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Correlation of live body weight and linear type traits in Sahiwal cattle

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Abstract
Total 86 Sahiwal cows were selected for this study and record the body weight and also measured the linear type traits. It was observed the stature, rump angle, rear leg set rear view, udder cleft and fore udder attachment showed positively and significantly *(P*<0.05) correlated with body weight of cattle and chest width also showed positively and highly significantly (*P*<0.01) with body weight. On other hand, rear udder height showed negatively and significantly correlated with body weight.

Keywords: Body weight, traits, correlated, cattle

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. With the increase in human population, the demand for milk has also been increased (Tollens *et al*., 2004) [1]. Most of the cattle breeds of the tropics and subtropics are slow maturing and low milk producers. This is partly due to inheritance and partly due to the malnutrition, management and the environment to which they are exposed (Das *et al.*, 2003) [2].

The livestock sector is major allied sector in India contributing nearly 25.6% total value of output in agriculture which is nearly 4.11% of total GDP and comprised of 190.9 million cattle, out of which there are 122.9 million females and 67.9 million males (Anonymous, 2012) [3]. The contribution of milk production is by 40% of total milk production in India (Rajeshwaran and Naik, 2016) [4]. However, most of the female suffered from number of metabolic disorders, during its lactating phase. The lameness and the problems associated with poor conformation traits are predominant one. This results in high degree of economic loss in terms of low milk yield. Lameness itself can reduce the milk production (Warnick *et al*., 2001) [5].

Live body weight is an economic trait which helps in the selection of animals for breeding. Live body weight is one of the most important assets to harvest maximum output from milch animals. Weight of cow in proportion to its age and lactation period ensures good milk yield. Body weight of animals implies fair idea about future performance of calves and plays an important role in reproductive performance of dairy animals. Research from other countries indicates the usefulness of linear type traits as predictors of body weight (Veerkamp and Brotherstone, 1997; Koenen and Groen, 1998) [6, 7], health (Rogers *et al.*, 1991; Pryce *et al.*, 1998; Rupp and Boichard, 1999) [8, 9, 10] and fertility (Pryce *et al.*, 1998; Royal *et al.*, 2002) [9, 11] in dairy cattle.

Most of the lameness incidence begin from hoof disorder, and there are different factors associated with body conformation (Tadich *et al*., 2010) [12]. Other factors responsible for lameness in dairy cattle are interaction between floor surface (Haufe *et al*., 2009) [13], physical properties of floor (Franck *et al*., 2007) [14] and diet (O' Driscoll *et al*., 2007) [15]. The aim of this study to see the association between body weight and type traits in dairy cattle.

Materials and Methods
Source of data: Present experiment was conducted in a purebred Sahiwal cattle herd of Bull Mother Experimental Farm and Government Cattle Breeding Farm located at the campus of College of Veterinary Science & Animal Husbandry, Anjora, Durg (C.G.). A total of 86 purebred Sahiwal cattle were selected to record the whole body weight of animals and also to

record the linear type traits of selected cows. All the linear type traits were measured and scored as per procedure described by International Committee for Animal Recording (ICAR, 2018) [16].

Feeding and Management Practices

All the selected Sahiwal cows of the present investigation were kept under similar management system, i.e. double row conventional barn housing with concrete flooring. The animals were given green fodder, dry fodder and concentrate as per their requirement and standard feeding schedule. The green fodder supplied to the animal includes Berseem, MP Chari, Sudan grass and local grasses. Dry fodder consisted of paddy straw and wheat straw. The concentrate mixture was fed during morning and evening at the time of milking. Drinking water was made available *ad lib* to all animals. Milking was done by hand milking method. Milk yield was recorded during morning and evening. Deworming, vaccination and other health care practices were followed as per standard method.

Procedure employed for measurement of body weight and linear type traits

A weighing machine was installed by digging 8 feet long, 6.5 feet wide and 2 feet depth pit. The level of weighing machine was adjusted with level of ground. Then take weight of animal individual.

The linear type traits in Sahiwal cattle were measured as per the recommendation of ICAR (2018) [16].

1. **Stature:** It is a vertical distance from top of spine in between hip to ground without touching cattle. It was recorded in centimeter.
2. **Chest width:** It is horizontal distance between top of front legs from inside.
3. **Rump angle:** The angle of rump is measured from hip bone. When the cow was assessed from side, the slope from hip bone to pin bone was measured.
4. **Rump width:** It is distance between two pin bones assessed from behind.
5. **Rear leg set (side view):** The angle is measured at hock joint to claw assessed from the side.
6. **Rear leg set (rear view):** It was assessed from behind at the hock to fetlock.
7. **Udder depth:** It is difference in distance between from lower part of udder to hock joint.
8. **Rear udder height:** It is vertical distance between bottoms of vulva to milk secreting tissue.
9. **Udder cleft:** This trait was assessed from rear, depth of udder cleft measured at base of rear quarter with the help of 15 cm scale.
10. **Fore udder attachment:** It is attachment of fore udder with abdominal wall. This was assessed from side, the attachment was measured as angle, angle between udder and abdominal wall was measured.
11. **Front teat placement:** It was assessed from rear, the fore teat position measured from centre of quarter.

Statistical analysis: Further to see the relation correlation coefficient and regression between different linear type traits and body weight were done as per Snedecor and Cochran (1989) [17].

Results and Discussion: the results were depicted in Tables.

Table 1: Showing that correlation between body weight and linear type traits in Sahiwal cows

	BW	Stature	CW	RA	RW	UD	RLS RV	RLS SV	UC	RDH	FDA	FTP
BW	1											
Stature	0.26*	1										
CW	0.121**	0.1093**	1									
RA	0.213*	0.15339	-0.0672	1								
RW	0.0769	0.0020*	-0.1259*	0.07*	1							
UD	-0.195	0.0485	0.0191	0.100	-0.10	1						
RLS RV	0.251*	0.0707*	0.0272	0.150	0.079	-0.10*	1					
RLS SV	0.0508	0.05569	-0.0137	0.060	0.047	-0.097	0.0814	1				
UC	0.049*	0.06402	0.1000*	-0.06	-0.07	0.186*	-0.136	0.0450	1			
RDH	-0.052*	-0.01871	0.0446	-0.16	-0.01	0.225	0.037	0.009	-0.150	1		
FDA	0.128*	0.01914*	0.14214	0.04	0.01*	-0.220	0.2112	0.125	0.122	-0.3	1	
FTP	0.091	0.0657	0.1480	-0.06	0.20*	-0.053	-0.219	-0.076	0.172	-0.06	-0.05	1

*Significant at $P<0.05$ and ** Significant at $P<0.01$

CW: Chest width, RA: Rump angle, RW: Rump width, RLS RV: Rear leg set rear view, RLS SV: Rear leg set side view, UC: Udder cleft, RDH: Rear udder height, FDA: Fore udder attachment, FTP: Front teat position

In present investigation, the live body weight positively and significantly ($P<0.05$) correlated with stature, rump angle, rear leg set rear view and fore udder attachment. On other hand, negatively and significantly ($P<0.05$) correlated with rear udder height. Chest width was positively and significantly ($P<0.01$) correlated with body weight (Table.1). Among this, rump angle, rear leg set side view, front teat position positively and non significantly correlated with body weight. The correlation among the traits was found such as stature was positively and significantly ($P<0.01$) correlated with chest width. Stature also positively and significantly ($P<0.05$) correlated with rump width, rear leg set rear view and fore udder attachment. Similarly, chest width was negatively and significantly ($P<0.05$) correlated with rump width. Whereas, also found positively and significantly ($P<0.05$) correlated with udder cleft. According to Nsoso *et al.*, 2003 [18] live body weight showed strong positively correlated with chest width (r =0.937). Moro and Ruiz (1999) [19] showed that found a positive and low correlation between chest width and udder cleft (r =0.16). The live body measurements showed positive correlations with chest width (0.42 to 0.81) (Choy *et al.*, 2017) [20]. BW were most of the traits showed moderate to strongly positive correlation with stature, chest width, rump angle, rump width (Berry, 2004) [21].

The correlation between udder cleft and rear udder height, it might be the reason that central ligament is associated with more desirable udders with enhances the productive permanence of the cow in the herd, lead to less involuntary

culling due to undesirable physical characteristics (Corrales *et al.*,2011) [22]. Stature was found to be associated with udder cleft (Haile-Mariam *et al*., 2004) [23]. Wall *et al.*, 2005 [24] showed that negatively correlation between rump angle and udder cleft (r = -0.03) in Holstein cattle. A strong positively and significantly correlation between udder depth and fore-udder attachment (r = 0.92); cows with shallow udders possessed tighter fore-udder attachments. Cows with genetically stronger, shallower udders had more sickled rear legs, with low foot angles; these animals were faster milkers. According to Koenen, 1998 [7] showed that the positively association between body weight and rump width (r = 0.43) whereas, udder depth showed negatively and significantly correlated with body weight of cattle.

Analysis of regression coefficient for linear type traits and live body weight

The regression coefficient for live body weight with different linear type traits is given in Table 2. The results indicated that an increase in stature, chest width, rump angle, rump width, rear leg set rear view, udder cleft, rear udder height, fore udder attachment and front teat position would be increase the body weight. However, an increase in udder depth and rear leg set side view would be decrease in body weight.

Table 2: Regression of linear type traits and live body weight in Sahiwal cows

Linear type traits	Regression coefficient (Body Weight kg)
Intercept - 14.35068	
Stature	2.277022 ±1.147895
CW	0.90909 ±1.182618
RA	2.854027 ±1.577811
RW	0.364116 ±1.980115
UD	-2.95591 ±1.490297
RLS RV	7.375409 ±3.965672
RLS SV	-0.06634 ±0.621112
UC	5.763589 ±6.339937
RDH	0.658387 ±1.407755
FDA	0.072722 ±0.364546
FTP	3.980218 ±4.779121

CW: Chest width, RA: Rump angle, RW: Rump width, RLS RV: Rear leg set rear view, RLS SV: Rear leg set side view, UC: Udder cleft, RDH: Rear udder height, FDA: Fore udder attachment, FTP: Front teat position

Conclusion

It is concluded that the association between body weight and linear type traits may be varied according to change in their body weight and also their physiological status of the animals. Linear type traits may also used to predict the accurate body weight of animals. In present investigation, they showed the positively and significantly correlation between body weight and some linear type traits such stature, chest width, rump angle, rear leg set rear view, udder cleft and fore udder attachment. Only rear udder height was negatively correlated with body weight.

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