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Research Article

EFFECT OF GENETIC AND NON-GENETIC FACTORS ON THE EATING, RUMINATING AND RESTING TIME OF CROSSBRED COWS

HUSSAIN J.*, ROYCHOUDHURY R., SAHARIA J., MILI D.C., SAIKIA B.N. AND BORPUZARI T.
Department of Livestock Production and Management, College of Veterinary Science, Khanapara, Assam Agricultural University, Guwahati, 781022, India
*Corresponding Author: Email - drjakir@gmail.com

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Abstract: The present experiment was conducted to observe the feeding behaviour of dairy cows. Ten dairy cows consisting of 5 Jersey crossbred (G1) and 5 Holstein Friesian crossbred (G2) were fed on TMR *i.e.*, total mixed ration (F1) and another ten cows with similar genetic group and lactation number and stages were fed by separate (F2) feeding practice with standard ration. The average body weight of G1 and G2 was 298.85 and 385.84 kg, respectively with age ranging from 4-8 years and body condition score ranging from 3.25-3.5. All the experimental cows were fed twice daily adlibitum at 8:30 AM and 3:30 PM. There was highly significant effect (P<0.01) of all the factors on time spent for eating in crossbred cows. The eating time was significantly lower in F1 than F2 feeding practice, whereas G1 had significantly lower eating time (303.92±3.91 min) than G2 genetic group (326.46±3.71 min) and amongst the seasons, significantly highest eating time (334.01±5.40min) was observed during pre-monsoon season (S1). The ruminating time was significantly (P <0.01) higher in F1 (413.62±14.84min) than F2 (383.63±1.07min) feeding practice. There was highly significant effect (P<0.01) of feeding practice and season and significant (P<0.05) effect of genetic group on the resting time. Significantly higher resting time was found in TMR feeding practice. Overall 21.89%, 27.68% and 50.43% of time the dairy cows spent for eating, ruminating and resting, respectively. The cows got longer time for rumination and rest due to TMR feeding.

Keywords: *Eating, Ruminating, Resting, Crossbred cows, TMR feeding*
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Introduction

The feeding practice of dairy cows is one of the most important management tools for improving production and reproduction. The feeding management may influence the ingestive behaviour and dry matter intake of dairy cows. Out of various ingestive behaviours, the most important behaviours are eating, ruminating and resting activities, which reflect the quality of feed and health status of an animal. The aim of dairy farms should be to increase the dry matter intake with a minimum time period and provide the cows an opportunity to ruminate it for longer time, so that the digestion of the feed would be enhanced for the overall benefit of the animals. It determines the effective feed utilization by the animal. The feeding practice also determines the amount of feed wastages and leftovers. Improper feeding pattern may also lead to indigestion and hamper the welfare of dairy cows. The natural eating and ruminating pattern in dairy cows vary greatly between the different feeding practices, individual cows, environmental temperature and other stresses such as fly activity which depress rumination time [1]. The species and breed differences are also obvious for feeding pattern and utilization. The eating behaviour of ruminants may vary due to type of feed and its physical characteristics that absolutely affects the digestive physiology of the ruminant [2]. The ingestive behaviour mainly depends on the palatability, presentation, quality and quantity of feeds available in different seasons and locations. Mahrous *et al.* (2006) [3] found that time spent for eating was lower while feeding more quantity of concentrate feed in case of Friesian cows. It has an important bearing on quality and quantity of milk production.

The frequent delivery of TMR tends to promote feeding activity and a more even distribution of feeding time throughout the day [4]. De Mol *et al*., (2016) [5] reported that the correlation between eating time and feed intake was 0.53 in a TMR system. Schirmann *et al.* (2012) [6] observed that rumination time peaked approximately 4 hour (240 min) after feeding. The longer rumination time in lactating dairy cows helped in higher milk production [7]. The seasonal changes in ruminating time might be due to relationship between Temperature Humidity Index (THI) and rumination [8]. So, feeding strategy may have to be modified according to the seasonal variation. The maximum cows favour eating time during winter [9]. The dairy farmers should allow maximum dry matter intake and longer rumination time in dairy cows for effective digestion and assimilation of nutrients present in the feed stuff. The information regarding ingestive behaviour of dairy cows is very scanty in the north-eastern region of India in general and the state of Assam in particular. The scientific information regarding the eating, ruminating and resting time is very essential to improve the production and welfare of dairy cows. Besides nutritional quality of feed, the practice of feeding or system of feeding may greatly regulate the assimilation of nutrients in the feed. The influence of various factors on the ingestive pattern must be investigated to suggest a better option for feeding the dairy cows. Therefore, present study was carried out to observe the ingestive behaviour of dairy cows to modify its feeding strategy for augmentation of milk production and profitability of dairy farming under organized farm condition.

Materials and Methods

The present experiment was conducted to study the effect of feeding practice, genetic group and season on the ingestive behaviour of crossbred dairy cows under organized farm condition. The experiment was performed in the Instructional Livestock Farm (Cattle), Faculty of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati during the year 2016-17, under standard management condition. Ten cows consisting of 5 Jersey crossbred (G1) and 5 Holstein Friesian crossbred (G2) were fed on TMR *i.e.*, total mixed ration (F1) and another ten cows with similar genetic group and uniform lactation number (1-5) and stages were fed by separate (F2) feeding practice with standard ration

Table-1 *Average (mean±se) daily time spent (min) on eating, ruminating and resting of crossbred cows*

Sources of variation	Eating time		Ruminating time		Resting time	
	Mean±SE	Percentage	Mean±SE	Percentage	Mean±SE	Percentage
Feeding practice (N=240)						
F_1	262.10±1.50[a]	18.20%	413.62±14.84[a]	28.72%	764.28±15.00[a]	53.08%
F_2	368.27±2.08[b]	25.57%	383.63±1.07[b]	26.64%	688.10±3.03[b]	47.78%
Genetic group (N=240)						
G_1	303.92±3.91[a]	21.11%	393.71±14.86	27.34%	742.37±15.24[a]	51.55%
G_2	326.46±3.71[b]	22.67%	403.53±1.48	28.02%	710.01±3.44[b]	49.31%
Feeding season (N=120)						
S1	334.01±5.40[a]	23.20%	410.36±1.55	28.50%	695.63±4.22[a]	48.31%
S2	280.78±4.23[b]	19.50%	375.11±1.65	26.05%	784.12±3.56[b]	54.45%
S3	316.28±5.54[c]	21.96%	400.68±9.71	27.83%	723.05±9.97[a]	50.21%
S4	329.69±5.36[d]	22.90%	408.34±1.66	28.36%	701.97±4.38[a]	48.75%
Overall (μ) (N=480)	315.19±2.74	21.89%	398.62±7.46	27.68%	726.19±7.84	50.43%

N=Number of observations in each group. Means with at least one common superscript within a column do not differ significantly.

Table-2 *Average micro environmental parameters of animal shed*

Seasons	Dry Bulb (^{0}C)	Wet Bulb (^{0}C)	RH (%)	THI
S1	23.51	20.03	77.13	71.95
S2	29.83	28.30	88.88	82.46
S3	23.65	20.57	77.01	72.44
S4	21.12	17.61	75.00	68.48

as per NRC (2001) [21]. The average body weight of cows in two feeding groups within a genetic group was also equivalent. The whole year was divided into four season such as Pre-monsoon (S1): March to May, Monsoon (S2): June to September, Post-monsoon (S3): October to November and Winter (S4): December to February as per Bhattacharya *et al*. (2001) [10]. The animals were reared in intensive system and kept in close house on concrete floor and wall up to manger and remaining part up to roof was wire netting. The asbestos sheets were used for roofing material. The indoor THI during S1, S2, S3 and S4 was 71.95, 82.46, 72.44 and 68.48, respectively [Table-2]. The TMR was prepared with wilted mixed grass, paddy straw and concentrate mixture at the ratio of 40:20:40 on DM basis. The concentrate ration was prepared with crushed maize-25 parts, wheat bran-20 parts, ground nut cake-20 parts, mustard oil cake-7 parts, rice polish-15 parts, rice bran-10 parts, mineral mixture (*Agrimin forte*)-2 parts and common salt-1 parts. The mixed grass was comprised of Para (*Brachiaria mutica*), Napier (*Pennisetum purpureum*), Guinea (*Panicum maximum*) and Maize (*Zea mays*) grass in the ratio of 40:20:20:20 on dry matter (DM) basis.

The paddy straw and wilted mixed grasses were chaffed before feeding. All the experimental cows were fed twice daily adlibitum at 8:30 AM and 3:30 PM. The time spent on eating, ruminating and resting were plotted on a graph paper at 15 min interval for three consecutive days once in a month during feeding trial of two months duration in each season. Different episodes occurred in 24 h were added and expressed in min per day. The statistical analysis of data was done using the generalized linear model (proc GLM) with the help of SAS 9.3 [11].

The model used was:

$$Y_{ijkl}=\mu + F_i + G_j + S_k + e_{ijkl}$$

Where,

Y_{ijkl} = Dependent variables (l^{th} observation in i^{th} feeding practice, j^{th} genetic group and kth season of feeding)

μ = General effect

F_i = Effect due to i^{th} feeding practice (i=1, 2)

G_j = Effect due to j^{th} genetic group (j=1, 2)

S_k = Effect due to k^{th} season of feeding (k=1, 2, 3, 4)

e_{ijkl} = Effect due to non assignable causes

Results and Discussion

Time spent on eating

The mean daily time spent on eating was 262.10±1.50 (18.20%) and 368.27±2.08 (25.57%) min in F1 and F2 feeding practices; 303.92±3.91 (21.11%) and 326.46±3.71 (22.67%) min in G1 and G2 genetic groups and 334.26±5.43 (23.20%), 280.28±4.47 (19.50%), 316.28±5.54 (21.96%) and 329.69±5.36 (22.90%)min during S1, S2, S3 and S4 seasons, respectively [Table-1] with overall mean of 315.19±2.74 min (21.89%) per day.

The analysis of variance revealed highly significant (P<0.01) effect of feeding practice, genetic group and season on the mean daily time spent on eating. The mean daily time spent on eating was significantly longer in F2 feeding practice than F1. In regards to genetic groups, G2 had significantly higher mean eating time than G1 genetic group. In case of season, S1 season had significantly longer eating time than the other three seasons.

The mean time spent on eating in the present study was higher than the observation of Christensen and Fehr (2000) and Braun *et al*. (2015) [12] in various breeds of dairy cows. But it was shorter than the report of Holinger (2012) [13] in Holstein Friesian crossbred cow (424 min/day) observed during the month of September. Lee *et al*. (2010) reported almost equal mean time spent on eating in growing Hanwoo steers for separate feeding and higher for TMR feeding practice than the present investigation.

Similarly, Prayitno *et al*. (2017) [14] also reported higher mean daily time spent on eating than the present investigation in lactating dairy cows. In conformity with the present finding, Braun *et al*. (2015) reported highly significant (P<0.01) effect of genetic group on eating time. He observed significantly more daily eating time in Brown Swiss cows (282 min) than in Holstein Friesian (256 min). In contrast to the present study, Holinger (2012) observed higher eating time during September (424 min) than December (295 min) in Holstein-Friesian crossbred cattle. In agreement with the present results, Lee *et al*. (2010) and Prayitno *et al*. (2017) anticipated more eating time in separate than TMR feeding practice. On the other hand, Beauchemin (2018) [15] reported that lactating dairy cows spend about 4.5 hours (270 min) per day for eating feeds.

The average eating rate of DM was higher in F1(2.87 kg/hour) than F2 (1.83 kg/hour). In regards to the genetic groups eating rate of DM was almost equal in G1 (2.26 kg/hour) and G2 (2.21 kg/hour). The average eating rates in different seasons were also almost similar. Lee *et al*. (2010) observed much lower eating rate in growing Hanwoo steers than the present investigation in dairy cows. However, he showed higher eating rate of DM in TMR (1.93 kg/hour) than the separate (1.25 kg/hour) feeding group.

The variation in time spent on eating by crossbred dairy cows might be due to different genetic makeup, quality of feed and method of feeding. Significantly higher eating time in Holstein-Friesian crossbred might be due to more feed consumption as its body weight was more than the Jersey crossbred cows. The TMR had significantly shorter eating time in spite of higher dry matter intake (DMI) than the separate feeding practice, which might be due to eating of all the components of feed in each bite and more eating rate. In regards to the seasonal variation, the eating time was significantly highest in pre-monsoon season for maximum feed intake due to more palatable soft grasses available during that period.

Time spent on ruminating

The mean daily time spent on ruminating was 413.62±14.84 (28.72%) and 383.63±1.07 (26.64%) min in F1 and F2 feeding practices; 393.71±14.86 (27.34%) and 403.53±1.48 (28.02%)min in G1 and G2 genetic groups and 410.36±1.55 (28.50%), 375.11±1.65 (26.05%), 400.68±9.71 (27.83%) and 408.34±1.66 (28.36%)min in S1, S2, S3 and S4 seasons, respectively [Table-1] with overall mean of 398.62±7.46 min (27.68%) per day. There was significant (P<0.05) effect of feeding practice on ruminating time and non-significant effect of both season and genetic group. The mean daily time spent on ruminating was observed to be significantly higher in F1 than F2 feeding practice. Lee *et al*. (2010) observed shorter mean daily time spent ruminating in Hanwoo steer. On the other hand, Holinger (2012), Braun *et al*. (2015) and Stone *et al*. (2017) found higher mean daily time spent for ruminating in dairy cows than the present investigation. In support of the present experimental findings, Lee *et al*. (2010) found that the mean daily ruminating time was shorter in separate (357.7 min) than TMR feeding (403.4 min) practice. In contrast to the present observation, Braun *et al*. (2015) reported highly significant (P<0.01) effect of genetic group on the ruminating time of dairy cows and Prayitno *et al*., (2017) got slightly higher mean ruminating time in component feeding than TMR feeding practice. Beauchemin (2018) found that the lactating dairy cows spend 7 hour (420 min) per day for ruminating, which was higher than the present value. Significantly higher ruminating time in TMR feeding practice might be due to maximum feed intake in better rumen environment created due to feeding concentrate and roughages simultaneously. Mahrous *et al*. (2006) found that increased concentrate in ration significantly reduced ruminating time. Apparently shortest ruminating time was observed during monsoon season, it might be due to negative relationship between temperature humidity index (THI) and ruminating time.

Time spent on resting

The mean daily time spent resting was 764.28±15.00 (53.08%) and 688.10±3.03 (47.78%) min in F1 and F2 feeding practice; 742.37±15.24 (51.55%) and 710.01±3.44 (49.31%) min in G1 and G2 genetic groups and 695.63±4.22 (48.31%), 784.12±3.56 (54.45%), 723.05±9.97 (50.21%) and 701.97±4.38 (48.75%) min in S1, S2, S3 and S4 seasons, respectively with overall mean value of 726.19±7.84 min (50.43%) per day [Table-1].

It was evident from the analysis of variance that the effect of feeding practice and season on mean daily time spent on resting was highly significant (P<0.01) and the effect of genetic group was significant (P<0.05). The mean daily resting time was significantly higher in F1 than F2 feeding practice and it was significantly higher in S2 than the other seasons. The mean daily resting time was significantly higher in G1than G2 genetic group.

The mean daily time spent on resting found in the present investigation was shorter than the observation of Lee *et al*. (2010) for separate feeding and higher for TMR feeding. It was longer than the observation of Grant and Albright (2000) [16], Gavojdian *et al*. (2009) [17] and Kumar (2010) [18] found shorter mean daily time spent on resting in lactating dairy cows. The resting time reported by Braun *et al*. (2015) in Brown Swiss cows was in agreement to the present investigation. Lee *et al*., (2010) showed that the mean resting time was slightly less in separate than TMR feeding group. However, Gavojdian *et al*. (2009) reported similar trend with the present findings in case of mean daily resting time during summer and winter.

Significantly longer mean daily time spent for resting during monsoon season might be due to decreased DMI and less eating and ruminating time as animal was under heat stress during this season. Significantly higher resting time in Jersey crossbred cows might be due to less total feed intake. In spite of higher DMI, significantly more resting time in TMR feeding practice might be due to maximum eating rate per bite. Reinhardt *et al*. (1978) [19] reported that the amount of time cattle spends resting depends on environmental conditions, time spent on ruminating, feeding (grazing) and genotype. Increase concentrate ration in the diet resulted in longer lying and standing idle in dairy cows by Mahrous, et al., (2006).

Conclusion

The time spent on eating was significantly influenced by feeding practice, genetic group and season. But the time spent on ruminating was affected by feeding practice only. The ruminating time was significantly longer on TMR than the conventional separate feeding practice.

Application of research: The TMR feeding in dairy cows may be practiced to increase rumination that results in improved digestibility and milk yield. During the summer season dry matter intake and rumination time in dairy cows should be increased through proper feeding management.

Research Category: Livestock Production and Management

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****Principal Investigator of research: Dr Jakir Hussain**
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References

[1] Christensen D.A. and Fehr M. (2000) *Advances in Dairy Technology* 12, 257-267.
[2] Lee S., Kim Y., Oh Y. and Kwak W. (2010) *Asian-Australasian Journal of Animal Science*, 23(11), 1469-1475.
[3] Mahrous U.E., Darwish M., Meneeh I.S. (2006) *Assiut University Bulletin for Environmental Research*, 9(1), 41-49.
[4] Miller-Cushon E. K., and DeVries T. J. (2017) *Journal of Dairy Science*, 100, 2213–2218.
[5] De Mol R. M., Goselink R. M. A., Van Riel J. W., Knijn H. M. and Van Knegsel A. T. M. (2016) *Proceeding, Precision Dairy Farming Conference, Wageningen Academic Publishers, Wageningen, the Netherlands*, 387–392.
[6] Schirmann K., Chapinal N., Weary D. M., Heuwieser W. and von Keyserlingk M. A. G. (2012) Journal of Dairy Science, 95, 3212-3217.
[7] Stone A. E., Jones B. W., Becker C. A. and Bewley J. M. (2017) *Journal of Dairy Science*, 100(3), 2395-2403.
[8] Soriani N., Panella G., and Calamari L. (2013) *Journal of Dairy Science*, 96, 5082–5094.
[9] Nikkhah A. and Kowsar R. (2012) *Turkish Journal of Veterinary and Animal Sciences*, 36(2), 123-129.
[10] Bhattacharya H.C., Borkakoti K. and Saikia R.S. (2001*) Agricultural Profile of Assam. In: Agriculture in Assam, Assam Agricultural University, Jorhat*-13.
[11] Anonymous (2009) *SAS 9.3 version, SAS Institute, Inc, Carry, NC, USA.*
[12] Braun U., Zurcher S. and Hassig M. (2015) *BMC Veterinary Research* 11, 231.

[13] Holinger M. (2012) *Master Thesis, submitted to Swiss Federal Institute of Technology, Institute of Agricultural Sciences (IAS), Animal Nutrition, Zurich, Switzerland*.
[14] Prayitno, C. H., Mukminah, N. and Jayanegara, A. (2017) *International Journal of Dairy Science*,12(1), 73-80.
[15] Beauchemin K. A. (2018) *Journal of Dairy Science*, 101, 4762-4784.
[16] Grant R. J. and Albright J. L. (2000) *Farm Animal Metabolism and Nutrition, Ed. J.P.F. D'Mello, CABI Publishing, UK*, 365-382.
[17] Gavojdian D., Cziszter L. T., Acatincăi S., Tripon I., Baul S., Ciobanu A., Popian C. and Bognar A. (2009) *Scientific Papers Animal Science and Biotechnologies*, 42(2), 564-567.
[18] Kumar C. (2010) *M.V.Sc. Thesis, submitted to NDRI, Karnal-132001(Haryana).*
[19] Reinhardt V., Mutiso F. M. and Reinhardt A. (1978) *Applied Animal Ethology*, 4, 261-71.
[20] NRC (2001) *Nutrient Requirements of Dairy Cattle. National Research Council. Seventh Rev. Edition, National Academy of Sciences, Washington, DC, USA*.