International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
VET 2024; SP-9(1): 516-519

www.veterinarypaper.com
Received: 23-11-2023
Accepted: 24-12-2023

Anuj Kumar
Ph.D. Research Scholar, Department of Livestock Production and Management, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Amit Kumar
Professor and Head, Department of Livestock Production and Management, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

DK Singh
Professor, Department of Livestock Production and Management, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Debashis Roy
Professor, Department of Animal Nutrition, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Manoj Kumar Singh
Asistant Professor, Department of Livestock Production and Management, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Rohit Kumar
Ph.D. Research Scholar, Department of Animal Nutrition, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Vivek Kumar Yadav
Ph.D. Research Scholar, Department of Animal Nutrition, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Corresponding Author:
Anuj Kumar
Ph.D. Research Scholar, Department of Livestock Production and Management, College of Veterinary and Animal Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Utttar Pradesh, India

Effect of enzyme supplementation on feeding behavior and physiological responses of lactating Murrah buffaloes during winter season

Anuj Kumar, Amit Kumar, DK Singh, Debashis Roy, Manoj Kumar Singh, Rohit Kumar and Vivek Kumar Yadav

DOI: https://dx.doi.org/10.22271/veterinary.2024.v9.i1Sh.1056

Abstract
The research trail was conducted on twenty four lactating Murrah buffaloes, which were selected from Livestock Research Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut (U.P.). Selected lactating buffaloes were randomly divided into four treatment groups having six animals in each group on the basis of their body weight, lactation length and test day milk yield. The nutrient allowances of lactating Murrah buffaloes in term of DM, DCP and TDN requirements were provided as per the feeding standards given by the Indian Council of Agricultural Research, New Delhi. To meet out the daily nutrient requirement of trail animals, a Total Mixed Ration (TMR) for buffaloes was prepared by mixing of roughage and concentrates in the ratio of 60:40 after grinding/chaffing. Roughage part was consisting of wheat straw and available green fodder in winter season at research centre. Feeding trial was planned into four dietary groups *viz.* T_1 (Basal diet without enzyme supplementation), T_2 (Basal diet with supplementation of xylanase @800000 IU), T_3 (Basal diet with supplementation of cellulase @240000 IU) and T_4 (Basal diet with supplementation of xylanase and cellulase). It was revealed from the present study that average time spend on feeding and rumination was 307.11 and 512.09, 314.13 and 466.77, 318.39 and 439.24, 304.85 and 432.01 in T_1, T_2, T_3 and T_4 treatment groups, respectively. The results were shown that time spent on rumination was lesser in all enzymes supplemented buffaloes while the difference was statistically not significant. Similarly, no significant differences were observed in rectal temperature and respiration rate among enzyme supplemented and non-supplemented group of buffaloes during entire experimental period. It was concluded from the study that enzyme supplementation will help into reducing the energy spent on rumination during cold climatic conditions which may leads to more energy availability in milk production.

Keywords: Buffalo, Murrah, behavior, physiological

1. Introduction
Buffalo is a thrifty, adaptable and productive animal that has gained national and worldwide attention in recent decades. Seasonality of performance attributes is related to environmental factors (photoperiods, temperature, relative humidity and rainfall) rather than genetic ones (Das and Khan 2010) [8]. In the tropical and subtropical regions ruminants rely heavily on forage plants for nutrition. The fibre has low digestibility and accessible energy because the plant's cell wall is an interwoven matrix of polymers that generates dynamic and complicated structures (Hatfield *et al*,. 1999) [10]. The use of enzymes in animal feeding has significant potential to improve production efficiency and reduce nutritional waste. Fibrolytic enzymes can improve the availability of storage polysaccharides and proteins. Enzymes can break down specific bonds in feedstuffs that are not normally destroyed by endogenous enzymes, releasing additional nutrients (Beauchemin *et al*,. 2001) [6]. Enzymes are biological catalysts that increase the rate of chemical reactions. Changes in the mechanical processing (Beauchemin and Rode 1994) [4] and chemical characteristics (Beauchemin and Buchanan-Smith 1989) [3] of feed can have a considerable impact on chewing behavior and subsequently saliva production.

As a result, the use of enzymes in dairy buffalo diets may affect eating behavior and saliva production which may have significance in productivity and reproduction of farm animals.

2. Materials and Methods

All of the procedures carried out and animal welfare were reviewed and approved by the Institutional Animal Ethics Committee of the Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India (IAEC/SVPUAT/2022/127). Twenty four lactating Murrah buffaloes were selected for the research trail from Livestock Research Centre of university. All the selected lactating buffaloes were randomly allocated into four treatment groups having six animals in each group nearer to their average body weight, lactation length and milk yield. The daily nutrient requirements of lactating Murrah buffaloes in term of all essential nutrients were provided as per the feeding standards of Indian Council of Agricultural Research, New Delhi. To meet out the daily nutrient requirement of trail animals a Total Mixed Ration was prepared by mixing of roughage and concentrates in the ratio of 60:40 after grinding/chaffing. Roughage part was consisting of wheat straw and available green fodder in winter season at research centre. Feeding trial was planned into four dietary groups *viz*. T_1 (Basal diet without enzyme supplementation), T_2 (Basal diet with supplementation of xylanase @800000 IU), T_3 (Basal diet with supplementation of cellulose @240000 IU) and T_4 (Basal diet with supplementation of xylanase @800000 IU and cellulase @240000 IU. A commercially prepared enzyme in powder form was procured from the market i.e. Xylanase having 400000 IU/g and Cellulase having 100000 IU/g activity. Enzyme was supplemented to each treatment groups individually at the time of feeding by preparing a premix with concentrate with required quantity of enzyme. An adjustment period of 10 days was given to the experimental animals. Feeding material concentrate ingredients, wheat straw, green fodders, left over feed and faecal matter were ground and analyzed for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF) and total ash (AOAC 2005) [1]. Fibre fraction of feed, fodder and faecal sample were analysed by using detergent method of fibre estimation (Van Soest *et al.*, 1991) [17]. Chemical composition (on % DM basis) of feed ingredients used during the trial in winter season is given in Table 1. Rectal temperature was measured with the help of simple mercury thermometers daily both in the morning and evening for all the animals included in the study. Respiration rate was also measured twice daily by silently observing the movement of the thoraces-abdominal region for each animal included in the study. Time spent on eating and rumination was recorded in minutes with the help of stop watch for two consecutive days in every month. Monthly average temperature (°C) and humidity (%) in the animal shed were recorded and related data is presented in Table 2. The temperature humidity index (THI) was calculated through equation given by Kendall and Webster 2009 [12].

$$THI = (1.8\ AT + 32) – [(0.55–0.0055\ RH) \times (1.8\ AT–26)]$$

Statistical Package for the Social Sciences (S.P.S.S. 2011) was used to analyse the data using a perfectly random design and the simple analysis of variance method (Snedecor and Cochran 1994) [15]. The multiple range test described by Duncan was used to differentiate homogenous groupings (1955) when $p<0.05$ differences between treatments were considered significant.

Table 1: Chemical composition (on % DM basis) of feed ingredients used during the lactation trial in winter season.

Items	Oats fodder	Wheat straw	Concentrate	Total mixed ration
Dry matter	19.35	87.88	88.68	68.12
Organic matter	87.41	88.74	89.50	88.89
Total ash	12.20	11.28	10.44	11.14
Crude protein	9.45	3.02	21.02	13.90
Ether extract	4.60	0.49	3.99	3.49
Crude fibre	21.81	37.61	6.84	17.59
Nitrogen free extract	51.80	47.51	58.45	53.78
Neutral detergent fibre	58.64	83.65	33.09	50.86
Acid detergent fibre	50.59	54.14	17.34	34.74
Hemicellulose	8.01	29.47	15.78	16.19
Acid detergent lignin	2.38	3.81	1.32	2.15
Cellulose	48.12	50.35	16.10	32.56

Table 2: Monthly temperatures (avg., max. and min. °C), mean relative humidity (RH %) and mean temperature humidity index (THI %) during the winter season.

Month	Temperature (°C)			Mean RH%	Mean THI%
	Avg.	Max.	Min.		
December	20.56	27.00	14.34	40.93	65.39
January	17.78	23.18	12.37	57.09	62.74
February	23.09	31.29	16.51	45.40	69.84
Overall	20.57	26.93	14.22	48.31	65.78

3. Results and Discussions

3.1 Feeding behavior

The data related to feeding behavior of control and treatment groups have been presented in Table 3. The overall time spent on feeding (minutes) was 307.11, 314.13, 318.39 and 304.85 in T_1, T_2, T_3 and T_4 groups, respectively. The analysis of variance revealed that there was no significant difference on feeding time in lactating Murrah buffaloes due to supplementation of xylanase and cellulase in different treatment groups. The overall time spent on rumination (minutes) was 512.09, 466.77, 439.24 and 432.01 in T_1, T_2, T_3 and T_4 groups, respectively (Figure 1). The results were shown that the time spent on rumination was lesser in all enzyme supplemented buffaloes. The analysis of variance revealed that there was no significant difference on rumination time in lactating Murrah buffaloes due to

supplementation of xylanase and cellulase in different treatment groups in winter season. Pre-treatment of feed with fibrolytic enzyme could reduce the amount of time required to chew and make saliva, thereby increasing the risk of acidosis (Arriola *et al.*, 2011) [2]. According to Bowman *et al*,. (2002) [7] the introduction of enzymes prior to feeding may alter the structure of the plant cell wall, thereby reduce the fiber physical effects. Some research reported that when cows are fed an enzyme-pretreated diet they consume more feed (He *et al.*, 2015 [11], Gandra *et al.*, 2017 [9]). Silva *et al.*, (2016) [14] found that supplementation with fibrolytic enzymes increased overall chewing activity. Other research has found that fibrolytic enzyme has no impact on overall chewing activity (Beauchemin *et al.*, 2000 [5], Refat *et al.*, 2018 [13]). Although this discrepancy is still unclear, it is assumed to be related to differences in types of substrates, enzyme activity and application of enzyme. Further study is needed to clarify these inconsistent effects of fibrolytic enzyme in feeding behavior. Yang *et al.*, (2022) [18] reported no significant effect on feeding behavior due to enzyme supplementation.

Table 3: Effect of enzyme supplementation on feeding behavior in lactating Murrah buffaloes during winter season

Parameters	Treatment groups				SEM	P-Value
	T_1	T_2	T_3	T_4		
Feeding time (min.)	307.11	314.13	318.39	304.85	7.81	0.640
Rumination time (min.)	512.09	466.77	439.24	432.01	27.20	1.778

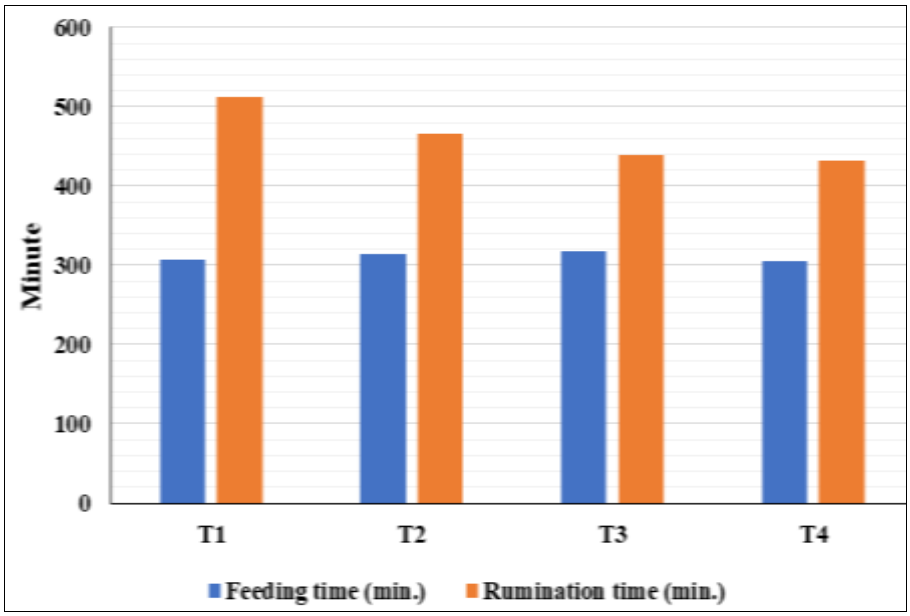

Fig 1: Effect of enzyme supplementation on feeding behavior in lactating Murrah buffaloes during winter season

3.2 Physiological reactions

Effect of enzyme supplementation on physiological reactions in lactating Murrah buffaloes during winter season is presented in Table 4. Rectal temperature was assessed to determine whether, there were any changes in heat generation in the body between buffalo fed enzyme and those fed basal ration. The average rectal temp. at morning was 100.24, 100.38, 100.33 and 100.47 °F and at evening was recorded as 100.31, 100.40, 100.35 and 100.48 °F in T_1, T_2, T_3 and T_4 groups, respectively. The analysis of variance revealed that there was no significant difference in either morning or evening rectal temperature among treatment groups. Titi (2003) [16] observed no significant differences in the rectal temperature due to feeding a fibrolytic enzyme to lactating dairy cows on their lactational performance during early lactation. The average respiration rate in the morning was 12.02, 12.67, 13.38 and 13.10 per minute and in evening 14.77, 15.79, 16.50 and 16.22 per minute in T_1, T_2, T_3 and T_4 groups, respectively. There were no significant differences in respiration rate in lactating Murrah buffaloes during winter season.

Table 4: Effect of enzyme supplementation on physiological reactions in lactating Murrah buffaloes during winter season

Parameters	Treatment groups				SEM	P-Value
	T_1	T_2	T_3	T_4		
Morning rectal temp. (°F)	100.24	100.38	100.33	100.47	0.071	0.186
Evening rectal temp. (°F)	100.31	100.40	100.35	100.48	0.064	0.304
Morning respiration rate/min.	12.02	12.67	13.38	13.10	0.456	0.207
Evening respiration rate/min.	14.77	15.79	16.50	16.22	0.488	0.097

4. Conclusion

It is concluded from the present study that enzyme supplementation will help into reducing the energy spent on rumination during cold climatic conditions which may leads to more energy availability in milk production.

5. References

1. AOAC. Official method of analysis. 18th edition, association of officiating analytical chemists, Washington DC, method 935.14 and 992.24, 2005.
2. Arriola KG, Kim SC, Staples CR, Adesogan AT. Effect of fibrolytic enzyme application to low and high

concentrate diets on the performance of lactating dairy cattle. Journal of Dairy Science. 2011;94(2):832-84.
3. Beauchemin KA, Buchanan-Smith JG. Effects of dietary neutral detergent fiber concentration and supplementary long hay on chewing activities and milk production of dairy cows. Journal of Dairy Science. 1989;72(9):2288-2300.
4. Beauchemin KA, Rode LM. Compressed baled alfalfa hay for primiparous and multiparous dairy cows. Journal of Dairy Science. 1994;77(4):1003-1012.
5. Beauchemin KA, Rode LM, Maekawa M, Morgavi DP, Kampen R. Evaluation of a nonstarch polysaccharidase feed enzyme in dairy cow diets. Journal of Dairy Science. 2000;83(3):543-553.
6. Beauchemin KA, Morgavi DP, McAllister TA, Yang WZ, Rode LM. The use of enzymes in ruminant diets. Recent advances in animal nutrition. Nottingham University, Press, Loughborough, UK. 2001, 297-322.
7. Bowman GR, Beauchemin KA, Shelford JA. The proportion of the diet to which fibrolytic enzymes are added affects nutrient digestion by lactating dairy cows. Journal of Dairy Science. 2002;85(12):3420-3429.
8. Das GK, Khan FA. Summer anoestrus in buffalo. Reproduction in Domestic Animals. 2010;45(6):483-494
9. Gandra JR, Miranda GA, Goes RHTB, Takiya CS, Del Valle TA, Oliveira ER, *et al*. Fibrolytic enzyme supplementation through ruminal bolus on eating behavior, nutrient digestibility and ruminal fermentation in Jersey heifers fed either corn silage or sugarcane silage based diets. Animal Feed Science and Technology. 2017;231:29-37.
10. Hatfield RD, Ralph J, Grabber JH. Cell wall structural foundations: Molecular basis for improving forage digestibility. Crop Science. 1999;39(1):27-37.
11. He ZX, Walker ND, McAllister TA, Yang WZ. Effect of wheat dried distillers grains with solubles and fibrolytic enzymes on ruminal fermentation, digestibility, growth performance, and feeding behavior of beef cattle. Journal of Animal Science. 2015;93(3):1218-1228.
12. Kendall PE, Webster JR. Season and physiological status affect the circadian body temperature rhythm of dairy cows. Livestock Science. 2009;125(2-3):155-160.
13. Refat B. Molecular structure features and nutrient availability and utilization of barley silage varieties with varying digestible structural carbohydrate in comparison with a new short season corn silage in high producing dairy cattle. Ph.D. thesis. University of Saskatchewan, Saskatoon, Canada, 2018.
14. Silva TH, Takiya CS, Vendramini THA, de Jesus EF, Zanferari F, Renno FP. Effects of dietary fibrolytic enzymes on chewing time, ruminal fermentation and performance of mid lactating dairy cows. Animal Feed Science and Technology. 2016;221:35-43.
15. Snedecor GW, Cochran WG. "Statistical methods," 8th Edition, Iowa State University Press, Ames, 1994.
16. Titi HH. Evaluation of feeding a fibrolytic enzyme to lactating dairy cows on their lactational performance during early lactation. Asian Australasian Journal of Animal Science. 2003;16(5):677-684.
17. Van Soest PJ, Robertson JB, Lewis BA. Methods for dietary fiber, neutral detergent fiber and non-starch polysaccharides in relation to animal nutrition. Journal of Dairy Science. 1991;74(10):3583-3597.
18. Yang J, Refat B, Guevara-Oquendo VH, Yu P. Lactational performance, feeding behavior, ruminal fermentation and nutrient digestibility in dairy cows fed whole plant faba bean silage based diet with fibrolytic enzyme. Animal: An International Journal of Animal Bioscience. 2022;16(9):100606.