Komunikasi Singkat

Eating Behavior of Ongole Crossbred and Limousin Crossbred Steers Fed Fermented Rice Straw and Concentrate

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ABSTRAK

PURNOMOADI A, A. W. BELA dan S. DARTOSUKARNO. 2003. Tabiat makan pada sapi Peranakan Ongole dan Peranakan Limousin jantan muda yang diberi pakan jerami padi fermentasi dan konsentrat. *JITV* 8(4): 276-280.

Penelitian tentang tabiat makan telah dilaksanakan dengan membandingkan antara sapi Peranakan Ongole (OC) dan Peranakan limousin (LC) jantan muda (umur 9 bulan) yang diberi pakan jerami padi terfermentasi (JPF). Jerami padi fermentasi dan konsentrat diberikan pada perbandingan 60:40. Jerami padi difermentasikan dengan menggunakan starter komersial (BioP 2000 Z), sedangkan konsentrat disusun dari konsentrat komersial dan ampas kecap. Ransum disusun untuk memenuhi kebutuhan konsumsi bahan kering (BK) sebesar 3.0% bobot hidup. Tingkah laku makan (dan ruminasi) diukur dari pengamatan selama 3x24 jam. Jumlah kunyah diukur dengan memasang sensor gerak (tape switch) pada tali keloh sisi rahang bawah yang dihubungan dengan personal komputer. Pencatatan dilakukan secara otomatis untuk setiap 1/10 detik. Hasil penelitian menunjukkan bahwa konsumsi bahan kering antara OC (3,21 kg) dan LC (4,18 kg) tidak berbeda nyata (P>0,05) yakni sekitar 2,8%BB. Akan tetapi jumlah kunyah pada OC (133808 kali per hari) lebih tinggi dibanding LC (106353 kali per hari). Jumlah kunyah untuk makan dan ruminasi pada OC (86995 dan 46813 kali) lebih tinggi dibandingkan pada LC (67628 dan 38725 kali). Efisiensi kunyah untuk makan pada OC (0,041 g BK per kunyah) lebih rendah daripada LC (0,066 g BK per kunyah). Kecenderungan yang sama didapatkan pada efisiensi kunyah untuk ruminasi dimana OC (0,080 g per kunyah) lebih rendah daripada LC (0.109 g per kunyah). Dari penelitian ini dapat disimpulkan LC mempunyai efisiensi kunyah yang lebih baik dibandingkan dengan OC dan hal ini disebabkan oleh perbedaan ukuran rahang antara OC dan LC.

Kata kunci: Kunyah, Peranakan Ongole, Peranakan Limousin

ABSTRACT

PURNOMOADI A, A. W. BELA and S. DARTOSUKARNO. 2003. Eating behavior of Ongole crossbred and Limousin crossbred steers fed fermented rice straw and concentrate. *JITV* 8(4): 276-280.

A study on eating behavior of Ongole Crossbred (OC) and Limousin Crossbred (LC) steers (aged 9 months) fed fermented rice straw and concentrate has been carried out. Rice straw and concentrate were given in 60:40 ratio. Rice straw was fermented by commercial starter (BioP 2000 Z), while concentrate was composed of commercial concentrate and soybean pulp (by-product of soy-sauce industry). The diet was set to meet the dry matter (DM) requirement at 3.0% of liveweight. Eating behaviour was measured from 3 days continuously observation. Chewing number was accounted by halter equipped with tape-switch in jaw side and was recorded every 1/10 second in connected PC. The results showed that DMI of both OC (3.21 kg) and LC (4.18 kg) was similar, being 2.8% LW. However, chewing number of OC (133808 chews/d) was higher than that of LC (106353 chews/d). Chewing for eating and for rumination in OC (86995 and 46813 chews) was higher than of LC (67628 and 38725 chews). Chewing efficiency for eating in OC (0.041 g DMI/chew) was lower than that of LC (0.066 g DMI/chew). Similar tendency was observed in chewing efficiency for rumination that OC (0.080 g DMI/chew) was lower than that of LC (0.109 g DMI/chew). The conclusion is LC has a better chewing efficiency than of OC and it was pointed to different jaw size between OC and LC.

Key words: Chewing, Ongole, Limousin

INTRODUCTION

Several new breeds of cattle have been introduced into Indonesia in order to increase the meat production for fulfilling people need in protein. One of these imported breeds is Limousin Crossbred (LC). As imported breed, Limousin (originated *Bos taurus*) needs to adapt to different climate, feedstuff's quality and feeding management in Indonesia. The different feeding management will affect feed intake that in turn will affect the productivity.

Animal behavior on eating (including rumination) can be used as indicator for palatability of feed and adaptability of animal to feed. Palatability that influence

feed intake is determined by appearance, odor, taste, texture and other sensory properties of feeds (POND *et al*., 1995) that may differ between breeds. Ambient temperature also influence feed intake as shown by our previous study on buffalo's eating behavior (PURNOMOADI and RIANTO, 2002) that animal tended to lay during hot period (between 12-14h) due to their mechanism to maintain the body temperature through conduction with barn floor that cooler that ambient temperature. This condition lead to decrease eating activity because they cannot grab feed from feederer. Moreover, the length of time for eating and rumination are affected by feed composition, feed quality, intake level (MORITA and NISHINO, 1994; MATSUI *et al*., 1994) and physical form of feed (FUJIHARA and NAKAO, 1990), while chewing activity is affected by feed intake (OSHIO, 2001).

Rice straw is the most abundant feedstuff in Indonesia, but the high potential of this feedstuff cannot be maximally utilized for livestock due to the low on quality and digestibility. Many efforts were done to improve the quality and one of them was fermentation by some microbes. Since LC is not Indonesian native cattle and is believed better than Ongole Crossbred (OC) to produce meat, therefore the study on their adaptability to Indonesian feedstuff under hot climate should be carried out. This study was aimed to compare the feeding behavior and chewing efficiency between OC and LC fed fermented rice straw and concentrated feed.

MATERIALS AND METHODS

This experiment used four OC and four LC steers and was designed to follow Independent Sample Comparison (SNEDECOR and COCHRAN, 1978). The steers of OC and LC were in the same age, 10 months and weighed 117 kg and 150 kg for OC and LC, respectively. They were kept in individual pens and were fed fermented rice straw and concentrated feed in 60:40 ratio. Rice straw was fermented by commercial starter (BioP 2000 Z) for 21 days followed the manufacturer's instruction written on the starter bag prior to feeding. Concentrated feed was composed of commercial concentrated feed and soybean pulp (by-product of soy-sauce industry) at 75:25 ratio. The diet was set to meet the dry matter (DM) requirement at 3.0% liveweight (LW). Rice straw was given twice a day, at 09:00 and 17:00 h, while concentrated feed was given two hours before rice straw at 07:00 and 15:00 h, respectively. Water was provided *ad libitum*. Feed intake was daily measured by weighing the feed given and the residual. Feed compositions are presented in Table 1.

Observation of eating behavior was carried out for 3 times (week 2, 6 and 10 of 12 weeks productivity experiment) with each observation was performed for 3 x 24 hours. During observation, the time of eating and rumination were recorded manually, while chewing number was accounted by chewing recorder that consisted of tape switch, halter and converter (Keyence, Ltd., Japan). Manual recording was done based on activity most done in every five minutes during the measurement. Chewing activity detected by on-off signal from tape switch placed in jaw side of halter that was then converted to 1/0 number by converter, and automatically recorded in connected IBM compatible personal computer. Chewing activity was recorded every 1/10 second. The chewing numbers were separated to chewing for eating and for rumination based on manual observation. The data observed were analyzed using *t*-test (SNEDECOR and COCHRAN, 1978).

RESULTS AND DISCUSSION

The daily dry matter intake (DMI), chewing activity and chewing efficiency of OC and LC are presented in Table 2. The DMI of OC (3.21 kg) was lower ($P<0.01$) than of LC (4.18 kg) as an effect of live weight that LC was higher than OC. However, if these DMI was converted to percentage of live weight, it was found similar ($P>0.05$), being 2.75 and 2.81% for OC and LC, respectively. This result showed that the palatability of fermented rice straw to LC was not different from that of OC, even LC tended to more palatable to the diet. Contribution of rice straw fermented to total DMI in OC and LC were not significantly different, being 1.21 kg (37.6%) and 1.34 kg (32.0%), respectively, while concentrate significantly ($P<0.05$) contributed DMI, being 2.00 kg (62.4%) and 2.84 kg (68.0%), respectively.

Total time for eating and rumination in OC (388.5 and 345.2 min/d) were higher ($P<0.05$) than in LC (237.5 and 247.0 min/d). These values were opposite with DMI that found DMI of OC (3.21 kg/d) was lower than of LC (4.18 kg/d), because theoretically time for eating was linearly correlated with DMI (MORITA and NISHINO, 1993). This phenomenon might be caused by eating rate which found LC (12.2 g DMI/min) was higher than OC (8.3 g DMI/min). This condition is supported by the facts that jaw and mouth sizes of LC (70.3 and 36.5 cm) were higher than of OC (66.3 and 31.8 cm), respectively.

Table 1. Chemical composition of feedstuff used in this study (%DM)

Feedstuff	Organic matter	Crude protein	Ether extract	Crude fiber	NFE
Rice straw fermented	63.74	11.51	1.37	34.47	16.69
Concentrated feed	85.09	7.20	2.70	18.53	56.65
Soy pulp	74.18	35.22	24.03	14.56	0.51

Table 2. Daily dry matter intake and eating behavior of Ongole Crossbred and Limousin Crossbred

	Ongole crossbred	Limousin crossbred	Significance	
Liveweight (kg)	117	150		
Daily gain (kg)	0.24	0.47		
Dry matter intake (kg)	3.21	4.18	0.010	**
Fermented rice straw (kg)	1.21	1.34	0.216	ns
Concentrate (kg)	2.00	2.84	0.009	**
Dry matter intake (% LW)	2.75	2.81	0.379	ns
Fermented rice straw (% LW)	1.03	0.92	0.232	ns
Concentrate (% LW)	1.72	1.89	0.035	*
Allocation time for feeding				
for eating (min/d)	388.5	345.2	0.036	*
for rumination (min/d)	237.5	247.0	0.461	ns
Chewing activity (chews/d)	133808	106353	0.193	ns
for eating (chews/d)	86995	67628	0.172	ns
for rumination (chews/d)	46813	38725	0.251	ns
Chewing efficiency (g/chew)	0.027	0.041	0.075	ns
for eating (g/chew)	0.041	0.066	0.070	ns
for rumination (g/chew)	0.080	0.109	0.109	ns
Feed conversion	13.4	8.89		

ns: non significant at P>0.05, *: significant at P<0.05, **: significant at P<0.01

The allocation time for eating and for rumination during day and night are illustrated in Figure 1. Eating time of OC in the night showed that OC (86.4 min) was higher (P<0.05) than in LC (61.7 min). This significant higher eating time in OC might be caused by the fulfillment of DMI (2.96% LW) was lower than possible maximum level as observed in LC (3.12% BW), and therefore lead to increase the feed intake during night. Present study showed that eating activity during the day was higher than of during the night, being 77.75 vs. 22.25% and 82.13 vs. 17.86%, for OC and LC respectively. This condition was considered correlated with decreasing life activity in the night due to low lightness (LANGHANS *et al.*, 1975), and also agreed with the finding of MORITA and NISHINO (1993) that eating during the day was higher than of during the night. Figure 1 also shown a similar pattern on eating and rumination during a day-night. The peak of eating behavior was occurred in 07:00, 09:00, 15:00 and 17:00 that was time of feeding concentrate (07:00 and 15:00) and fermented rice straw (09:00 and 17:00). Allocation time for eating was higher in a day than in the night, while rumination activity was higher in the night than in a day.

Allocation time for rumination in OC and LC was found 237.5 and 247.0 min/d, respectively. This result was correlated with the DMI that found LC (4.18 kg) was higher than of OC (3.21 kg), and agreed with the statement for MORITA and NISHINO (1993) that rumination time is affected by feed intake. Rumination is an activity to reduce particle size of ingested feed in order to pass the rumen (OKAMOTO and ABE, 1990; MCDONALD *et al.*, 1995), so it was also affected by physical and chemical composition of feeds (FUJIHARA

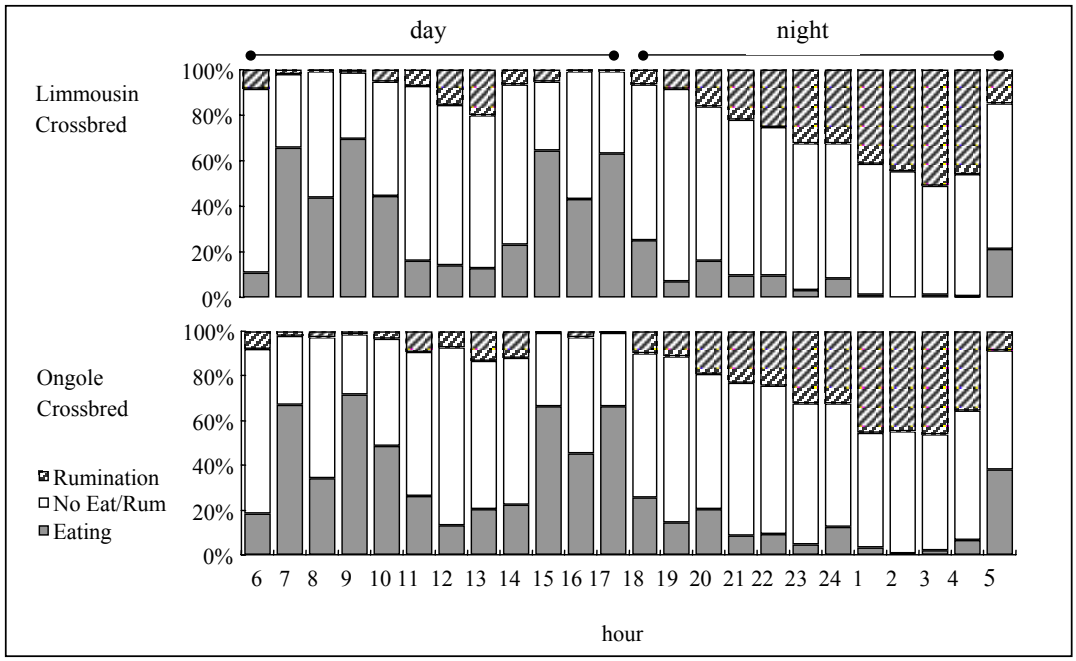

Figure 1. The pattern of eating and rumination of OC and LC fed fermented rice straw and concentrated feed

and NAKAO, 1990). In comparison to our previous study using buffalo heifers fed rice straw (PURNOMOADI and RIANTO, 2002), the present study (OC : 237.5 min for 3.21 kg DMI and LC : 247.0 min for 4.18 kg DMI) was shorter than 7.8 hour for DMI 2.63 kg. Fermentation on rice straw gives better (softer) texture of rice straw that may give a lower rumination time (FUJIHARA and NAKAO, 1990).

The daily chewing activity between OC (133808 chews) and LC (106353 chews) was similar (P>0.05), and it was considered due to the similar level on dry matter intake (in percent of liveweight). However, these data showed that chewing activity of LC was lower than of OC, and it was in contrast theoretically with the statement that chewing number is positively correlated with DMI (OSHIO, 2001). This phenomenon was observed because the DMI of rice straw was similar (OC: 1.21 vs LC: 1.34 kg), while concentrate that significantly contributed DMI was physically fine and may give less chewing activity. This condition lead to a non-significant difference (at 5% level) in chewing efficiency for eating and rumination, even the difference was close, being lying at 7-11% level. Another reason for explaining the low eating time and rumination in LC while the DMI was high could be pointed to chewing efficiency. The data of chewing activity for eating and for rumination in LC (67628 and 38725 chews/d) were lower than that of OC (86995 and 46813 chews/d).

Chewing efficiency for eating in LC (0.066 g DM/chew) was better than that of in OC (0.041 g DM/chew). Similar tendency was observed in chewing efficiency for rumination in LC (0.109 g DM/chew) was higher than that in OC (0.080 g DM/chew). The different on chewing efficiency between OC and LC was pointed to the different size of mouth and jaws that observed LC (36.5 and 70.3 cm) was bigger than of OC (31.8 and 66.3 cm). The bigger size of mouth and jaws may give a bigger capacity of mouth, and therefore LC could grab feed and crash the feed more efficient than in OC.

Eating rate and rumination rate of OC (8.29 and 13.41 g/min) was lower (P<0.05) than of LC (12.17 and 17.03 g/min). These data showed that in same period of time LC degraded feed better than of OC. These eating and rumination rates were much higher than of unfermented rice straw in previous study using buffalo heifer, being 5.17 and 5.62 g/min respectively (PURNOMOADI and RIANTO, 2002). This bigger result somewhat showed that fermented rice straw has a better texture so could be degraded easily than unfermented ones.

CONCLUSION

The conclusion in this study was, LC has a better chewing efficiency than of OC and therefore could support the productivity by efficiency on energy utilization. This better chewing efficiency was pointed to the size of jaw that LC was bigger than of OC.

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REFERENCES

FUJIHARA, T. and T. NAKAO. 1990. The eating and rumination behaviour in sheep fed the diet of silage made from fibrous residue left after extraction of Iadino clover (*Trifolim repense* L. var gigantium) leaf protein with timothy (*Phelum pratense* L.) hay. *J. Zootechnol. Sci. (Jpn),* 61: 757-761.

LANGHANS, W., M. SENN, E. SCHARRER and E. EGGENBERGER. 1988. Free feeding pattern of pigmy goats eating a pelleted diet. *J. Anim. Physiology and Anim. Nutr*. 59: 160-166.

MATSUI, K., Y. KUROKAWA and T OKUBO. 1994. Changes of heart rate, grazing and rumination time and jaw movements in cattle with grazing days. *Animal Science and Technology (Jpn),* 65: 532-537.

MCDONALD, P., R.A. EDWARDS, J.F.D. GREENHALGH and C.A. MORGAN. 1995. Animal Nutrition. 5th Ed. Longman Scientific & Technical, John Wiley & Sons, Inc. New York. P157.

MORITA, S. and S. NISHINO. 1994. The effects of hours of access to a mixed ration on the amount of intake, rate of eating and probability of an eating bout continuing in steers. *Anim. Sci. Tech. (Jpn),* 64: 448-454.

OKAMOTO, M. and H. ABE. 1990. The chewing activity of sheep fed with rice straw treated with ammonia, steam and ammonia after steam treatment. *J. Zootechnol. Sci. (Jpn),* 61: 157-161.

OSHIO, S. 2001. Effect of intake of Italian ryegrass hay on chewing behaviour, rumen volume and fecal particle size in heifers. *Anim. Sci. J.* 72: 410-414.

PURNOMOADI, A. and E. RIANTO. 2002. Feeding behaviour of buffalo heifers fed rice straw supplemented with urea-mollases. Proc. Seminar Nasional Teknologi Peternakan dan Veteriner 2002. Puslitbang Peternakan, Bogor.

SNEDECOR, GW. and WG. COCHRAN. 1978. Statistical Methods. 6th Ed. Iowa State University Press. Ames, Iowa, USA. pp. 114-115.