



## Comparative study of lameness in crossbred cows on sand and pucca floor

SUSHIL KUMAR SINGH<sup>1</sup>, S S LATHWAL<sup>2</sup>, SANDEEP KASWAN<sup>3</sup> and INDU DEVI<sup>4</sup>

ICAR-National Dairy Research Institute, Karnal, Haryana 132 001 India

Received: 22 August 2016; Accepted: 11 April 2017

**Key words:** Crossbred, Floor, Lameness, Rumen pH, Sand

Lameness is recognized as third most economic problem after mastitis and infertility in most dairy herds throughout the world (Blowey 1992). Affected animals show a drastic drop in body weight, decrease in milk yield, reduced reproductive efficiency as measured by an increase in number of inseminations per conception and increased service period, delayed ovarian cyclicity by 3.5 times than normal animals (Garbarino *et al.* 2004). Involuntary culling rate due to lameness was reported to be increased on an average by 1.7% (Whitaker *et al.* 2000). The total losses due to lameness in various forms (i.e. reduced milk yield, treatment costs, reduced feed intake, reduced fertility, increased cullings, replacement costs etc.) may go up to 4 to 5% of a typical farm income (Enting *et al.* 1997). Lameness is the result of an interaction between housing design, farm management, nutrition and animal characteristics (Cook and Nordlund 2007). Thus, in context to availability of scanty literature about the investigation of lameness, some factors (rumen pH, milk fat %, lying time, locomotion score etc.) were included in present study to find out their association with lameness, if any exists. Forty lactating crossbred Karan Fries cows maintained at LRC, NDRI, Karnal, were selected as experimental animals. Out of 40 cows selected, 20 were lame and rests 20 were normal based on visual analysis. Two types of floor were developed for required study viz. sand floor and brick on edge/pucca floor. Lame and normal cows (10 each) were kept on sand floor as well as pucca floor. The data for the study was generated by recording the ruminal acidity, milk fat percentage and lying time of all the 40 lactating KF cows kept on respective floors (sand and pucca) at fortnightly interval from all the cows for four month study. About 10–20 ml of rumen fluid was collected in capped test tubes after noon when animals had properly taken their feed and water after noon milking. Rumen pH was estimated using electronic pH meter having precision up to two decimal places. For estimation of milk fat percentage, 100–

150 ml of milk was collected in sampling bottles during milking and fat percentage was estimated using milk analyzer, Lactostar. Lying times were recorded (in h) after noon milking up to start of evening milking because this was the best time to observe resting behaviour of cows. Hence, duration of time for which lying time was observed was approximately six hours. Visual (manually) locomotion scoring was done for all the 40 lactating KF cows using the “Visually Analyzed Locomotion Scoring” system developed by Flower and Weary (2007). Collected data were analyzed using Least Square Analysis and DMRT test to determine the association of factors under study with lameness. Mean ruminal pH of normal and lame cows reared on sand floor for 4 months period are presented in Table 1. While on pucca floor, rumen pH of normal and lame cows are presented in

Table 1. Measurements of normal and lame KF cows on sand floor

Parameter	Lame cows	Normal cows	Overall mean
Locomotion score	3.05±0.27 <sup>a</sup>	1.60±0.27 <sup>b</sup>	2.32±0.19
Milk fat %	4.82±0.07	4.80±0.07	4.80±0.05
Rumen pH	5.97±0.03 <sup>a</sup>	6.50±0.03 <sup>b</sup>	6.23±0.02
Lying time (h)	2.64±0.06	2.55±0.06	2.60±0.05

Values are presented as mean±standard error and those with different letter as superscript in a row indicates significant difference (P<0.01).

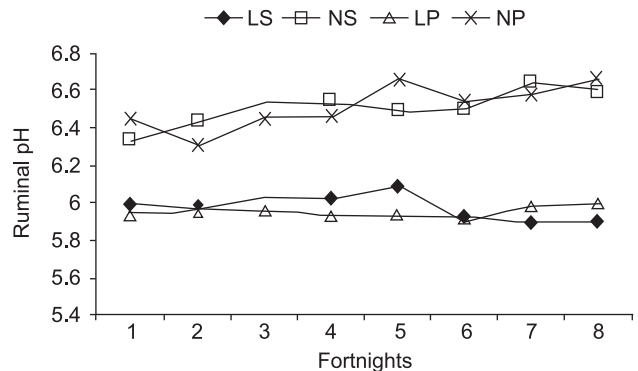


Fig. 1. Rumen pH of normal and lame KF cows on both floors during different fortnights. LS, Lame cows on sand; NS, normal cows on sand; LP, lame cows on pucca floor; NP, normal cows on pucca floor.

Present address: <sup>1,4</sup>PhD Scholar (sushil9415077763@gmail.com, indulathwal@gmail.com), <sup>2</sup>Principal Scientist (lathwal314@gmail.com), <sup>3</sup>Assistant Professor (deepu02vet@gmail.com), Department of Livestock Production Management, GADVASU, Ludhiana.

Table 2. Ruminal pH was significantly ( $P<0.01$ ) lower in lame cows than normal cows on both the floors but it did not differ significantly among the respective normal and lame cows on sand and pucca floor (Fig. 1). Reduced ruminal pH in lame cows was also supported in some of the earlier studies (Frain *et al.* 2002, Kleen *et al.* 2003, Krause and Oetzel 2005). They suggested that the state of lameness is associated with frequency, intensity and duration of systemic acidosis or reduced rumen pH. Gozho *et al.* (2005) reported that repeated bouts of sub-acute rumen acidosis results in lysis of ruminal bacteria releasing LPSE which triggers inflammatory response all over the body including hoof laminae resulting in excess wear and tear of hoof tissues. This finding of critical link of lame groups with low rumen pH (high acidity) appears to be associated with a persistent hypoperfusion (as a result of histamine and LPSE released during high rumen acidity) resulting in ischemia of digit, and finally lameness. Locomotion score was significantly ( $P<0.01$ ) higher in lame cows than normal cows on both the floors but it did not differ significantly among the respective lame and normal cows on sand and pucca floor. Values of these locomotion scores were as per Flower and Weary (2007). There was no significant difference with respect to fat percentage between lame and normal group of cows on both floors as well as between the floors. No similar literature could be found to compare with these findings. It indicates that milk fat percentage may not be a suitable indicator of lameness. There was no

significant difference in lying time between normal and lame cows on both the floors, although lame cows spent marginally more time than normal cows on both the floors. But significant difference ( $P<0.01$ ) in lying time was found between two types of floors i.e. both lame and normal cows spent more time in lying on sand floor in comparison to pucca floor (Fig. 2). This may be due to more comfort (more resting) for the lame as well as normal cows on sand floor as a result of being more softer (sand) than pucca floor. Difference of lying time between cows on sand and pucca floor was supported in several studies (Endres and Barberg 2007, Norring and Passillé 2008, Ito *et al.* 2009). In these studies, it was found that cows kept on soft floors spend more time lying than cows kept on concrete/hard floorings. The type of floor and rumen acidosis (low rumen pH) had significant effect on health (lameness) of KF crossbred lactating cows. More lying time was observed on soft bedding (sand floor) by lame and normal cows in comparison to pucca floor. From this study in crossbred lactating cows, it could be concluded that milk fat percentage and lying time may not be suitable parameters for indication of lameness. Whereas ruminal pH has association with lameness and reduced ruminal pH along with locomotion scoring could be used as reliable indicator for lameness in lactating cows.

#### SUMMARY

A total of 40 (20 normal and 20 lame) lactating crossbred Karan Fries cows were randomly divided, considering their age, stage of lactation and parity, into four equal groups so as to rear on sand and pucca floor. Therefore, each group of sand and pucca floor included 10 normal and 10 lame cows for comparative study. All the lactating cows were recorded for milk fat %, rumen pH and lying time at fortnightly interval to find out existence of any kind of association with lameness. Parameters were recorded from each animal at fortnightly interval for duration of four months. Locomotion score of all the animals was recorded by visual examination of posture and gait of cows. Rumen pH was significantly ( $P<0.01$ ) lower in lame KF cows in comparison to normal (non-lame) cows irrespective of type of floor. Similarly, locomotion score differed significantly ( $P<0.01$ ) between lame and normal KF cows on both the floors. There was no significant difference with respect to milk fat percentage and lying time between lame and normal group of cows on both the floors. However, cows on sand floor showed significantly ( $P<0.01$ ) higher lying time as compared to cows on pucca floor. Lower ruminal pH in lame cows could be one of the possible reasons for other complications related to lameness in lactating cows. Hence, soft bedding and diet management can be recommended for efficient management of crossbred lactating dairy animals with respect to hoof related problems.

Table 2. Measurements of normal and lame KF cows on pucca floor

Parameter	Lame	Normal	Overall mean
Locomotion score	3.15±0.23 <sup>a</sup>	1.65±0.23 <sup>b</sup>	2.40±0.16
Milk fat %	4.83±0.03	4.90±0.03	4.86±0.02
Rumen pH	5.95±0.04 <sup>a</sup>	6.51±0.04 <sup>b</sup>	6.23±0.03
Lying time (h)	1.42±0.05	1.41±0.05	1.42±0.03

Values are presented as mean±standard error error and those with different letter as superscript in a row indicates significant difference ( $P<0.01$ )

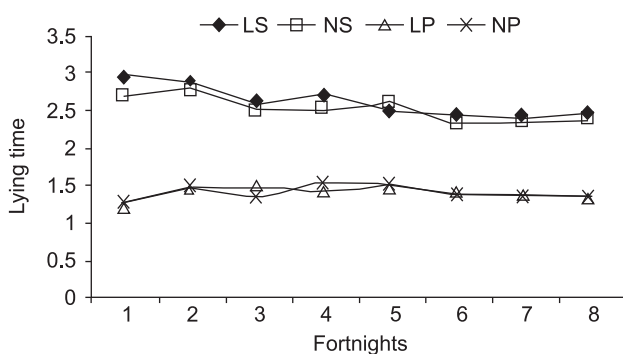


Fig. 2. Lying time (h) of normal and lame KF cows on both floors during different fortnights. LS, Lame cows on sand; NS, normal cows on sand; LP, lame cows on pucca floor; NP, normal cows on pucca floor

#### ACKNOWLEDGEMENT

All authors are highly thankful to Director, ICAR – NDRI, Karnal, for providing all necessary facilities for

conducting this study.

#### REFERENCES

- Blowey R. 1992. Cattle Lameness and Hoof Care, An Illustrated Guide. Farming Press, Ipswich, U.K.
- Cook N B and Nordlund V. 2007. The influence of the environment on dairy cow behaviour, claw health and herd lameness dynamics. *The Veterinary Journal* **179**: 360–69.
- Endres M I and Barberg A E. 2007. Behaviour of dairy cows in an alternative bedded-pack housing system. *Journal of Dairy Sciences* **90**: 4192–4200.
- Enting H, Kooij D, Dijkhuizen A A, Huirne R B M and Hoordhuizen–Stassen E N. 1997. Economic losses due to clinical lameness in dairy cattle. *Livestock Production Sciences* **49**: 259–67.
- Flower F C and Weary D M. 2007. Effect of hoof pathologies and floor type on subjective assessments of dairy cow gait. *Journal of Dairy Sciences* **89**: 139–46.
- Frain J M, Shirley J E, Titgemeyer E C, Park A F and Ethington R T. 2002. Impact of feeding a raw soybean hull-condensed corn steep liquor pellet on induced subacuteruminal acidosis in lactating cows. *Journal of Dairy Sciences* **85**: 2000–08.
- Garbarino E J, Hernandez J A, Shearer J K, Risco C A and Thatcher W W. 2004. Effect of lameness on ovarian activity in postpartum Holstein cows. *Journal of Dairy Sciences* **87**: 4123–31.
- Gozho G N, Plaizier J C, Krause D O, Kennedy A D and Wittenberg K M. 2005. Subacuteruminal acidosis induces ruminal lipopolysaccharide endotoxin release and triggers an inflammatory response. *Journal of Dairy Sciences* **88**: 1399–1403.
- Ito K, Weary D M and Von Keyserlingk M A G. 2009. Lying behavior: Assessing within-and between-herd variation in free-stall-housed dairy cows. *Journal of Dairy Sciences* **92**: 4412–20.
- Kleen J L, Hooijer G A, Rehage J and Noordhuizen J P. 2003. Subacute ruminal acidosis (SARA): a review. *Journal Veterinary Physiology, Pathology Clinical Medicine* **50**: 406–14.
- Krause K M and Oetzel G R. 2005. Inducing subacute ruminal acidosis in lactating dairy cows. *Journal of Dairy Sciences* **88**: 3633–39.
- Norring M and Passillé de A M. 2008. Effects of sand and straw bedding on the lying behavior, cleanliness, and hoof and hock injuries of dairy cows. *Journal of Dairy Sciences* **91**: 570–76.
- Tucker C B, Weary D M, von Keyserlingk M A G and Beauchemin K A. 2009. Cow comfort in tie-stalls: Increased depth of shavings or straw bedding increases lying time. *Journal of Dairy Sciences* **92**: 2684–90.
- Whitaker D A, Kelly J M and Smith S. 2000. Disposal and disease rates in 340 British dairy herds. *Veterinary Record* **146**: 363–67.