Indian Journal of Animal Sciences **90** (8): 1198–1200, August 2020/Short communication

Skin fold thickness and its association with milk production performance in Sahiwal cows

SWETA BANJARE[1], AJIT KUMAR SANTRA[1], KAISER PARVEEN[2]✉, SHARAD MISHRA[1] and NISHIMA SINGH[1]

Chhattisgarh Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh 492 006 India

Received: 14 June 2019; Accepted: 18 October 2019

Keywords: Milk yield, Sahiwal, Skin thickness, Udder thickness

There is a great variation in number of external morphometric characters as well as other economic traits among dairy animals in different breeds. One of the traits that may be associated with selection and judging of dairy animals for their economic character and performance is skin thickness (Barati *et al*. 2017). Skin has a major importance as an organ of adjustment between the animal and its climatic environment. In India, among all the milch breeds, Sahiwal is considered to be one of the important milch breeds and known for its higher milk production, resistance to tropical diseases, low cost of maintenance and high feed conversion efficiency. Though its original breeding tract lies in Montgomery district of Pakistan, the pure Sahiwal herds are maintained in only a few established farms in India. Bull Mother Experimental Farm, College of Veterinary Science and Animal Husbandry, Anjora, Durg is one of the farms in India that maintains pure Sahiwal animals. From early days, scientists have tried to establish a relationship between some external body characteristics and milk production, so that early selection of dairy animals is possible on the basis of this relationship. Hence, the present study was, therefore, undertaken to investigate the variability of skin thickness of Sahiwal cows in relation to their milk production.

The information on skin fold thickness, test day milk yield, total milk yield related to the present study was recorded from the Sahiwal animals maintained at Bull Mother Experimental Farm (BMEF), College of Veterinary Science and Animal Husbandry, Anjora, Durg. Eighty milking Sahiwal cows (range of first to fifth parity) that have completed their records of 305 days lactation with milk yield ≥500 kg and lactation length ≥100 days were selected. The skin fold thickness were measured from eight sites of animal body (Dhillod *et al.* 2017), viz. neck, dewlap, chest, abdomen, hind quarter, rump, udder and flank with the help of a Digital Vernier Calliper. The data on total lactation milk yield and daily milk yield was classified and coded on the basis of skin fold thickness of 8 regions (3 levels; thin, moderate and thick) and parity (5 levels; 1–5). The data collected for skin thickness were classified into thin, moderate and thick categories based on Struge's formula. Statistical analysis was done by least square analysis to compare the effect of different non-genetic factors on the production traits under study using the GLM function of Statistical Analysis System (SAS Institute Inc., version 9.2). The significance of the fixed effects was analyzed by using the Tukey test with a significance level of $P<0.05$.

The fixed linear model equation for the analysis of the effect of non-genetic factors was as follows:

$$Y_{ijklmnopqr} = \mu + P_i + SN_j + SD_k + SC_l + SA_m + SF_n + SH_o + SU_p + SR_q + e_{ijklmnopqr}$$

where $Y_{ijklmnopqr}$, total lactation and daily milk yield of r^{th} animal at i^{th} parity, j^{th} neck thickness, k^{th} dewlap thickness, l^{th} chest thickness, m^{th} abdomen thickness, n^{th} flank thickness, o^{th} hind quarter thickness, p^{th} udder thickness, q^{th} rump thickness; μ, overall least square mean; P_i, fixed effect of i^{th} parity; SN_j, fixed effect of j^{th} neck thickness; SD_k ,fixed effect of k^{th} dewlap thickness; SC_l , fixed effect of l^{th} chest thickness; SA_m, fixed effect of m^{th} abdomen thickness; SF_n, fixed effect of n^{th} flank thickness; SH_o, fixed effect of o^{th} hind quarter thickness; SU_p, fixed effect of p^{th} udder thickness; SR_q, fixed effect of r^{th} rump thickness (r=1–3); $e_{ijklmnopqr}$, random error which is NID (0, $\sigma^2 e$).

The correlation between milk yield and skin thickness of different regions, and regression of milk yield on skin thickness of different regions was estimated using the Statistical Analysis System (SAS Institute Inc., version 9.2).

The udder skin thickness was minimum followed by that in ascending order in the neck, dewlap, chest, hind quarter, abdomen, flank and rump regions of Sahiwal cows (Table 1). However, Hossain *et al.* (2016) in native cattle of Bangladesh reported that the skin was thickest over the head, neck, legs and mid-dorsal line and decreased towards the ventral surface of the body. The plane of nutrition might be the important factor in determining the extent to which the skin thickness of an individual differs from the breed

Present address: [1]Department of Livestock Production and Management; [2]Department of Animal Genetics and Breeding, College of Veterinary Science and Animal Husbandry, Durg. ✉Corresponding author email: kesuagb@yahoo.com

Table 1. Mean skin thickness (mm) at various regions in Sahiwal cows

Region	Mean±SE
Neck	3.44±0.06
Dewlap	3.49±0.06
Chest	3.53±0.06
Abdomen	4.53±0.08
Flank	5.62±0.12
HQ	4.07±0.07
Udder	2.45±0.04
Rump	6.63±0.17

Overall average skin thickness (4.22±0.06).

average. The plane of nutrition influences the thickness of adipose tissue layer and the expansion and consistency of the corium. It is also due to the fact that highly functional papillary layer of skin in Zebu cattle are significantly thinner. The follicles in this layer are more numerous than in the *Bos taurus* species (Dhillod *et al.* 2017). Other researchers (Katyatiya *et al.* 2017, Prabhakar *et al.* 2018) have shown that tropical cattle have significantly thinner skin than temperate breeds and the skin thickness in crossbred was found to be intermediate. The estimates of the skin fold thickness effect on total lactation milk yield and the average daily milk yield of Sahiwal cows are presented in Table 2. Skin thickness of abdomen and udder region has significant effect on the total lactation milk yield of Sahiwal cows. From the studies it can be concluded that the Sahiwal cows with high skin thickness of udder were found to be highest total milk production per lactation whereas the cows with thin skin thickness of abdomen were observed to produce more milk. However, the results also showed that the skin thickness of different body regions has no significant effect on the daily lactation milk yield of Sahiwal cows. The significant effect of different skin fold thickness on total lactation milk yield was also reported by Bharti *et al.* (2017) in Murrah buffalo, Prabhakar *et al.* (2018) in Tharparkar cattle, Kapandis and Thakur (2018) in Deoni × HF crossbred cows, Zhang *et al.* (2019) in Chinese Holstein crossbred cattle, Yadav *et al.* (2019), Gavan (2019) in HF cows respectively. The correlation coefficient between skin thickness of different eight sites and total milk yield and daily milk yield along with regression coefficient for total milk yield and daily milk yield with skin thickness of different regions is given in Table 3. The correlation coefficients between skin thickness of all the sites studied with total lactation milk yield and daily milk yield were found negative and not statistically significant, except for abdomen and udder skin thickness. The skin thickness of rump with milk yield in Sahiwal cows was observed to be maximum correlation (–0.273). It is possible that correlation between skin thickness with milk yield might vary according to the temperament of individual animal and breeds. The present findings as positive correlation of milk yield with different skin fold thickness was also reported by Kshatriya *et al.* (2009) in Kankrej

Table 2. Least Square mean (±SE) of total milk production (litre) and daily milk production (litre) in Sahiwal cows (fixed effects in model)

Effect		Mean±SE	Mean±SE
Overall mean		1596.92 (80)± 53.91	5.34 (80)± 0.19
Parity	1st	1579.70^{b} (16)± 100.51	5.17^{c} (16)± 0.37
	2nd	1607.44^{b} (16)± 104.68	5.30^{b} (16)± 0.38
	3rd	1650.20^{a} (16)± 103.03	5.47^{a} (16)± 0.38
	4th	1668.5^{a} (16)± 96.14	5.38^{b} (16)± 0.35
	5th	1478.74^{c} (16)± 96.83	5.37 ^{b} (16)± 0.35
Neck	Thin	1583.03 (31)± 105.66	5.42^{a} (31)± 0.39
	Moderate	1640.91 (30)± 63.60	5.48 (30)± 0.23
	Thick	1566.83 (19)± 171.81	5.11 (19)± 0.63
Dewlap	Thin	1673.41 (20)± 95.67	5.44 (20)± 0.35
	Moderate	1615.39 (29)± 92.12	5.55 (29)± 0.34
	Thick	1501.98 (31)± 73.53	5.02 (31)± 0.27
Chest	Thin	1467.18 (19)± 92.17	5.11 (19)± 0.34
	Moderate	1670.97 (29)± 80.33	5.43 (29)± 0.29
	Thick	1652.63 (32)± 82.83	5.48 (32)± 0.30
Abdomen	Thin	1680.57^{a} (21)± 99.94	5.46 (21)^{a}± 0.36
	Moderate	1640.78 ^{b} (33)± 79.51	5.39 (33)^{b}± 0.29
	Thick	1469.43 ^{c} (26)± 93.79	5.16 (26)^{c}± 0.34
Flank	Thin	1514.66 (22)± 86.47	4.99 (22)± 0.32
	Moderate	1694.29 (27)± 79.85	5.84 (27)± 0.29
	Thick	1581.81 (31)±94.27	5.19 (31)±0.34
HQ	Thin	1575.60 (25)± 86.02	5.27 (25)± 0.31
	Moderate	1601.55 (30)± 84.70	5.42 (30)± 0.31
	Thick	1613.63 (25)± 83.73	5.32 (25)± 0.30
Udder	Thin	1472.98 (21)± 93.52	5.11 (21)± 0.34
	Moderate	1560.04^{c} (30)± 75.48	5.20^{c} (30)± 0.27
	Thick	1757.75^{a} (29)± 83.58	5.71^{a} (29)± 0.30
Rump	Thin	1575.01^{b} (22)± 97.99	5.28^{b} (22)± 0.36
	Moderate	1581.03 (27)± 78.80	5.30 (27)± 0.29
	Thick	1634.73 (31)± 73.38	5.43 (31)± 0.27

Means bearing different superscripts among subclasses differed significantly at P<0.05.

Table 3. Correlation co-efficient and regression coefficients of different skin thickness with total milk yield and daily milk yield in Sahiwal cows

Skin thickness measurement site	Total milk yield	Daily milk yield
Neck	–0.136 –8.21±127.67	–0.137 –0.03±0.42
Dewlap	–0.155 –27.32±117.71	–0.155 –0.08±0.38
Chest	–0.056 17.28±97.83	–0.05 50.06±0.32
Abdomen	0.004 51.20±86.07	0.005 0.16±0.28
Flank	–0.049 4.46±54.62	–0.048 0.01±0.18
HQ	–0.183 –83.92±82.97	–0.186 –0.28±0.27
Udder	0.023 94.58±118.91	0.026 0.32±0.39
Rump	–0.275 –73.39±35.32	–0.273 –0.24±0.11

Upper values are correlation coefficients and lower values are regression coefficients.

crossbred cows, Patel *et al.* (2016) in crossbred cows and Zhang *et al.* (2019) in Chinese Holstein crossbred cattle. Regression analysis indicated that an increase in skin thickness by 1 mm at different places would decrease total lactation by 8 to 83 kg where as very less remarkable changes are noticed in daily milk yield (less than 0.5 kg). The present study is in agreement with Kapandis and Thakur (2018), Zhang *et al.* (2019),Yadav *et al.* (2019) and Gavan (2019) who reported that an increase in skin thickness by 1 mm at different sites would cause a decrease in average total lactation milk yield from 24 to 45 litre in crossbred cows and exotic cows like HF.

SUMMARY

The present experiment was conducted at Bull Mother Experimental Farm (BMEF), College of Veterinary Science and Animal Husbandry, Anjora to study the relationship between skin thickness and milk yield of Sahiwal cows. The overall mean skin thickness of neck, dewlap, chest, abdomen, flank, hind quarter, udder and rump was 3.44±0.06, 3.49±0.06, 3.53±0.06, 4.53±0.08, 5.62±0.12, 4.07±0.07, 2.45±0.04 and 6.63±0.17 mm respectively. Analysis of variance showed that that the effect of skin thickness was statistically significant (P<0.01) on total milk yield and daily milk yield. The findings of milk yield in relation to different categories of skin thickness, it was observed that cows total milk yield per lactation was highest for cows with low skin thickness of dewlap (1673.41±95.67 litre) and abdomen (1680.57±99.94 litre). The correlation coefficient between skin thickness of all the sites with daily milk yield was negatively correlated except for abdomen and udder region. Regression coefficient indicated that a decrease in skin thickness by 1 mm would cause an increase in average daily milk yield by 3 to 28 kg.

REFERENCES

Barati R, Singh R, Fahim A, Singh Y P, Ali N, Gupta A and David B M. 2017. Skin measurements in relation to milking traits in Murrah buffaloes. *Indian Journal of Animal Sciences* **87**(10): 1282–84.

Dhillod S, Kar D, Patil C S, Sahu S and Singh N. 2017. Study of the dairy characters of lactating Murrah buffaloes on the basis of body parts measurements. *Veterinary World* **10**(1): 17–21.

Gavan C. 2019. The skinfold thickness and its association with body condition score and milk production traits in Holstein Friesian cows. *Animal Science and Biotechnologies* **52**(1): 78–81.

Hossain M E, Uddin M, Shil S K, Kabir M H B, Mahmud M S and Islam K N. 2016. Histomorphometrical characterization of skin of native cattle (*Bos indicus*) in Bangladesh. *American Journal of Medical Biological Research* **4**(3): 53–65.

Katiyatiyaa C L F, Bradleyb G and Muchenjea V. 2017. Thermotolerance, health profile and cellular expression of HSP90AB1 in Nguni and Boran cows raised on natural pastures under tropical conditions. *Journal of Thermal Biology* **69**: 85–94.

Kapadnis P J and Thakur P N. 2018. Study on skin thickness in crossbreed cattle. *Asian Journal of Animal Science* **13**(2): 72–74.

Kshatriya P S, Trivedi M M and Dhami A J. 2009. Association of udder biometry and skin thickness with milk yield in Kankrej and crossbred cows. *Indian Journal of Field Veterinarian* **5**: 11–13.

Patel Y G, Trivedi M M, Rajpura R M, Savaliya F P and Parmar M. 2016. Udder and teat measurements and their relation with milk production in crossbred cows. *International Journal of Science Environment and Technology* **5**(5): 3048–54.

Prabhakar A, Rashid S A, Tomar A K S, Maurya V and Channa G P. 2018. Effect of coat characteristics on milk production and milk composition traits in Tharparkar cattle. *Journal of Entomology and Zoology Studies* **6**(5): 939–41.

Sturges H A. 1926. The choice of a class interval. *Journal of American Statistical Association* 65–66. DOI: 10.1080/01621459.1926.10502161.

SAS Institute. 1996. Statistics, Version 9.2. SAS Institute. Inc. Cary. NC, USA.

Yadav A, Sahu J, Patel P K and Dubey A. 2019. Skin thickness in relation to milk production in dairy animals: A short note. *Pharma Innovation Journal* **8**(3): 492–93.

Zhang H, Liu A, Li X, Xu W, Shi R, Luo H, Su G, Dong G, Guo G and Wang Y. 2019. Genetic analysis of skinfold thickness and its association with body condition score and milk production traits in Chinese Holstein population. *Journal of Dairy Science.*