MARDI Res. J. 16(1) (1988): 43–47

Comparative intake, digestibility and utilization of guinea grass by buffaloes and cattle

J.B. Liang* and M.N. Samiyah*

Key words: intake, digestibility, utilization, guinea grass, buffaloes, cattle

Abstrak

Satu kajian pemakanan telah dijalankan untuk membandingkan pengambilan makanan terkawal, pencernaan bahan kering (kaedah in vivo dan beg nilon) dan parameter-parameter yang berkaitan bagi kerbau dan lembu. Kerbau dan lembu ini diberi makan rumput guinea yang dipotong semasa umur 4 dan 10 minggu. Pengambilan bahan kering oleh kerbau dan lembu ialah masing-masing 6.0 kg dan 4.6 kg bagi rumput yang berumur 4 minggu manakala bagi pemberian rumput yang berumur 10 minggu ialah 5.1 kg dan 4.1 kg. Pengambilan bahan kering/kg $W^{0.75}$ hanya berbeza untuk pemberian rumput yang berumur 10 minggu (74.8 g dan 64.7 g berturutan bagi kerbau dan lembu). Apabila diberi rumput yang sama, data pencernaan in vivo bahan kering bagi kedua-dua baka ternakan adalah sama. Walau bagaimanapun, pencernaan bahan kering dalam beg nilon yang diram dalam rumen menunjukkan kadar cerna dalam rumen kerbau adalah lebih tinggi.

Sungguhpun tiada perbezaan yang ketara di antara pengambilan ME/kg $W^{0.75}$ kedua-dua ternakan yang diberi makan rumput yang sama, nilai yang diperoleh didapati lebih condong pada kerbau. Pengambilan ME kerbau dan lembu yang diberi makan rumput berumur 4 minggu didapati melebihi keperluan saraan dan menghasilkan penambahan berat hidup yang agak tinggi. Walau bagaimanapun, bagi kerbau yang diberi makan rumput yang berumur 10 minggu, pengambilan ME adalah sekadar melebihi sedikit keperluan saraan, manakala penahanan tenaga dan berat hidup lembu pula menurun.

Abstract

A feeding trial was conducted to compare voluntary intake, dry matter (DM) digestibility (in vivo collection and nylon bag methods)and related parameters for buffaloes and cattle eating guinea grass cut at 4 weeks and 10 weeks of age. The daily DM intake for buffaloes and cattle was 6.0 kg and 4.6 kg respectively for the 4-week old grass treatment and 5.1 kg and 4.1 kg respectively for the 10-week old grass treatment. The DM intake per kg $W^{0.75}$ for buffaloes and cattle was only significant for the 10-week old grass treatment (74.8 g and 64.7 g respectively). The in vivo DM digestibility data for the two breeds given the same grass were almost identical. However, DM degradability in nylon bags incubated in the rumen suggested significantly higher rate of digestion in the buffalo rumen.

Although there were no significant differences between the ME intake per kg $W^{0.75}$ of the two breeds eating same grass, the values were always in favour of the buffaloes. The ME intakes for buffaloes and cattle eating the 4-week old grass were well above the maintenance requirements and resulted in considerable liveweight gain. However, in the 10-week old grass treatment, the ME intake of buffaloes was marginally above maintenance while the cattle recorded negative energy retention and liveweight change.

*Livestock Research Division, MARDI, P.O. Box 12301, 50774 Kuala Lumpur, Malaysia
Authors' full names : Liang Juan Boo and Samiyah Mohd. Nor

Introduction

Buffaloes are generally claimed to have the ability to use poor quality diets better than cattle. Results of several in vivo feeding trials support the assumed superiority of buffaloes in digestion (Kumar and Raghavan 1974; Wanapat, Sombat and Chanthai 1984). In other trials, significant differences were not demonstrated in dry matter (DM) intake and digestibility (Moran 1985; Kennedy, Hogan, John, McSweeney and Schlink 1986). Based on studies on DM disappearance in nylon bags, it appears that the digestion rate within the fore-stomach (rumen) of the buffaloes is higher than that of cattle (Vijchulata, Mahyuddin and Sivarajasingam 1985; Abdullah, Mahyuddin and Jalaluddin 1986). The superiority of the buffaloes in this regard could be due to the higher passage rate from the rumen, greater recycling of plasma urea to the rumen and/or higher levels of rumen ammonia (Kennedy et al. 1986), which provide a more efficient environment for microbial fermentation.

This paper presents the results of a series of experiments in which buffaloes and cattle were compared for the differences in voluntary intake and DM digestibility when fed with guinea grass (*Panicum maximum*) cut at two stages of growth. Related parameters such as retention time of feed and DM degradability in the rumen were also investigated.

Materials and methods

Eight local swamp buffaloes (271 ± 20.5 kg) and eight Brahman heifers (224 ± 34.8 kg) of about 30 months of age were used in this experiment. The animals within each breed were subdivided into two groups and were fed with grass cut at 4 weeks and 10 weeks of age.

The experiment took 21 days, *i.e.*, 2 weeks of adaptation and 1 week of measurement. The DM intake and digestibility were determined. Grass samples were collected daily during the digestibility trial period and, were pooled according to age and analysed *(Table 1)*.

Retention of rumen digesta was determined using chromium mordanted fibre as marker, prepared by procedures described by Uden, Colucci and van Soest (1980). Faecal samples were collected from each animal at about 6-h intervals on the first day post dose and at 12-h intervals for the next 4 days. The log-concentration of faecal chromium was plotted against time and the terminal exponential (K) determined by regression. The reciprocal of the exponential was taken to provide a relative measure of the retention time of the marker in the rumen and hence the particulated portion of the digesta (Grovum and Williams 1973).

The grass DM degradation in the rumen was determined using two buffaloes and two Kedah-Kelantan bulls fitted with rumen fistulae. A duplicated ±5 g DM of each grass was placed in a nylon bag. The bags were taken out at 0 (control), 24 and 48 h after suspension in the rumen following procedure similar to that described by Orskov (1982). The DM degradation was calculated as the

Table 1. Chemical composition and gross energy content of guinea grass cut at two stages of growth

Parameter	4-week old grass	10-week old grass
Dry matter (%)	13.1	29.1
Crude protein (%)	10.8	6.5
Acid detergent fibre (%)	41.3	48.7
Ether extract (%)	3.1	1.2
Gross energy (kJ/kg DM)	14.9	17.5

Table 2. Voluntary intake and digestion characteristics of swamp buffalo and Brahman heifers given guinea grass cut at two stages of growth

Parameter	4-wk old grass		10-wk old grass	
	Buffalo	Cattle	Buffalo	Cattle
Liveweight (kg)	279a	225b	278a	219b
DM intake (kg)	6.0a	4.6c	5.1b	4.1d
DM intake/kg $W^{0.75}$ (g)	88.6a	79.7ab	74.8b	64.7c
DM digestibility (%)	65.7a	65.8a	52.8b	52.3b
DDM intake/kg $W^{0.75}$ (g)	58.1a	52.4a	39.5b	33.8c
Energy digestibility (%)	60.7a	62.5a	52.5b	51.3b
DE intake/kg $W^{0.75}$ (kJ)	755.6a	699.7ab	688.9ab	582.0b
DM retention:				
K (%/h)	2.4b	3.2a	2.1b	2.3b
Time (h)	46a	31b	47a	44a
DM degradability in nylon bag:				
24 h (%)	41.0a	31.0b	25.2c	20.4d
48 h (%)	48.8a	45.2b	33.0c	29.9d

a,b,c,d = Values in the same row not followed by a common letter differ significantly ($p<0.05$)
DDM = Digestible dry matter
DE = Digestible energy

difference between DM weight of the samples in the nylon bags before and after incubation.

Results and discussion

Voluntary feed intake

Results in *Table 2* show that the voluntary DM intake of buffaloes was insignificantly higher than that of cattle eating the same grass. When DM intake was expressed as DM intake/kg $W^{0.75}$, the buffaloes was found to have higher intake than cattle. This difference was insignificant (11.2%) with the 4-week old grass. However, it was significant (15.75%) with the 10-week old grass treatment. This suggests that any advantage in intake and digestion of buffaloes over cattle would be evident with poor quality diet.

DM digestibility

The in vivo DM digestibility data suggest no significant difference between breeds eating the same grass because the values were almost identical (*Table 2*). The overall digestibility data for animals eating the 4-week old grass was about 13 units higher than that for animals eating the 10-week old grass. It has been shown that DM digestibility declined between 3% and 14% when intake was increased by 1% of body weight (Devendra 1979). The higher DM intakes of buffaloes may have depressed the DM digestibility values in their respective treatments.

The DM degradability in the nylon bags indicates significantly higher rate of DM disappearance in buffaloes than in cattle (*Table 2*). The results are in agreement with those reported earlier (Vijchulata et al. 1985; Abdullah et al. 1986).

The DM digestibility values only indicates digestion efficiency in percentage and not the quantity of the digested material. The latter depends, on the amount of feed material taken in by the animals. The estimated digestible DM intake/kg $W^{0.75}$ (DM intake/kg $W^{0.75}$ x DM digestibility) value for buffaloes was 11% higher than that for cattle for the 4-week old grass treatments and was 17% higher for the 10-week old grass treatment. However, the differences were only significant for the 10-week old grass treatments (*Table 2*).

Table 3. Daily metabolisable energy intake, estimated energy retention and average daily gain of buffaloes and cattle eating guinea grass cut at two stages of growth

	ME (kJ/kg $W^{0.75}$)*		Est. energy retention	Av. daily gain (kg)
	Intake	Maintenance		
4-wk old grass				
Buffalo	620±38.7	554⁺	66	0.77±0.54
Cattle	574±64.5	494‡	80	0.72±0.59
10-wk old grass				
Buffalo	564±28.5	554⁺	10	0.34±0.20
Cattle	477±26.4	494‡	−17	−0.06±0.20

ME = metabolisable energy
*ME intake = 0.82 DE intake (refer *Table 2*)
⁺Mean of 523 (Kearly, 1982) and 584 (Liang, 1987)
‡Liang, Samiyah and Hirooka (1987)

Retention time in rumen

The faecal chromium excretion rate constant (K) and the retention time values for the animals are also shown in *Table 2*. Except for cattle in the 4-week old grass treatment, these values were not significantly different from each other. The retention times observed for the buffaloes were comparable to the 45 h reported for bufaloes fed with poor quality rice straw based (95%) diet (Kennedy et al. 1986). These results thus suggest that feed retention time in the rumen of buffaloes remains almost unchanged irrespective of the quality of the diet. On the other hand, cattle appeared to retain their feed in the rumen according to the quality of diet. They allowed the unfermented portion of the more digestible feed (4-week old grass) to flow out of the rumen quickly to allow for new intake by the animals. However they retained the less digestible feed (10-week old grass) longer in the rumen for better fermentation. When the cattle were given very fibrous rice straw diet, the feed retention time increased further to 57 (Kennedy et al. 1986).

Nutrient intake and utilization

The metabolisable energy (ME) intakes and the estimated energy retention data are presented in *Table 3*. There were no significant differences in the ME intake/kg $W^{0.75}$ between breeds eating the same grass. The values, however, are always in favour of the buffaloes.

Taking the daily ME requirement for maintenance as 554 kJ/kg $W^{0.75}$ buffaloes and 494 kJ/kg $W^{0.75}$ for cattle, the estimated energy retentions for buffaloes and cattle eating the 4-week old grass were 66 and 80 kJ/kg $W^{0.75}$ respectively. These animals recorded considerably high liveweight gain. For the 10-week old grass treatment, the estimated energy retention was 10 kJ/kg $W^{0.75}$ and −17 kJ/kg $W^{0.75}$ respectively for buffaloes and cattle. Buffaloes in the 10-week old grass treatment recorded some liveweight gains while cattle were observed to lose weight. The liveweight change data for the animals may be of less use in absolute terms because of the short interval between measurements (17 days). The values are nevertheless in agreement with the trend of the estimated energy retention values.

Considering the evidence in hand, it would appear that claims of superior digestive efficiency of buffaloes may be justified. There is sufficient research information to suggest higher rate of digestion in the rumen of buffaloes than in the cattle. The less conclusive results in vivo feeding trials in these regards could be due to complex interactions between the animals and their environment, including type and quality of the feeds used in the different experiments. The

results of this study, however, suggest that any advantage in nutrient intake and use of feed by buffaloes over cattle would only be evident with poor quality diet.

Acknowledgements

The authors are grateful to their colleagues Mr Nor Ismail, M.S., Mr Mohd Sharudin, M.A., Mr Nantha, K. and Mr Poovasagam, S. for technical assistance and Ms Fairda Lim for laboratory analysis of feed and faecal samples.

References

Abdullah, N., Mahyuddin, M. and Jalaluddin, S. (1986). Fermentation and degradation of guinea grass in cattle and buffaloes. *Proc. 5th Int. Conf. on Livestock Production and Diseases in the Tropies,* Kuala Lumpur, 1986, p. 1–3.

Devendra, C. (1979). The potential values of grasses and crop by-products for feeding buffaloes in Asia. *ASPAC Ext. Bull.* ***No. 126.***

Grovum, W.L. and Williams, V.J. (1973). Rate of passage of digesta in sheep: IV. Passage of marker through the alimentary tract and the biological relevance of rate concentration of marker in faeces, *Bri. J. Nutr.* ***30***: 313–23.

Kearl, L.C. (1982). *Nutrient Requirements of Ruminants in Developing Countries* p. 99–100. International Feedstuffs Institute. Logan: Utah State University.

Kennedy, P.M., Hogan, J.P. John, A., McSweeney, C.S. and Schlink, A.C. (1986). Approaches to the study of nutrition of the buffalo-relevance of information from cattle. Paper presented at the First res. coord. meet. on improve domestic buffalo production in Asia-phase 11, Bogor, 1986.

Kumar, B.A. and Raghavan, G.V. (1974). Effect of level of intake on the rate of passage of food and its effect on the digestibility of nutrients in Murrah buffaloes and Hariana cattle. *Indian J. Anim. Sci.* ***44***: 953–65.

Liang, J.B. (1987). First Quarterly Technical Report, Livestock Research Division, MARDI (mimeo).

Liang, J.B., Samiyah, M.N. and Hirooka, H. (1987). Energy requirements for growing Kedah-Kelantan (KK) and Brahman-KK heifers in Malaysia [Accepted for *MARDI Res. J.* ***16(2).***

Moran, J.B. (1985). Comparative performance of five genotypes of Indonesian large ruminants: I. Effect of dietary quality on live weight and feed utilization *Aust. J. Agric. Res.* ***36***: 743–52.

Orskov, O.R. (1982). *Protein Nutrition in Ruminants.* p. 47–50. London: Academic Press Inc. Ltd.

Uden, P., Colucci, P.E. and van Soest, P.J. (1980). Investigation of chromium, cerium and cobalt as markers in digesta : Rate of passage studies, *J. Sci. Food Agric.* ***31***: 625–32.

Vijchulata, P., Mahyuddin, M. and Sivarajasingam, S. (1985). Effect of ammonium hydroxide treatment on nutritive value of palm press fibre in buffaloes and cattle. *Malays. Appl. Biol.* ***14***: 31–7.

Wanapat, M.P., Sombat, S. and Chanthai, S. (1984). The utilization of diets containing untreated rice straw, urea-ammonia treated rice straw and water hyacinth. *Proc. 3rd Ann. Workshop of the Australian-Asian Research Network,* University of Peraneniya, Sri Lanka, 1984, p. 156–65.

Accepted for publication on 28 November 1987