PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

OPEN ACCESS Pakistan Journal of Nutrition

ISSN 1680-5194
DOI: 10.3923/pjn.2018.683.688

Research Article
Response of Selected Heifer Buffalo to Feed Improvement in Bombana Regency, Indonesia

[1]La Ode Nafiu, [1]Takdir Saili, [1]Ali Bain, [2]Muhidin, [1]Muhammad Rusdin and [1]Rusli Badaruddin

[1]Department of Animal Science, Faculty of Animal Science, Halu Oleo University, Kendari 93232, Southeast Sulawesi, Indonesia
[2]Department of Agrotechnology, Faculty of Agriculture, Halu Oleo University, Kendari 93232, Southeast Sulawesi, Indonesia

Abstract

Background and Objective: The main constraint on the development of buffalo in Southeast Sulawesi is the poor quality of the feed in the pasture, so growth tends to be slow and there is high mortality. The study aimed to investigate the response of selected heifer buffalo to feed improvement. **Materials and Methods:** The research was performed using a Completely Randomized Block Design (CRBD). There were 4 treatments based on the type of feed: T_1 (natural grass), T_2 (natural grass+concentrate (1 kg sago hampas+1.5 kg rice bran), T_3 (elephant grass) and T_4 (elephant grass+concentrate). **Results:** Treatments T_2 and T_4 produced average daily gains (0.502 and 0.574 kg head^{-1} day^{-1}) respectively, significantly higher ($p<0.05$) than that with feeding on T_1 or T_3, which produced only 0.338 and 0.427 kg head^{-1} day^{-1}, respectively. The addition of concentrate also decreased the value of feed conversion, i.e., those for T_4 and T_2 were only 8.637 and 10.160 kg head^{-1} day^{-1}, respectively, significantly lower ($p<0.05$) than the T_1 and T_3 values of 11.463 and 14.928 kg head^{-1} day^{-1}, respectively. **Conclusion:** The selected heifer buffalo showed a positive response to the feed improvement in the form of high daily gain and low feed conversion.

Key words: Buffalo, dry matter intake, daily gain, feed conversion, elephant grass, natural grass

Received: October 06, 2017 Accepted: August 30, 2018 Published: November 15, 2018

Citation: La Ode Nafiu, Takdir Saili, Ali Bain, Muhidin, Muhammad Rusdin and Rusli Badaruddin, 2018. Response of selected heifer buffalo to feed improvement in bombana regency, Indonesia. Pak. J. Nutr., 17: 683-688.

Corresponding Author: La Ode Nafiu, Department of Animal Science, Faculty of Animal Science Halu Oleo University, Kendari 93232, Southeast Sulawesi, Indonesia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The demand for beef in Indonesia has increased much faster than the production capacity. The average demand for beef in Indonesia has reached 670 thousand t per year, while the production capacity is only approximately 440 thousand t (56.67%), so approximately 230 thousand t (43.33%) per year must be supplied by importing frozen meat and beef cattle[1].

The programme to increase meat production in Indonesia continues to be encouraged. It includes the utilization of potential alternative meat sources, such as buffalo. One of the advantages of buffalo is that they can digest feed containing a high amount of crude fibre, such as rice straw. Rice straw is abundantly available in during the harvest season and can be stored for use as a feed reserve in the dry season[2]. It allows buffalo to grow well in the dry season, whereas other livestock, such as beef cattle, often show decreased body weight during the dry season despite supplemental feeding.

In Indonesia, Southeast Sulawesi Province has a wetland suitable for the development of buffalo, comprising unplanted swamps or rice fields and estimated to be 152,384 ha[3]. The Southeast Sulawesi Province thus has good potential for the development of buffalo. However, the buffalo population in Southeast Sulawesi has fluctuated and experienced a drastic decrease. The buffalo population in Southeast Sulawesi was only 2,492 head, while in 2005, it was 7,926 head[4]. The region that has the largest buffalo population in Southeast Sulawesi is Bombana Regency. Buffalo maintenance in Bombana Regency is currently extensive but occurs without any culling or selective breeding[5]. Instead, all ideal buffalo bulls are sold because buyers are able to pay a high price. Another problem with the development of buffalo in Bombana Regency is the low quality of feed in the pastureland. The forage is dominated by reed and natural grass. Buffalo generally feed exclusively by grazing and this causes slow growth, poor body condition, low rates of reproduction and high mortality.

One alternative for overcoming the feed problem for buffalo is the provision of quality feed by tapping the potential of local feed ingredients, such as superior forage and concentrate. Improved feed quality is expected to improve the body condition and increase the growth rate[6]. Meanwhile, improvements in the genetic quality can be achieved through the selection on young buffalo (before reaching sexual maturity), based on meat production criteria and body condition. This study aimed to determine the response of selected buffalo to feed improvement by using the criteria based on dry matter intake, daily gain and feed conversion.

MATERIALS AND METHODS

Research material: The study was conducted with the assistance of group of farmers in Bombana District and it lasted for 8 months, including an elephant grass planting period, buffalo adaptation to intensive management and observation of buffalo growth. The buffaloes used in this study were selected based on growth parameters (weight and body size) and were 15-22 months old and weighed 172-230 kg. The young female buffalo selected for analysis in this study are referred to as selected heifer buffalo.

Research design: The study was performed using a Completely Randomized Block Design (CRBD). The buffalo were grouped based on body weight, as follows: (1) >220-240 kg, (2) >200-220 kg, (3) >180-200 kg and (4) >160-180 kg. There are 4 treatments and 4 replications (groups), for a total of 16 experimental units. Each experimental unit used one selected heifer buffalo, for a total of 16 buffaloes. The treatments were the types of feed, as follows:

- T_1: Natural grass or field grass
- T_2: Natural grass+concentrate (consisting of 1 kg sago hampas+1.5 kg rice bran)
- T_3: Elephant grass
- T_4: Elephant grass+concentrate

The chemical compositions of some feed ingredients used in the study are shown in Table 1.

The concentrate material consisted of fermented rice bran and sago hampas to increase the nutrient value. The chemical compositions of the rice bran and sago hampas before and after fermentation are presented in Table 2.

Table 1: Nutrient composition of feed ingredients (%)

Feed ingredients	Dry matter	Crude protein	Crude fat	Crude fibre	Total digestible nutrient
Fermented rice bran	87.50	11.33	5.81	28.39	55.00
Fermented sago hampas	76.34	6.79	1.72	9.44	26.21
Elephant Grass	22.10	13.20	3.50	34.10	57.00
Natural grass	21.80	6.70	1.80	34.20	56.20

UHO analytical laboratory (2015)

Variables observed:

- Dry matter intake (kg head^{-1} day^{-1}) is the average amount of feed consumed by a buffalo every day multiplied by the level of dry matter
- The weight gain (kg head^{-1} day^{-1}) is the initial body weight subtracted from the final body weight, divided by the length of the rearing (in days)
- Feed conversion is the average intake of dry matter feed divided by the increase in body weight during the same unit of time

Data analysis: The data obtained were analysed using two-way analysis of variance (ANOVA) and if the treatment had a significant effect on the measured variable, the analysis continued with Duncan's Multiple Range Test (DMRT) at $\alpha = 0.05$ to identify significant differences between treatments.

RESULTS AND DISCUSSION

Dry matter intake: The results of ANOVA showed a significant improvement of feed for selected heifer buffalo from providing concentrate ($p<0.01$) that affected the dry matter intake. The average dry matter intake during the observation period can be seen in Table 3.

The results of the current study correlate with the results of Ahmad *et al.*[7], who reported that feeding with different amount of dietary supplements had a very significant effect on the consumption and digestibility of feed ingredients for buffalo. The DMRT results show that consumption and digestibility were higher for select heifer buffalo whose feed was improved by providing concentrate than for those fed without providing concentrate and with only natural grass or elephant grass alone as the main feed. For the T_2 treatment, the dry matter intake was 5.026 kg head^{-1} day^{-1}, which is higher than that with only natural grass (T_1) that is 4.710 kg head^{-1} day^{-1} or only elephant grass (T_3) that is 4.828 kg head^{-1} day^{-1}. However, the addition of concentrate to a base feed of elephant grass (T_4 treatment) was not significantly different from the other three treatments. The results are fairly similar to other reports on quality improvement for buffalo feed[8,9]. Another study also reported that different carbohydrate sources in buffalo rations did not have a significant effect on the dry matter intake and feed digestibility[10].

The dry matter intake by select heifer buffalo increased along with increasing age and buffalo body weight. However, dry matter intake in the T_2 and T_4 treatments was noticeably higher at the end of the observation, although it showed fluctuations (Fig. 1).

The fluctuation in dry matter consumption may be related to the increase in air temperature at the study sites during the third and fourth weeks of observation, which could have led the buffalo to overheat and have decreased their feed consumption.

Table 2: Nutrient composition of rice bran and sago hampas before and after fermentation

	Nutritional composition			
Feed materials concentrate	Crude protein (%)	Lipid (%)	Fibre (%)	Available energy (kcal)
Rice bran				
No fermentation	10.75	5.02	32.18	3421
Fermentation	11.33	5.81	28.39	3682
Sago hampas				
No fermentation	3.83	1.02	15.80	2482
Fermentation	6.79	1.72	9.44	2621

UHO analytical laboratory (2015)

Table 3: The average dry matter intake for selected heifer buffalo

	Dry Matter Intake (kg head^{-1} day^{-1})			
Weeks of observation	Natural grass (T_1)	Natural grass+concentrate (T_2)	Elephant grass (T_3)	Elephant grass+concentrate (T_4)
1-2	4.295^{a}	3.989^{b}	3.668^{c}	4.437^{a}
3-4	4.353^{c}	4.083^{b}	3.888^{c}	3.735^{c}
5-6	4.353^{b}	4.882^{a}	4.751^{a}	4.600^{ab}
7-8	4.425^{c}	4.969^{a}	4.773^{b}	4.661^{b}
9-10	4.505^{c}	5.076^{a}	5.012^{a}	4.761^{b}
11-12	4.592^{b}	5.127^{a}	5.042^{a}	4.904^{a}
13-14	5.217^{b}	5.791^{a}	5.546^{ab}	5.913^{a}
15-16	5.939^{b}	6.290^{ab}	5.941^{b}	6.597^{a}
Average	4.710^{b}	5.026^{c}	4.828^{ab}	4.951^{bc}

Different superscripts in the same line indicate significant differences ($p<0.05$)

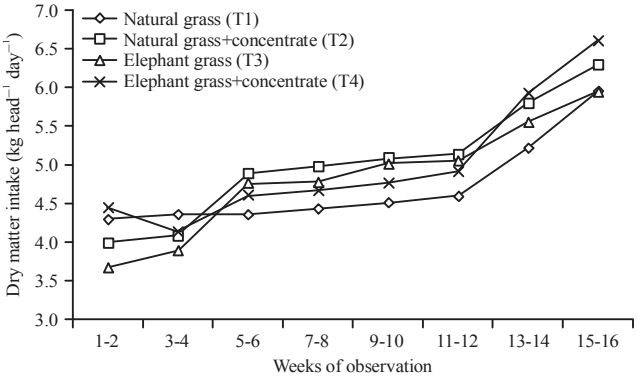

Fig. 1: Consumption of dry matter among selected heifer buffalo

Table 4: Average daily gain by selected heifer buffalo

	Daily gain (kg head^{-1} day^{-1})			
Weeks of observation	Natural grass (T_1)	Natural grass+concentrate (T_2)	Elephant grass (T_3)	Elephant grass+concentrate (T_4)
1-2	0.210^{d}	0.357^{b}	0.293^{c}	0.448^{a}
3-4	0.219^{d}	0.440^{b}	0.351^{c}	0.493^{a}
5-6	0.274^{d}	0.405^{b}	0.355^{c}	0.523^{a}
7-8	0.286^{d}	0.464^{b}	0.412^{c}	0.536^{a}
9-10	0.357^{d}	0.512^{b}	0.448^{c}	0.571^{a}
11-12	0.380^{d}	0.535^{b}	0.464^{c}	0.595^{a}
13-14	0.457^{d}	0.626^{b}	0.515^{c}	0.683^{a}
15-16	0.521^{d}	0.682^{b}	0.580^{c}	0.744^{a}
Average	0.338^{d}	0.502^{b}	0.427^{c}	0.574^{a}

Different superscripts in the same line indicate significant differences ($p<0.05$)

Daily Weight Gain (DWG): The Daily Weight Gain (DWG) can be used as a criterion for measuring buffalo growth. The average DWG for buffalo ranged from 0.210-0.744 kg head^{-1} day^{-1}. The averages for 16 weeks of observation for the T_1, T_2, T_3 and T_4 treatments were 0.338, 0.502, 0.427 and 0.574 kg head^{-1} day^{-1}, respectively (Table 4). Based on the analysis, feed type was found to have a significant effect ($p<0.05$) on the daily gain of selected heifer buffalo. This result is consistent with the other reports that feeding at different concentrate levels had a significant effect ($p<0.01$) on the growth rate of buffalo[11,12].

This result was relatively similar to the findings of Singh *et al.*[13], who reported an average daily gain for heifer buffalo that ranged from 0.492-0.540 kg head^{-1} day^{-1}. Ferdous *et al.*[14] reported an average daily gain of 0.40 kg head^{-1} day^{-1} for young buffalo and 0.36 kg head^{-1} day^{-1} for buffalo cows. Helal *et al.*[11] also reported that the buffalo given concentrated feed showed a growth rate averaging 0.941-1.016 kg head^{-1} day^{-1}. Provision of fibre feed and quality concentrate led to growth rates of up to 1 kg day[15]. The differences in nutritional responses cause unequal growth rates, with both protein and energy consumption affecting the rate of growth and buffaloes consuming large amounts of protein and energy will have a faster growth rate[16].

The DWG of selected heifer buffalo correlates with age and feed improvement. The provision of concentrate in addition to the main feed of natural grass or elephant grass consistently increased the DWG starting from weeks 1-2 to weeks 15-16 (Fig. 2). It can be seen that for the selected heifer buffalo, T_4 (elephant grass + concentrate) and T_2 (natural grass+concentrate) resulted in higher daily gain than T_1 and T_3.

Feed conversion: The smaller the feed conversion, the more efficiently the feed is used to produce body weight. The average feed conversion for the selected heifer buffalo varied according to duration and type of feed (Table 5). The average feed conversion was 11.297 kg head^{-1} day^{-1}, ranging from 20.501-8.238 kg head^{-1} day^{-1}.

The ANOVA results showed that the improvement of feed for selected heifer buffalo had a significant effect ($p<0.05$) on feed conversion. Further evaluation with DMRT show that in general, different feed types resulted in different feed

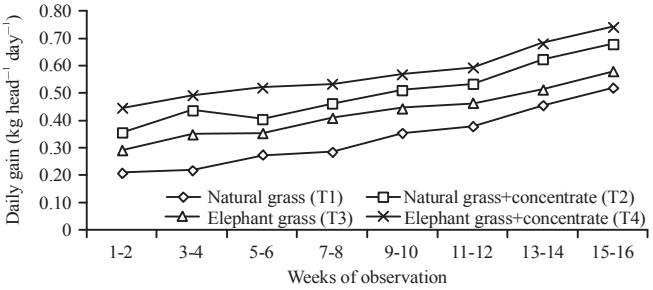

Fig. 2: Daily gain of selected heifer buffalo

Table 5: Average feed conversion for selected heifer buffalo

	Feed conversion			
Weeks of observation	T_1	T_2	T_3	T_4
1-2	20.501^a	11.231^c	12.518^b	9.896^d
3-4	19.946^a	9.305^c	11.075^b	7.580^d
5-6	15.898^a	12.043^c	13.405^b	8.799^d
7-8	15.502^a	10.715^c	11.592^b	8.705^d
9-10	12.643^a	9.915^c	11.208^b	8.348^d
11-12	12.106^a	9.578^c	10.870^b	8.238^a
13-14	11.425^a	9.251^b	10.778^a	8.660^b
15-16	11.406^a	9.239^c	10.262^b	8.868^c
Average	14.928^a	10.160^c	11.463^b	8.637^d

conversions from initial observation (weeks 1-2) to the end of observation (weeks 15-16). The highest feed conversion occurred in T_1, where it reached 14.928 and that in T_3 reached 11.463, both of which are significantly higher than the feed conversion values for T_4 and T_2. This outcome indicates that supplementing the feed with concentrate can improve feed efficiency in selected heifer buffalo. The T_2 and T_4 treatments contained better nutrient values and were easier to digest than T_1 and T_3, resulting in lower feed conversion.

These results are similar to those of Tomar *et al.*[17], who found that buffalo fed different types of concentrates produced feed conversion values of 10.26±1.43, 11.36±1.85 and 10.98±1.37 for Group 1 (controls with energy levels meeting National Research Council (NRC) requirements), Group 2 (energy level 10% higher than control) and Group 3 (energy level 20% higher than control), respectively. The conversion of feed for ruminants is influenced by the feed quality, digestibility and efficiency of nutrient utilization in the metabolic process within the body tissues[18]. The improved quality of feed consumed by the animals will be followed by a higher daily gain and more efficient use of feed.

Feed improvement can accelerate the growth of young female buffalo. Thus, the implication of this research is an increase in growth rate that can decrease the time between puberty and age of first birthing. If applied by the breeder, this approach will increase the productivity of a female buffalo, with implications for increasing the income of breeders. This result of the treatment depends on the following requirements: (1) The costs of the enclosure, planting forage and concentrate, (2) Additional time and energy allocated to intensive buffalo husbandry and (3) The ability to ferment the pulp of sago and rice bran.

CONCLUSION

It can be concluded that the selected heifer buffalo demonstrated a positive response to feed improvements. The addition of concentrates to a primary feed of elephant grass or natural grass can increase the rate of growth and improve the efficiency of feed use by selected buffalo.

SIGNIFICANCE STATEMENT

This research is important because it will help farmers overcome problems related to the limitations of feed in the dry season when both quantity and quality can cause slow growth and when the animals take longer time to mature. Publications on increasing buffalo production through feed improvements are numerous and the feed ingredients used in this study are also common but other studies generally use adult male buffalo (age ≥30 months). The novelty of this research lies in the following: (1) the buffalo used were young

female buffalo at the ages of 15-22 months, (2) The buffalo were selected, which is useful for providing breeders with superior stock, (3) The feed ingredients (concentrate) included sago pulp, which is widely available in Southeast Sulawesi, including in the study site but has not been used as buffalo feed and (4) The nutritional value of sago pulp was enhanced through fermentation using local microorganisms. The benefits of the study are (1) Finding a new model to accelerate the growth of selected heifer buffalo through the utilization of fermented feed materials using local microorganisms and (2) Helping farmers produce superior heifer buffalo.

ACKNOWLEDGMENT

The authors extend their gratitude and appreciation to the Minister of Research, Technology and Higher Education Republic of Indonesia, Rector and Chairman of the Research and Community Service Institute of Halu Oleo University, for providing the *Grant* in the fiscal year of 2017.

REFERENCES

1. Afriyadi, A.D., 2017. Bisnis impor daging di RI menggiurkan. Ini Alasannya. Liputan6.com. Februari 1, 2017. Jakarta.
2. Triwulanningsih, E., P. Subandriyo, T. Situmorang, R.G. Sugiarti and D.A. Sianturi *et al*., 2004. Data base kerbau di Indonesia. Laporan Penelitian. Balai Penelitian Ternak. Ciawi, Bogor.
   BPS Sulawesi Tenggara, 2016. Data sensus pertanian badan pusat statistik republik Indonesia. Sulawesi Tenggara.
3. BPS Sulawesi Tenggara, 2006. Data sensus pertanian badan pusat statistik republik Indonesia. Sulawesi Tenggara.
4. Nafiu, L.O. and T. Saili, 2013. Potrait of reproductive management implementation on buffalo breeding in Bombana district. Proceedings of Buffalo International Conference 2013, November 3-4, 2013, Makassar, pp: 122-131.
5. Hendratno, C., Suharyono, Z. Abidin, R. Bahauddin and J.M. Obst, 1981. Penggunaan dedak dibandingkan bungkil kedelai sebagai konsentrat pada kerbau yang diberi makan rumput lapangan. Prosiding of Seminar Penelitian Peternakan, Cisarua, Maret 23-26, 1981, Puslitbang Peternakan, Bogor, pp: 156-160.
6. Ahmad, S., M.A. Jabbar, A. Khalique, F. Shahzad, N. Ahmad, M. Fiaz and U. Younas, 2014. Effect of different levels of NDF on voluntary feed intake, dry matter digestibility and nutrients utilization in dry Nili Ravi buffaloes. J. Anim. Plant Sci., 24: 1602-1605.
7. Kennedy, P.M., 1989. Digestion and passage of swamp buffaloes fed tropical forages. Proceedings of Final Research Coordination Meeting on the Use of Nuclear Techniques to Improve Domestic Buffalo Production in Asia-Phase II, February 20-24, 1989, International Atomic Commission Agency, Vienna, Austria.
8. Dania, I.B. and H. Poerwoto, 2006. Pertambahan berat badan, laju pertumbuhan dan konversi pakan kerbau jantan akibat pemberian kesempatan berkubang dan jerami padi amoniasi. Prosiding of Lokakarya Nasional Usaha Ternak Kerbau Mendukung Program Kecukupan Daging Sapi, Agustus 4-5, 2006, Sumbawa.
9. Wanapat, M., R. Pilajun, S. Polyorach, A. Cherdthong, P. Khejornsart and P. Rowlinson, 2013. Effect of carbohydrate source and cottonseed meal level in the concentrate on feed intake, nutrient digestibility, rumen fermentation and microbial protein synthesis in swamp buffaloes. Asian-Aust. J. Anim. Sci., 26: 952-960.
10. Helal, F.I.S., K.M.A. Rahman, B.M. Ahmed and S.S. Omar, 2011. Effect of feeding different levels of concentrates on buffalo calves performance, digestibility and carcass traits. Am.-Eurasian J. Agric. Environ. Sci., 10: 186-192.
11. Mahmoudzadeh, H. and H. Fazaeli, 2009. Growth response of yearling buffalo male calves to different dietary energy levels. Turk. J. Vet. Anim. Sci., 33: 447-454.
12. Singh, S.V., O.K. Hooda, B. Narwade, Beenam and R.C. Upadhyay, 2014. Effect of cooling system on feed and water intake, body weight gain and physiological responses of Murrah buffaloes during summer conditions. Indian J. Dairy Sci., 67: 426-431.
13. Ferdous, S., A.K.M. Masum, M.A.S. Khan and M.A. Islam, 2010. Comparative study of the performance of buffalo calves and cow calves by feeding urea molasses block with straw based diet. J. Bangladesh Agric. Univ., 8: 87-90.
14. Anggraeni, A. and E. Triwulanningsih, 2007. Keragaan bobot badan dan morfometrik tubuh kerbau Sumbawa terpilih untuk penggemukan. Prosiding Seminar Dan Lokakarya Usaha Ternak Kerbau 2007, (LUTK'07), Pusat Penelitian dan Pengembangan Peternakan, Bogor, pp: 124-131.
15. Soeparno, 2005. Ilmu dan Teknologi Daging. Gadjah Mada University Press, Yogyakarta, Indonesia.
16. Tomar, S.K., L.N. Patil, P. Singh and S.S. Kundu, 2014. Effect of feeding various energy levels on nutrient utilization and growth in male buffalo calves. J. Anim. Plant Sci., 24: 33-35.
17. Pond, W.G., D.C. Church and K.R. Pond, 1995. Basic Animal Nutrition and Feeding. 4th Edn., John Wiley and Sons, New York.