Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 1178-1181
Received: 07-11-2019
Accepted: 09-12-2019

Anupam Soni
M.V.Sc. Scholar, Department of Livestock Production Management (CGKV), Durg, Chhattisgarh, India

Sharad Mishra
Director Extension Services and Professor, Dept. of Livestock Production Management (CGKV), Durg, Chhattisgarh, India

Rupal Pathak
Assistant Professor (LPM), Instructional Livestock Farm Complex (CGKV), Durg, Chhattisgarh, India

Kaiser Parveen
Assistant Professor, Department of Animal Genetics and Breeding (CGKV) Durg, Chhattisgarh, India

MD Bobade
Ph.D. Scholar, Department of Livestock Production Management (CGKV), Durg, Chhattisgarh, India

Ashutosh Dubey
Ph.D. Scholar, Department of Livestock Production Management (CGKV), Durg, Chhattisgarh, India

Aayush Yadav
Ph.D. Scholar, Department of Livestock Production Management (CGKV), Durg, Chhattisgarh, India

Corresponding Author:
Aayush Yadav
Ph.D. Scholar, Department of Livestock Production Management (CGKV), Durg, Chhattisgarh, India

Association of centre of gravity with various linear type traits at different physiological status of Sahiwal cattle

Anupam Soni, Sharad Mishra, Rupal Pathak, Kaiser Parveen, MD Bobade, Ashutosh Dubey and Aayush Yadav

Abstract
For present investigation, 86 purebred Sahiwal cattle of Bull Mother Experimental Farm and Government Cattle Breeding Farm located at the campus of College of Veterinary Science & Animal Husbandry, Anjora, Durg, Chhattisgarh were randomly divided into 5 groups on the basis of their physiological status *viz.* dry cows, early lactating cows, mid lactating cows, mid pregnant cows and late pregnant cows to measure the association between centre of gravity and linear type traits. All the linear type traits were measured and scored as per procedure described by International Committee for Animal Recording, 2018. During dry/non-pregnant stage, various significant correlations were observed for chest width/rear leg set-rear view (+ve; $p<0.01$), rump angle (+ve; $p<0.05$) and udder depth (-ve; $p<0.01$). During early lactation, for udder depth (+ve; $p<0.01$), Fore udder attachment (+ve; $p<0.05$) and chest width (-ve; $p<0.05$), during mid lactation for chest width (+ve; $p<0.01$), rear leg set-rear view/rear udder height (-ve; $p<0.05$) and during late pregnancy for chest width/udder cleft (+ve; $p<0.05$). The results implicated the careful selection of animals with good conformation and proper floor management to prevent lameness due to varying positions of centre of gravity is important.

Keywords: Centre of gravity, linear type traits, floor management and lameness

Introduction
Dairying is an important enterprise for many countries of the world. It has been an important source of income generation for rural families in the developing countries. The lameness and problems associated with poor conformation traits are one of the major concerns for successful dairy farming, which results in high degree of economic loss in terms of low milk yield. Lameness itself can reduce the milk production by 2.6 kg per day per animal (Warnick *et al*., 2001) [13]. Lameness is associated with varied aetiology where the deviation of centre of gravity could be the reason of lameness and / or associated with poor body conformation of dairy and draft cattle (Tadich *et al*., 2010) [12]. Other factors responsible for lameness in dairy cattle are interaction between floor surface (Haufe *et al*., 2009) [8], physical properties of floor (Franck *et al*., 2007) [7] and diet (O' Driscoll *et al*., 2007) [10].
The conformation or linear type traits of animal is one of the essential factors for the breeding and selection of dairy cattle. The longevity of animal largely depends on linear type traits especially the traits which are related to udder, feets and legs (Dubey *et al*., 2012) [5]. However, these traits vary with time period or physiological status of animals (Dubey and Mishra, 2013) [6].

Materials and methods
Present experiment was conducted on 86 purebred Sahiwal cattle maintained at Bull Mother Experimental Farm and Government Cattle Breeding Farm located at the premises of College of Veterinary Science & Animal Husbandry, Anjora, Durg (C.G.) and were selected on the basis of their age or physiological status *viz.* dry cows (N=21), Early lactation stage (N=17), mid lactation stage (N=15), mid pregnant stage (N=18) and at later stages of pregnancy (N=15) to measure associations between centre of gravity and the linear type traits. All the linear type traits were measured and scored as per procedure described by International Committee for Animal Recording (ICAR, 2018) [18].

Procedure employed for estimating centre of gravity
A pit of 8'x6.5'x2' was made for installation of weighing machine. The level of weighing machine was adjusted with level of ground because high or low level of machine with ground can affect the location of centre of gravity.

The body weight was measured in two sections, the weight of first half till umbilicus was measured first followed by the hind part i.e. from umbilicus to rest part of body and then entire body weight was taken with the help of digital weighing machine. Distance between front legs and rear legs were measured by using the measuring tape.

The Centre of gravity was calculated by using the following formula

$X_2 = M_1X_1/M_2$ (Bishop and Hay, 1979)

Where M_1 = Mass of front legs (in kg)

X_1= Distance between front and rear legs (in inches)

M_2 = Mass of rear legs (in kg)

X_2= Value to locate the point of centre of gravity

Statistical analysis: The Pearson's correlation coefficient between centre of gravity and linear type traits in different physiological status of animals were calculated by using formula given by Snedecor and Cochran (1989) [11].

Results and Discussion

In general, both positive and negative correlations were observed between centre of gravity and linear type traits that varied during various physiological stages of animal.

On dry cow/non pregnant cattle (N=21)

As shown in Table-1, the chest width was one of the important traits which influence the position of centre of gravity of dry cow. Since, in dry cows, forelimb bears more weight than hind limbs and centre of gravity lies near the front limbs, this may be one of the reasons for chest width to have significant (p<0.01) and positive (r = 0.53) correlation with centre of gravity in dry cows. Rear leg set (rear view) was significantly (p<0.01) and positively (r = 0.63) correlated with the centre of gravity. It may be due to the fact that most of the dry cows selected for study were in 3rd or 4th parity, so in such cows, rear legs bear more weight of reproductive organ especially uterus. Positive (r = 0.51) and significant (p<0.05) correlation was observed between rump angle and centre of gravity, which might be due to the reason that most of the cows selected were 3rd or 4th parity, which increases the slope of rump angle along with width of pelvic cavity. Udder depth was significantly (p<0.01) and negatively (r = -632) correlated with the centre of gravity. Since, the activities of secretory epithelial cells are very less in dry cows (Capuco *et al*., 1997) [3] along with very less rate of secretions. Moreover, empty (unfilled with milk) udder showed less weight, causing centre of gravity to remained at forelimb. Overall, the positive and moderate association centre of gravity dry cows with chest width, rump angle and rear leg set (rear view) indicated that aforesaid traits of helps in balancing the dry animals as the cows were neither in milk nor pregnant.

Table 1: Correlation between centre of gravity and linear type traits of dry cow of Sahiwal

S. No.	Linear type traits	Correlation	Remarks
1.	Stature	-0.05	Non Significant
2.	Chest width	0.53**	Significant
3.	Rump angle	0.51*	Significant
4.	Rump width	-0.14	Non Significant
5.	Udder depth	-0.632**	Significant
6.	Rear leg set (rear view)	0.634**	Significant
7.	Rear leg set (side view)	-0.106	Non Significant
8.	Udder cleft	0.185	Non Significant
9.	Rear udder height	0.40	Non Significant
10.	Fore udder attachment	0.31	Non Significant
11.	Front teat position	0.23	Non Significant

*Significant at p<0.05 level; **Significant at p<0.01 level

On early lactating Sahiwal cows (N=17)

The significant (p<0.01) and positive (r = 0.613) correlation of udder depth with centre of gravity in early lactating Sahiwal cows may be due to reason that as the cow achieved peak milk yield at this stage there is corresponding increase in weight of udder (Bertulat *et al*. 2012; Chapinal *et al*. 2009) [1]. Hence, the centre of gravity shifts towards the rear limb with increased depth of udder. In present study, the fore udder attachment was significantly (p<0.05) and positively (r = 0.035) correlation with centre of gravity. However, the correlation is very low. The frequency of strong udder attachment was 44.18 per cent. The strong attachment of udder can bear the weight of more amount of milk as compared to loose ones, hence, during peak milk production, the higher weight on rear side, simultaneously shifts centre of gravity towards rear. As it was observed that there were shift of centre of gravity towards rear limbs. Chest width was found significantly (p<0.01) and negatively (r = -0.399) correlated with centre of gravity in early lactating Sahiwal cow (Table-2). Early lactating cows, as an adjustment for increasing weight of rear part (due to heavy udder) tends to keeps its legs closure, so as to balance its body, hence the centre of gravity moves towards rear.

Table 2: Correlation between centre of gravity and linear type traits at early stage of lactation

S. No.	Linear type traits	Correlation	Remarks
1.	Stature	0.242	Non Significant
2.	Chest width	-0.399*	Significant
3.	Rump angle	0.183	Non Significant
4.	Rump width	-0.098	Non Significant
5.	Udder depth	0.613**	Significant
6.	Rear leg set (rear view)	-0.325	Non Significant
7.	Rear leg set (side view)	-0.511	Non Significant
8.	Udder cleft	0.266	Non Significant
9.	Rear udder height	0.431	Non Significant

10.	Fore udder attachment	0.35*	Significant
11.	Front teat position	0.001	Non Significant

*Significant at $p<0.05$ level; ** Significant at $p<0.01$ level

On mid lactating stage of Sahiwal cows (N=15)

As shown in Table-3, the chest width was found significant ($p<0.01$) and positively (r = 0.393) correlated with centre of gravity in mid lactating Sahiwal cows. Since, in mid lactation stage, after passing of peak milk yield production, the milk yield becomes less, hence, shifting of centre of gravity from rear to front was observed. Rear leg set (rear view) was found significant ($p<0.05$) and negatively (r = -0.447) correlated with centre of gravity in mid lactating Sahiwal cows. It may be due to the fact that the reduced weight of udder, causes simultaneous reduction in weight of rear legs, thus the centre of gravity moves from fore limb to hind limb. Rear udder height was found significant ($p<0.05$) and negatively (r = -0.219) correlated with centre of gravity in mid lactating Sahiwal cows. Since, udder of cow is less engorged with milk as compared to early stage, thus the secretory tissues become loose with increasing the stanchion mark, thereby reducing the height of rear udder along with shifting centre of gravity towards front. Overall, the negative, positive and low to moderate association between centre of gravity and linear type traits at mid lactation of Sahiwal cows help to balance the body of cows by shifting the point of centre of gravity towards rear limb. After mid lactation the point of centre of gravity shifts to forelimb.

Table 3: Correlation between centre of gravity and linear type traits at mid lactating stage of cattle

S. No.	Linear type traits	Correlation	Remarks
1	Stature	0.503	Non Significant
2	Chest width	0.393**	Significant
3	Rump angle	0.133	Non Significant
4	Rump width	-0.396	Non Significant
5	Udder depth	-0.267	Non Significant
6	Rear leg set (rear view)	-0.447*	Significant
7	Rear leg set (side view)	-0.676	Non Significant
8	Udder cleft	0.020	Non Significant
9	Rear udder height	-0.219*	Significant
10	Fore udder attachment	0.213	Non Significant
11	Front teat position	0.149	Non Significant

*Significant at $p<0.05$ level; ** Significant at $p<0.01$ level

On mid pregnancy stage of Sahiwal cows (N=18)

During mid pregnancy stage of Sahiwal cattle, both positive and negative correlations was observed, however, no significant correlation was observed between centre of gravity and linear type traits (Table-4). Since, the effect of conformation was non-significant on centre of gravity, hence it could be assumed that the body of animal is most balanced at this stage. This may be one of the reasons that the incidences of abortion are least during mid stage of pregnancy as compared to other stages.

Table 4: Correlation between centre of gravity and linear type traits at mid pregnant stage

S. No.	Linear type traits	Correlation	Remarks
1.	Stature	-0.250	Non Significant
2.	Chest width	-0.071	Non Significant
3.	Rump angle	-0.015	Non Significant
4.	Rump width	-0.080	Non Significant
5.	Udder depth	-0.385	Non Significant
6.	Rear leg set (rear view)	0.257	Non Significant
7.	Rear leg set (side view)	-0.349	Non Significant
8.	Udder cleft	-0.072	Non Significant
9.	Rear udder height	0.072	Non Significant
10.	Fore udder attachment	0.241	Non Significant
11.	Front teat position	0.121	Non Significant

*Significant at $p<0.05$ level; ** Significant at $p<0.01$ level

On late pregnancy stage of Sahiwal cows (N=15)

The chest width was significantly ($p<0.05$) and positively (r = 0.532) correlated with centre of gravity in late pregnant cows. It could be the reason that the advanced pregnant cows shifted more weight toward the rear because of maximum development of the foetus. Hence, the centre of gravity moves towards rear, so as to balance her body. Thus, chest width was wide then the centre of gravity maintained and reduced the risk of lameness. Udder cleft was found significant ($p<0.05$) and positively (r = 0.575) correlated with centre of gravity in late pregnant cows (Table-5). The cow prepares itself to fulfill the needs of its newly born young ones. As a preparation for this, its udder becomes swollen with increasing activity of secretory tissues and secretions of milk. This causes increase in weight of udder. The deep udder cleft is supposed to keep such heavy udder in balance, causing increase in the size of udder cleft. Overall, during late pregnancy the engorged udder and developed foetus resulted in shifting of point of centre of gravity maximum towards rear limb so as to balance the body of late pregnant Sahiwal cows.

Table 5: Correlation between centre of gravity and linear type traits at late pregnancy stage

S. No.	Linear type traits	Correlation	Remarks
1	Stature	0.171	Non Significant
2	Chest width	0.532*	Significant
3	Rump angle	0.298	Non Significant
4	Rump width	0.216	Non Significant
5	Udder depth	0.438	Non Significant
6	Rear leg set (rear view)	-0.420	Non Significant
7	Rear leg set (side view)	-0.084	Non Significant
8	Udder cleft	0.575*	Significant
9	Rear udder height	0.186	Non Significant
10	Fore udder attachment	0.394	Non Significant
11	Front teat position	0.464	Non Significant

*Significant at $p<0.05$ level; ** Significant at $p<0.01$ level

Conclusions

The results of significant ($p< 0.05$) and ($p< 0.01$), positive and negative associations of some linear type traits with centre of gravity could be attributed to balance the body resulted by shifting of centre of gravity during different physiological status of Sahiwal cattle. It could be narrated that the point of centre of gravity varied with different physiological conditions of the Sahiwal cows creating imbalance in the body. There are number of reasons of lameness in cattle. Whereas, lameness due to imbalance developed due to deviation of point of centre of gravity from its normal position could be one. Hence, the proper selection of animals with best body confirmation and stage specific floor management may reduce the incidences of lameness in dairy cattle.

References

1. Bertulat S, Fischer-Tenhagen C, Werner A, Heuwieser W. Validating a dynamometer for noninvasive measuring of udder firmness in dairy cows. Journal of Dairy Science. 2012; 9:6550-6556.
2. Bishop RD, Hay JG. Basketball: the mechanics of hanging in the air. Medicine and science in sports. 1979; 11(3):274-277.
3. Capuco AV, Akers RM, Smith JJ. Mammary growth in Holstein cows during the dry period: quantification of nucleic acids and histology. Journal of Dairy Science. 1997; 80:477-487.
4. Chapinal N, De Passillé AM, Rushen J. Weight distribution and gait in dairy cattle are affected by milking and late pregnancy. Journal of Dairy Science. 2009; 92:581-588.
5. Dubey A, Mishra S, Khune V, Sahu BK, Nandanwar AK. Improving Linear Type Traits to Improve Production Sustainability and Longevity in Purebred Sahiwal Cattle. J of Agri. Sci. & Tech. 2012; 2:636-639.
6. Dubey A, Mishra S. Effect of various genetic & non-genetic factors on linear type traits in Sahiwal cattle. E-Planet. 2013; 11(2):41-43.
7. Franck A, Opsomer G, de Kruif A, De Belie N. Frictional interactions between bovine claw and concrete floor. Biosystems Engineering. 2007; 96(4):565-580.
8. Haufe HC, Gygax L, Steiner B, Friedli K, Stauffacher M, Wechsler B. Influence of floor type in the walking area of cubicle housing systems on the behaviour of dairy cows. Applied Animal Behaviour Science, 2009, 116.
9. ICAR. Conformational recording of dairy cattle. Available at, 2018. www.icar.org/documents/……/ guidelines/.
10. O'Driscoll K, Boyle L, French P, Hanlon A. The effect of out-wintering pad design on hoof health and locomotion score of dairy cows. Journal of Dairy Science. 2007; 91:544-553.
11. Snedecor GW, Cochran WG. Statistical methods (seventh editions). Iowa, State University Press, Ames, Iowa (U.S.A), 1989.
12. Tadich N, Flor E, Green L. Associations between hoof lesions and locomotion score in 1098 unsound dairy cows. The Veterinary Journal. 2010; 184:60-65.
13. Warnick LD, Janssen D, Guard CL, Grohn YT. The effect of lameness on milk production in dairy cows. Journal of animal science. 2001; 84(9):1988-1997.