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Effect of Housing on Lameness, Body Condition Score and Udder Health of Sahiwal Dairy Cattle

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ABSTRACT

Background: Lameness is a huge problem in intensive livestock production, leading to enormous losses in terms of stress to animals, less reproductive ability and increased chances of mastitis. Zero grazing system is needed for today's intensive livestock production, but it has also led to increased lameness chances, unnecessarily increased body condition score and increased mastitis incidences. On the other hand, pasture grazing promotes cows to exhibit natural behaviour, which improves the health and welfare of animals.

Methods: Present study was aimed to find effect of housing on lameness, body score and udder health of Sahiwal cows. 204 Sahiwal cows were included in the study out of which 50 were reared on pasture and the rest were stall-fed. Lameness and body condition scoring was done and milk samples were collected using aseptic techniques.

Result: Clinical lameness is quite low in Sahiwal *i.e.* 6% with no significant difference between pasture grazing and stall fed animals. Stall fed animals revealed significantly more claw lesions than pasture grazed animals. Grazing animals revealed significantly lower body condition score than stall fed animals. In term of udder health, stall fed animals revealed higher odds of mastitis than pasture grazed animals.

Key words: Cow, Grazing, Lameness, Mastitis, Sahiwal.

INTRODUCTION

Lameness is a huge problem in intensive livestock production and a source of pain and distress for dairy cows (Whay *et al*. 1997). After fertility and mastitis, lameness ranks third in terms of financial losses in the milk industry (Booth *et al*. 2004). Zero grazing system is adopted in many parts of the world to adjust cow feed intake according to their production (Van *et al*. 2008) but now there is an increasing ethical demand for cows to have access to pasture which permits cows to exhibit natural behaviour, which improves the health and welfare of animals and there is a perception that grazing animals are less affected by lameness (Hund *et al*. 2019). But grazing on slippery grounds can also have harmful consequences like ligament injuries (Webster, 2002).

Standing time plays a pivotal role in lameness, in pasture-based dairy systems, cows stand for same time or even longer than housed cattle but the major difference is that, stall fed animals are kept on the concrete floor which have a detrimental effect on claw horn but grazing animals stand and roam on pastures, which is much more comfortable (Navarro *et al*. 2013).

Lameness is less prevalent during the grazing season than during indoor confinement (Gitau *et al*. 1996). Some digital disorders had a higher prevalence in zero-grazing dairy cows compared to others housing systems (Smits *et al*. 1992). Navarro *et al*. (2013) observed that double sole, sole ulcer and infectious diseases like digital dermatitis, interdigital dermatitis and inter digital phlegmon were more frequent in housed animals but white line disease, vertical horn fissures and wall abscesses were more prevalent in cattle on pasture.

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Sahiwal, an indigenous breed of Zebu cattle of northern India has maximum milk production among indigenous cattle breeds (Nivsarkar *et al*. 2013) and has many advantages over exotic and crossbred cattle breeds, like high parasite resistance, tolerance to high environmental temperature, drought resistance, good temperament, bloat tolerance, ease of calving and longevity. Sahiwal is also known for its A2 type milk which has medicinal value in human beings (Kalra *et al*. 2017). Despite of all of its characteristics very little improvement in production traits in this breed had been attempted over the years in our country. Most of the research related directly to mastitis, milk characteristics and lameness has been focused on exotic and crossbred species (Bran *et al*. 2019; Randhawa *et al*. 2006 and Singh, 2017). Now, Sahiwal cow is being promoted for milk production in the country. A recent study revealed 43.12 and 18.12 per cent prevalence of subclinical mastitis animal wise and quarter

wise, respectively (Singh, 2017). However, not a single study has been witnessed so far on lameness in Sahiwal cows. The objective of this study was to test whether there is a difference in lameness score of cows between stall fed and pasture grazed Sahiwal cows and to determine udder health in both housing systems.

MATERIALS AND METHODS

The present was conduted at Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) in the year 2020-2021.

Selection of animals and management practices

204 lactating Sahiwal dairy cows were included in the study from Sahiwal dairy farms at Noormahal, Kaljharani and Abohar in Punjab, India. The animals were stall fed at Noormahal and Kaljharani (n=154) farms which has concrete flooring in feeding area and kacha floor in other half and at Abohar (n=50) animals were pasture grazed with loose housing system in night time. Machine milking was done in one of the organized farm (Noormahal) whereas rest two farms practiced hand milking. Hoof trimming was not practiced in any of the farm. Stall fed animals were fed seasonal fodder and dry roughage. Silage feeding and mineral mixture supplementation were also done in organized farms. Pasture grazed animals were let loose in pastures for grazing and only milking animals were supplemented with concentrate and mineral mixture.

Sampling and observations

On the day of sampling, each animal was allowed to walk on a flat surface and the gait of each animal was examined using a five-point numerical scoring scale as formulated by Randhawa *et al*. (2008).

Body condition score

The body condition score was evaluated on a five-point scale same as described by Ferguson *et al*. (1994).

Milk sampling

Milk samples were collected after properly disinfection of the teat surface with 70% ethanol. Samples of milk were collected during evening milking time. About 10 mL to 20 mL of quarter foremilk were collected aseptically in separate sterile containers after squirting a few initial streams in all cows and cow composite sample were collected form individual buckets after full milking. The milk samples were placed in an ice box and carried to the laboratory where they were kept at 4°C in a refrigerator for further laboratory testing.

Analytical milk processing

The California Mastitis Test was conducted and interpreted as per the standard method (Pandit and Mehta, 1969) as cow side test with laboratory prepared CMT reagent. The somatic cell count in composite milk was analysed by a flow cytometry based automatic analyser (Somascope, Delta Instruments, Netherlands) and the results were expressed in$\times 10^3$ cells/mL. Electrical conductivity was recorded with the help of digital conductivity meter (Eutech Instruments, CON 700) and the results were expressed in milli Siemens per cm (mS/cm) at 25°C. The pH was recorded by electrical pH recorder (Systronics, µpH system 361). Milk composition, in terms of fat, SNF, protein and lactose, was estimated by a milk analyzer (Lactoscan, Bulgaria) in percentages.

Statistical analysis

Data were analysed using MINITAB statistical software to analyse the relationship of lameness and milk quality. Cows having healthy and/or latent quarter health status were categorized in the healthy group. However, cows having at least one quarter with specific or non-specific mastitis were considered as the mastitis group. Cows with a locomotion score '0' were grouped as non-lame and cows having locomotion scores 1 (mild), 2 (moderate) or 3 (severe) were considered as the lame group. Pearson chi-square test was applied to analyse relation between lameness and body condition score and lameness and mastitis. Data pertaining to somatic cell count (SCC) was log transformed (LnSCC) to obtain normal distribution and descriptive statistics (mean, standard error) were calculated using the general linear method. SCC log, TP, SNF, Lactose, Fat, EC and pH in different housing were also analysed by Pearson chi-square test. The results were expressed as statistically significant at $P<0.05$.

RESULTS AND DISCUSSION

The prevalence of clinical lameness was quite low in Sahiwal cows *i.e.* 6 per cent (in this overall study), which could be due to comparatively more innate immunity of these cows due to indigenous nature. Low milk production in Sahiwal cows in comparison to crossbred and exotic cows may lessen their demand for concentrates, thereby leading to lesser chances of sub-acute ruminal acidosis and associated laminitis. Moreover, Sahiwal cow's hooves were observed much harder undertaking claw trimming, in contrast to cross bred cow hooves (personal observation) and severity of lesions progresses much rapidly in soft hooves.

All the Sahiwal cows had black hooves and it was observed that black hooves are less prone to claw lesions than white hooves (Randhawa, 2006). Sahiwal cows were also observed to have more subcutaneous fat, as the majority of cows had BCS ≥3, more fat in body means they must be having more fat in digital cushion also, which must have provided cushioning effect to a great extent. Hence the animals were non lame on visual examination even though claw lesions were present.

Lameness score in relation to management system (free stall *vs.* pasture grazing)

Lameness score was not significantly affected ($P>0.05$) by housing management of the cows (Table 1). Cows in the pasture grazing system were equally prone to lameness odds as in free stalls. Overall, low prevalence of clinical lameness can contribute to this finding. The findings of

Table 1: Lameness score in different management systems.

LS		Management		P-value
		Pasture grazed	Stall fed	
0	N	35	88	
	Per cent	70%[a]	57.14%[a]	
1	N	13	56	0.268
	Per cent	26%[a]	36.36[a]	
2+3	N	2	10	
	Per cent	4.00[a]	6.49[a]	

[a,b,c] value of the different superscript showing significant difference (P<0.05).

Table 2: BCS in different management systems.

BCS		Management		P-Value
		Free range	Stall fed	
2	N	17	8	
	Per cent	34.00[a]	5.19[b]	
3	N	28	83	
	Per cent	56.00[a]	53.90[a]	
4	N	5	57	0.000
	Per cent	10[a]	37.01[b]	
5	N	0	6	
	Per cent	0[a]	3.9[b]	

[a,b,c] value of the different superscript showing significant difference (P<0.05).

Table 3: Prevalence of claw lesions in different feeding systems.

Lesion	Management		df	P-value
	Pasture grazed	Stall fed		
White line lesion	15.25%[a]	1.6%[a]	1	0.509
Under run sole	7.50%[a]	23.2%[b]	1	0.000
Cork screw	0.25%[a]	2.4%[b]	1	0.006
Double sole	0.75%[a]	0.4%[a]	1	0.392
Sole avulsion	0%[a]	1.95%[b]	1	0.005
Sole haemorrhage	0%[a]	1.4%[b]	1	0.024
Sole overgrowth	0.5%[a]	3.6%[b]	1	0.001
Heel erosion	0%[a]	0.8%[b]	1	0.017
Wall cracks	0%	0.3%	1	-
Toe haemorrhages	0%	0.2%	1	-
Normal hooves	79.3%[b]	59.9%[a]	1	0.000

[a,b,] value of the different superscript showing significant difference (P<0.05).

Table 4: Incidence of mastitis in different management systems.

Variables		Healthy cows	Mastitic	df	P-value
Pasture grazed	N (50)	37	13		
	Per cent	74%[a]	26%[b]		
Stall-fed	N (154)	85	69	1	0.018
	Per cent	55.19%[a]	44.81%[b]		

[a,b] value of the different superscript showing significant difference (P<0.05).

present study are similar to Laven and Lawrence (2006) who stated that grazing is not relevant for decreasing lameness prevalence. Haufe *et al*. (2012) also reported that beneficial effects of seasonal grazing on lesions such as sole haemorrhages, sole ulcer and heel-horn erosion are not necessarily verifiable and similarly, Bergsten *et al*. (2015) reported that longer periods of access to pasture during seasonal grazing do not generally improve claw health. In his study, Hund *et al*. (2019) also noticed that lameness (severe) problems continue to occur in pasture-based herds as in stall fed herds.

In contrast, Gitau *et al*. (1996) observed that the lameness incidence was significantly higher in zero-grazing *i.e*. housed cows compared to cows on pasture. Hernandez-Mendo *et al*. (2007) observed that even as brief time as 4 weeks continuously on pasture can improve the gait of lame cows significantly, particularly reluctance to bear weight and tracking up is improved. It was not determined if the effect was due to an improvement in claw health, increased exercise at pasture, or decreased joint stiffness, which causes less lameness incidences in grazing animals (Van der *et al*. 2005). Likewise Olmos *et al*. (2009) observed that the continuously grazing cows exhibited less abnormal locomotion and clinical lameness compared housed cows.

Body condition score in different management systems

Grazing animals had significantly lower (P<0.05) BCS than stall fed animals (Table 2). Feeding of TMR to stall-fed animals could be a reason for this finding as grass in pasture has lower nutrient content than TMR. More exercise in grazing animals than stall fed animals stall-fed animals could be another factor responsible for this finding.

Further, lactating cows on pasture might lose body weight by metabolizing their fat reserves to meet their energy requirement for lactation (Hernandez-Mendo *et al.* 2007). Similar, findings were observed by Mbugua *et al*. (1999) and Washburn *et al*. (2002) that stall-fed animals were of higher body weight and better condition than the grazed animals, throughout the lactation. However, Rust *et al*. (1995) did not observe body condition score differences in confinement cows and pastured cows.

Prevalence of claw lesions in different management systems

More lesions were present in the stall fed animals than pasture grazed animals (Table 3). White line lesions and double soles were prevalent equally in both the systems whereas all other lesions were found significantly more in stall-fed animals (P<0.05). Concrete flooring in stalls could be a precipitating factor for higher prevalence of lesions in stall fed animals as there is more wearing of horn on concrete flooring. The loose horn of the hooves gets flacked away in pasture grazing animals due to friction during walking, thus the mild lesions will get trimmed naturally but the stall fed animals have limited walking area that too hard abrasive concrete floor which aggravates the horn injury. Surprisingly, beside the presence of lesions animals in both groups were

Table 5: SCC, TP, lactose, fat, pH and EC in different housings.

Housing	logSCC		TP		SNF		Lactose		Fat		EC		pH	
	Mean± StDev	P	Mean± StDev	P	Mean± StDev	P	Mean± StDev	P	Mean± StDev	P	Mean± StDev	P	Mean± StDev	P
Pasture grazed	5.034± 0.389[a]	0.002	3.361± 0.199	0.981	8.88± 0.876	0.529	5.04± 0.379	0.648	5.40± 1.73	0.311	2.86± 1.11[a]	0.000	6.81± 0.336	0.111
Stall fed	5.248± 0.519[b]		3.362± 0.335		8.97± 0.959		5.07± 0.525		5.10± 1.91		3.99± 1.97[b]		6.89± 0.181	

[a,b] value of the different superscript showing significant difference (P<0.05).

(TP= Total protein, EC= Electrical conductivity, SNF= Solids not fat, SCC= Somatic cell count).

Table 6: CMT in different management systems.

Score		Management		P-value
		Pasture grazed	Stall fed	
0	N	183	509	0.008
	Per cent	26.45[a]	77.5[b]	
1	N	1	79	
	Per cent	15.05[a]	84.9[b]	
2+3	N	3	28	
	Per cent	9.98[a]	90.3[b]	

[a,b] value of the different superscript showing significant difference (P<0.05). (CMT= California mastitis test).

not lame clinically this reveals their higher threshold for pain perception and adaptation to local condition. This finding was supported by the observations of Smits *et al*. (1992) and Somers *et al*. (2003), who recorded that claw disorders have a higher prevalence in zero-grazing dairy cows exposed to concrete flooring than others.

In the contrast Bergsten *et al*. (2015) observed more claw disorders after pasture grazing in seasonally grazing animals. Navarro *et al*. (2013) also noticed that white line disease, vertical horn fissures and wall abscesses were more frequently found in lame cattle on pasture as compared to housed animals.

Incidence of mastitis in Sahiwal cows in different management systems

In present study, higher CMT scores (Table 4), SCC and EC (Table 5) revealed that significantly more (P<0.05) number of quarters of stall fed animals were having mastitis in comparison to the grazing animals (Table 6). This could be attributed to presence of underfoot slurry in the stall fed animals which acts as a source of infection for ascending infection in the udder. These finding are identical to the findings of Washburn *et al*. (2002) who recorded a decreased incidence of mastitis in loose-housed, pasture grazed cows when compared to tied, zero-grazing cows. On the contrary, Rust *et al*. (1995) did not found any difference of SCC and mastitis in grazing and stalled animals. Reason for non-significant change in milk fat percentage and other factors could be that, the milk composition was assessed in the composite milk in which fat is usually low and other factors could have got diluted.

Conclusion

The frequency of clinical lameness in Sahiwal cows was relatively low, at just 6 percent and housing management had no noticeable impact on lameness score. Compared to stall fed cattle, grazing animals had considerably lower BCS. White line lesions and double soles were similarly common in both systems, however all other foot lesions were observed considerably more prevalent in stall-fed animals than in pasture-grazed animals. Higher CMT scores, SCC and EC results in the current investigation showed that considerably more stall-fed animals' quarters had mastitis than did grazing animals.

Conflict of interest: None.

References

Bergsten, C., Telezhenko, E. and Ventorp, M. (2015). Influence of soft or hard floors before and after first calving on dairy heifer locomotion, claw and leg health. Animals. 5(3): 662-86.

Booth, C.J., Warnick, L.D., Gröhn, Y.T., Maizon, D.O., Guard, C.L., and Janssen, D. (2004). Effect of lameness on culling in dairy cows. Journal of Dairy Science. 87(12): 4115-22.

Bran, J.A., Costa, J.H., von Keyserlingk, M.A. and Hötzel, M.J. (2019). Factors associated with lameness prevalence in lactating cows housed in freestall and compost-bedded pack dairy farms in southern Brazil. Preventive Veterinary Medicine. 172: 104773.

Ferguson, J.D., Galligan, D.T. and Thousen, N. (1994). Principal descriptor of body condition score inholstein cows. Journal of Dairy Science. 77: 2695-703.

Gitau, T., McDermott, J.J. and Mbiuki, S.M. (1996). Prevalence, incidence and risk factors for lameness in dairy cattle in small-scale farms in Kikuyu Division, Kenya. Preventive Veterinary Medicine. 28(2): 101-15.

Haufe, H.C., Gygax, L., Wechsler, B., Stauffacher, M. and Friedli, K. (2012). Influence of floor surface and access to pasture on claw health in dairy cows kept in cubicle housing systems. Preventive Veterinary Medicine. 105(1-2): 85-92.

Hernandez-Mendo, O., Von Keyserlingk, M.A.G., Veira, D.M. and Weary, D.M. (2007). Effects of pasture on lameness in dairy cows. Journal of Dairy Science. 90(3): 1209-14.

Hund, A., Logroño, J.C., Ollhoff, R.D. and Kofler, J. (2019). Aspects of lameness in pasture based dairy systems. Veterinary Journal. 244: 83-90.

Kalra, A., Kanaujia, A., Jat, O., Saxena, M. and Varshney, A. (2017). A study to increase the shelf life of A2 milk of Sahiwal cows. International Journal of Livestock Research. 7(7): 48-50.

Laven, R.A. and Lawrence, K.R. (2006). An evaluation of the seasonality of veterinary treatments for lameness in UK dairy cattle. Journal of Dairy Science. 89(10): 3858-65.

Mbugua, P.N., Gachuiri, C.K., Wahome, R.G., Wanyoike, M.M., Abate, A., Munyua, S.J.M. and Kamau, J.M.Z. (1999). Performance of Dairy Cattle under Two Different Feeding Systems, as Practiced in Kiambu and Nyandarua District of Central Kenya (No. IAEA- TECDOC-1102).

Navarro, G., Green, L.E. and Tadich, N. (2013). Effect of lameness and lesion specific causes of lameness on time budgets of dairy cows at pasture and when housed. Veterinary Journal. 197(3): 788-93.

Nivsarkar, A.E., Vij, P.K. and Tantia, M.S. (2013). Sahiwal in "Animal Genetic Resources of India Cattle and Buffalo". Directorate of Knowledge Mahangement in Agriculture Indian Council of Agricultual Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. pp: 144-49.

Olmos, G., Boyle, L., Hanlon, A., Patton, J., Murphy, J.J. and Mee, J.F. (2009). Hoof disorders, locomotion ability and lying times of cubicle-housed compared to pasture-based dairy cows. Livestock Science. 125(2-3): 199-207.

Pandit, A.V. and Mehta, M.L. (1969). Sodium lauryl Sulphate as substitute for CMT reagent (California mastitis test reagent) for diagnosis of subclincal mastitis in buffaloes. Indian Veterinary Journal. 46: 111-19.

Randhawa, S.S. (2006). Prevalence, Biomechanics, Pathogenesis and clinico-therapeutic studies on foot lameness in dairy animals. Ph.D. Dissertation, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India.

Randhawa, S.S., Dua, K., Dhaliwal, P.S., Uppal, S.K. and Singh, S.T. (2008). Effect of formalin foot bathing ion the prevalence of foot lesions and conformational indices in dairy cattle. Veterinary Record. 163: 335-37.

Rust, J.W., Sheaffer, C.C., Eidman, V.R., Moon, R.D. and Mathison, R.D. (1995). Intensive rotational grazing for dairy cattle feeding. American Journal of Alternative Agriculture. 10: 147-51.

Singh, A. (2017). Studies on udder health and milk quality in Sahiwal dairy cows. M.V.Sc Thesis Submitted to Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India.

Smits, M.C.J, Frankena, K., Metz, J.H.M. and Noordhuizen, J.P.T.M. (1992). Prevalence of digital disorders in zero-grazing dairy cows. Livestock Production Science. 32(3): 231-44.

Somers, J.G.C.J., Frankena, K., Noordhuizen-Stassen, E. N. and Metz, J.H.M. (2003). Prevalence of claw disorders in Dutch dairy cows exposed to several floor systems. Journal of Dairy Science. 86(6): 2082-93.

Van den P.D.A, Vellinga, T.V., Johansen, A. and Kennedy, E. (2008). To graze or not to graze, that's the question. Grassland Science Europe. 13: 706-16.

Van der, W.E.H., Holzhauer, M., Ellen, E., Kamphuis, C. and De Jong, G. (2005). Genetic parameters for claw disorders in Dutch dairy cattle and correlations with conformation traits. Journal of Dairy Science. 88(10): 3672-78.

Washburn, S.P., White, S.L., Green Jr, J.T. and Benson, G.A. (2002). Reproduction, mastitis and body condition of seasonally pasture systems. Journal of Dairy Science. 85(1): 105-11.

Webster, A.J.F. (2002). Effects of housing practices on the development of foot lesions in dairy heifers in early lactation. Veterinary Record. 151(1): 9-12.

Whay, H.R., Waterman, A.E. and Webster, A.J.F. (1997). Associations between locomotion, claw lesions andnociceptive threshold in dairy heifers during the peri-partum period. Veterinary Journal. 154(2): 155-61.