al. (2000). The other factors were higher retention time of feed in the rumen and whole entire digestive tract Gli than CS (49.84 vs 34.46 h and 73.98 vs 54.79 h).

Calculated data showed that all mean daily intake parameters of buffalo were higher than that of cattle ($P \leq 0.01$) except for CS and Gli, this fact supported the previous finding that buffalo showed their superiority when fed with marginal or lower quality of forages. OM intake of buffaloes was higher than that of ongole cattle supported by data of higher OM digestibility of buffaloes was higher ($P<0.01$) than cattle (61.51 vs 59.51) and also supported by Budhi et al. (2003) that reported NH_3 rumen liquor concentration of buffaloes was higher than that of ongole cattle (14.35 vs 9.34 mg/100 ml). It's also showed that rumen particle out flow rate on buffaloes was tend to be higher than that of ongole cattle of 2.955 vs 2.752%/h, hence rapidness of rumen outflow increased feed intake.

Ingvarsten (1994) cited by Faverdin (1995) showed that the regulation of DMI was very complex e.g; a. animal factors (breed, sex, live weight, growth, age, milk yield, stage of lactation, pregnancy, previous feeding, body condition and diseases), b. feed factors (plant species, diet composition, chemical composition, digestibility, degradation profiles, rate of passage, physical form, conservation quality, fermentation quality); c. management , housing and environmental factors. Faverdin et al. (1995) stated that the capacity of the digestive tract, particularly the rumen, was involved in the control of intake which supported by three evidence: a. the presence of stretch and mechano-receptor in the rumen wall; b. the effects on intake of additions or removal of material from the rumen; c. the

relationship between several feed attributes (cell-wall content, fibrousness, rate of digestion) and DMI.

Nutrient digestibility

The mean digestibility of nutrient shown in Table 3. Results of analyses of variance showed that digestibility was significantly ($P \leq 0.01$) influenced by feed stuffs origin. Organic Matter digestibility of SS was lowest while the highest was CST of 54.56 and 71.66% respectively.

Digestibility of crude protein (DCP) was also significantly ($P<0.01$) influenced by feed stuffs origin. The lowest DCP was CST and the highest was PH of 44.10 and 67.99% respectively. The results of analyses of variance showed that Digestibilities of NDF and ADF was significantly influenced by feed stuffs ($P \leq 0.01$). The lowest NDF and ADF digestibility were Cal of 40.84 and 33.19% and the highest digestibility of NDF and ADF were CST of 68.53 and 63.57% respectively.

The lowest DM and OM digestibilities of caliandra also reflects the noticeably lowest CP, NDF, ADF digestibilities and degradability of OM in the rumen. The highest of rumen pH liquor (7.38) and retention time of feed residu in the rumen and whole digestion tract (51.98 and 83.46 h). This may have been caused by a depressed ruminal digestion associated with high content of tannin. The other factor was asynchrony release of VFA and NH3 in the rumen liquor as reported by Dawson (1999) that asynchrony release N and energy in the rumen was one of factor caused lower nutrients utilization in the rumen which happened on Cal.

Buffalo digested all feed stuffs used in this experiment better ($P<0.01$) for DM and OM while CP, NDF and ADF ($P<0.05$) than cattle. It can be assumed that buffalo had superiority in digesting fibrous feeds which fed as sole feed. That results were supported from rumen fermentation data where buffaloes produced higher rumen Volatile Fatty Acid (VFA) than ongole cattle (75.93 vs 58.75 mmol/l), rumen pH of buffaloes was lower than that of ongole cattle (7.49 vs 7.26) and mean concentration of N-NH_3 was higher in buffaloes (15.17 vs 5.17 mg/100ml) than ongole cattle (Budhi et al., 2003). Those condition indicated that rumen microbial activity in buffaloes more intensive than in ongole cattle. Those results have similar phenomenon with Franzolin (1994) showed that buffaloes superiority occurred when fed low quality of roughages compared with cattle. Pradhen et al. (1991) in Mugdal (1999) showed that the additional causes for better conversion of feed in buffalo may be attributed to longer

Table 3. Nutrients digestibilities in Ongole cattle and buffaloes fed (%DM).

Variables	Forage									
	PH	KG	CS	EG	RSA	RS	SS	CStw	Gli.	Cal.
DM digestibility										
Cattle	55.80	59.78	67.60	52.26	52.45	54.01	41.41	68.70	54.45	47.61
Buffaloes	65.64	52.77	58.97	48.05	63.53	59.54	53.23	67.10	49.33	48.67
OM digestibility										
Cattle	59.11	65.32	70.25	54.27	58.05	55.75	52.71	71.19	57.33	51.09
Buffaloes	70.45	57.29	60.82	49.54	71.32	62.06	59.43	72.14	51.79	51.55
CP digestibility										
Cattle	66.96	62.72	65.25	47.48	56.51	51.80	45.08	46.21	70.77	48.52
Buffaloes	69.03	61.34	68.35	49.23	65.44	61.81	53.31	42.00	61.30	46.42
NDF digestibility										
Cattle	48.65	61.04	68.94	49.36	52.94	49.72	42.94	69.04	44.27	39.12
Buffaloes	60.96	54.49	58.52	53.36	63.13	54.66	43.32	68.03	43.47	42.56
ADF digestibility										
Cattle	32.20	58.02	67.59	45.96	58.37	55.86	50.54	63.05	43.67	32.94
Buffaloes	51.48	44.95	55.15	42.50	57.81	53.04	42.29	64.10	41.33	33.45
Energy digestibility										
Cattle	57.76	65.32	70.17	53.7	59.67	55.08	48.40			
Buffaloes	67.41	53.49	63.47	63.47	72.20	61.18	57.05			

PH: Peanut haulm; RS: Rice straw; KG: King grass; SS: Soybean straw; CS: Corn stalk; CStw: Corn straw; EG: Elephant grass; Gli : Gliricidea sp.; RSA: Rice straw ammoniation; Cal : Caliandra sp.

retention of feed in the digestive tract , favourable rumen condition for NH_3 utilization and less depression of cellulose digestibility by soluble carbohydrates. Kawashima et al. (2006) reported that swamp buffaloes may have an ability to utilize fiber and energy better than cattle. However, it still requires further studies to clarify the differences. Wanapat and Rowlinson (2007), Wanapat and Cherdthong (2009) showed that cattle and swamp buffaloes showing differences in rumen bacterial, protozoal population and fungal zoospore counts might attribute to the explanation of the differences in digestive capability due to the fermentation and products available for the absorbtion and utilization.

Conclusions

There were an important variation of feed composition and digestibility of feed stuffs (fibrous feed). The capacity ingestion and utilization of fibrous feed in buffalo were better than that of cattle.

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