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Skin Thickness in Relation to Milk Production of Crossbred Cows

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Abstract: The study was conducted at Bangladesh Agricultural University Dairy Farm, Mymensingh to find out the skin thickness in different regions of body of dairy cows and the relationship of skin thickness to milk yield. Twenty five crossbred milking cows of indigenous and Sahiwal were selected for experiment. The skin thickness was measured by Vernier calipers. The skin thickness of the same animals is varies at different regions of the body. The average skin thickness of neck, dewlap, chest, abdomen and hindquarter were 3.33, 4.12, 2.93, 4.23 and 4.20 mm, respectively and the average skin thickness was 4.20 ± 0.90 mm at the five different regions and the milk yield were negative and was significant ($p < 0.05$). The results of the present study indicated that 29% of the variation in milk yield of cows depend on skin thickness and 71% depends on another factors. Form the study it was found that milk production of low skin thickness group was higher then that of medium and high skin thickness group. This may be a fact that low skin thickness cows did not deposited extra fat in their body and utilized most of her energy for milk production.

Key words: Skin thickness, milk production crossbred, different region and relationship

Introduction

The present cattle population in Bangladesh is 23.4 million. Out of this cattle population, the number of milking cows in Bangladesh are 3.79 million which is 18 % of all cattle, 35% of heifers and 45 % of adult cows, of the total cows, only 1.09 percent were crossbred cows (BBS, 1986). The average milk production of our indigenous cattle is low compared to the crossbreds of cattle and its varies between 300 to 400 liters per lactation period of 180 to 240 days. On the other hand, milk yield of crossbred cows varies from 600 to 800 liters per lactation of 210 to 240 days (Islam and Olluzzaman, 1992). The cattle of Bangladesh are mostly of indigenous type (Bos indicus) with few crossbreds along with some pure breeds such as Sindhi, Sahiwal Jersey, Holstein-Friesian. The number of crossbred cattle is increasing day by day with the spread of artificial insemination practices throughout the country.

The external surface of the body of animals are covered by hairy skin. The skin and its appendages act as organ of protection, defense, excretion amd heart regulation and as an elaborate sense organ. Khachatryan (1987) reported that histological structures determining the expand ability, elasticity amd density of the skin different with milk yield. It was suggested that skin thickness would be of little use in selection of buffaloes for increased milk yield (Namjoshi and Katpatal, 1983). Skin is also an ideal organ in which to demonstrate sensitization (Montagna *et al.*, 1972). Furthermore, since certain reactions are produced predominantly or exclusively in skin, it is an excellent organ for investigating the biologic activities of antibodies. Skin of the domesticated animals has an extra economic importance as it provides industrial raw materials for the manufacture of various items of daily uses. Apart from the devaluation of leather, skin diseases cause loss of condition, milk production, draft power and market value of the animals.

Various genetic groups of cattle produce milk to different environmental conditions (Bonsma, 1949) and have different skin thickness. Conflicting reports have been published regarding the relationship of skin thickness with the milk production. It is essential to know the skin thickness of dairy breeds. In the developed countries researchers have been undertaken to study the skin thickness in relation to milk production. Inspite the importance of skin mentioned above no scientific work on the cattle of Bangladesh has been done. The milk yield is the trait of major economic importance in dairy animals. The net economic return is, however, determined by their lifetime performance. The thickness of skin is the important factor to determine performance of a cow.

So, on the basis of above discussion, the present study was therefore undertaken the objectives were as follows:

I. To find out the skin thickness at different regions of crossbred cows
II. To investigate and determine the relationship between milk yields and skin thickness at five different regions of cows

Materials and Methods

The experiment was conducted at Bangladesh Agricultural University Dairy Farm, Mymensingh, to study the relationship between milk yield and skin thickness of crossbred cows. The methods and procedure are described in following captions.

Experimental animals: Twenty five crossbred milking cows at Bangladesh Agricultural University Dairy Farm, Mymensingh having no similarity of milk production and body size were used in this study. That cows was selected which has completed at least three lactation and always same management and health care was taken for husbandry.

Collection of information: Daily milk yield was recorded for all the 25 cows under the records for milk drawn by hand twice a day in the pail were complied into daily yield. Only normal lactating crossbred cows were included. Total milk yield of two normal milking time i.e. morning and evening milk yield were calculated to get the actual milk yield per day of individual cows. The average milk yield of morning, evening and average milk yield litre/day was utilized.

Measuring the thickness of skin: The area of skin measurement was carefully folder and lifted up while measuring the skin fold thickness so that it may not be too much stretched and the pressure exerted at the jaws of the Vernier calipers may remain uniform as far as possible. Minimizing the error of the skin thickness erves at five different regions of the of the body. All the

Table 1: Average thickness of different regions of cows

Skin thickness of different sites (mm)					F	Level of significance
Neck	Dewlap	Chest	Abdomen	Hindquarter		
2.95	5.13	2.40	5.80	4.63		
2.90	3.42	3.29	3.50	5.51		
3.90	4.96	2.90	4.90	6.16		
4.34	4.72	3.17	5.16	5.09		
2.54	3.70	3.35	3.42	4.28		
2.92	4.53	2.51	3.45	4.13		
3.19	3.24	2.71	4.04	4.37		
5.31	4.92	4.47	5.24	4.35		
3.64	4.43	3.73	3.72	3.61		
3.50	4.17	3.02	3.02	4.35		
2.75	3.63	2.05	3.16	4.27		
2.53	3.16	2.40	3.32	2.85		
3.09	4.71	3.39	4.17	2.80		
3.18	3.45	3.70	3.50	3.94		
2.70	3.95	2.44	3.72	4.10		
3.33	4.25	2.84	5.94	5.48	17.30**	(p<0.01)
3.39	3.80	2.46	3.95	4.03		
3.87	4.16	2.19	3.33	3.77		
2.55	3.20	2.34	3.75	3.41		
3.05	4.24	3.07	3.91	4.04		
3.31	4.20	3.06	4.72	3.46		
3.50	5.48	3.52	4.61	5.24		
3.91	3.54	2.76	3.94	3.64		
2.68	3.05	2.76	4.56	3.50		
4.22	5.06	3.56	5.56	4.27		
83.26	102.99	73.18	105.74	104.99		
3.33	4.119	2.927	4.229	4.199		
(X)	(X)	(X)	(X)	(X)		

** = Significant at 1% level of probability, X = Mean

Table 2: Correlation co-efficient (r) of skin thickness with morning evening and average milk yield

Skin thickness measurements sites	Morning corr. Co-eff. (r) Corr. Co-eff (r)	Evening corr. Co-eff. (r) Corr. Co-eff (r)	Milk yield per day Corr. Co-eff. (r)
Neck	-0.321±0.16	-0.126±0.03	-0.545±0.12
Dewlap	-0.388±0.21	-0.261±0.08	-0.304±0.11
Chest	-0.435±0.17	-0.209±0.04	-0.409±0.10
Abdomen	-0.409±0.20	-0.204±0.05	-0.383±0.08
Hind quarter	-0.518±0.25	-0.431±0.10	-0.562±0.21
Average thickness	-0.568±0.21	-0.280±0.06	-0.537±0.23

Table 3: Co-efficient of determination (r) of different skin thickness with milk yield

Skin thickness measurement sites	Morning Co-eff. of deter (r)	Evening Co-eff. of deter (r)	Average Co-eff. of deter (r)
Neck	0.103	0.015	0.297
Dewlap	0.150	0.068	0.092
Chest	0.189	0.043	0.167
Abdomen	0.168	0.041	0.146
Hind quarter	0.268	0.185	0.315
Average	0.322	0.078	0.288

Table 4: Regression co-efficient (b) and intercept (a) of different skin thickness with morning, evening and average milk yield (Y = a + bx)

Skin thickness Measurement sites	Morning	Evening		Average milk production		
	(b)	(a)	(b)	(a)	(b)	(a)
Neck	-0.201	3.366	-0.043	1.521	-0.458	4.775
Dewlap	-0.228	3.639	0.008	1.411	-0.204	4.252
Chest	0.325	3.649	-0.085	1.629	-0.411	4.465
Abdomen	-0.210	3.594	-0.057	1.622	-0.264	4.388
Hind quarter	-0.310	3.65	-0.118	1.875	-0.377	4.850
Average thickness	-0.446	3.70	-0.120	1.831	-0.568	5.393

Table 5: Regression co-efficient of different skin thickness with average lactation yield

Skin thickness Measurement sites	Morning (it./mm)	Evening (it./mm)	Milk yield (it./mm)
Neck	-45.22	-9.67	-103.05
Dewlap	-51.3	-1.80	-56.00
Chest	-73.12	-19.12	-91.47
Abdomen	-47.25	-12.82	-59.40
Hind quarter	-70.00	-26.55	-84.82
Average	-100.35	-27.00	-127.35

Table 6: Skin thickness in relation to milk production (litre) from different regions of cows

Parameter	Period	Skin thickness			SED
		2.53-3.45	3.46-4.39	4.40-5.31	
Neck	Morning	2.09	1.96	1.7	0.350^{NS}
	Evening	1.229	1.32	0.945	0.180^{NS}
	Average milk yield	3.323	3.282	2.645	0.461^{NS}
		3.05-3.87	3.88-4.79	4.80-5.54	
Dewlap	Morning	2.149	2.067	1.694	0.248^{NS}
	Evening	1.26	1.204	1.236	0.148^{NS}
	Average milk Yield	3.409	3.271	2.93	0.349^{NS}
		2.05-2.89	2.90-3.69	3.70-4.46	
Chest	Morning	2.209	1.788	2.20	0.405^{NS}
	Evening	1.288	1.136	1.775	0.184^{NS}
	Average milk Yield	3.44	2.925	3.475	0.428^{NS}
		3.31-4.19	4.20-5.0	5.10-5.93	
Abdomen	Morning	2.168	1.85	1.878	0.269^{NS}
	Evening	1.272	1.231	1.122	0.150^{NS}
	Average milk Yield	3.44	3.08	2.956	0.355^{NS}
		2.80-3.99	4.0-5.0	5.1-6.16	
Hind quarter	Morning	2.208	2.045	1.65	0.238*
	Evening	1.345	1.226	1.044	0.131*
	Average milk Yield	3.554	3.271	2.694	0.304*
		2.84-3.51	3.52-4.18	4.19-4.85	
Average skin	Morning	2.184	2.082	1.691	0.234*
Thickness	Evening	1.27	1.257	1.136	0.141^{NS}
	Average milk Yield	3.45	3.339	2.828	0.319^{NS}

*Significant at 5% level of probability, NS = Non significant

regions were measured to the accuracy of 0.1 cm. For getting the accurate value all the measurements were taken three times in every regions of the body in each cow and it was double the actual thickness. To get the thickness of skin fold two divided fitness.

Neck: At a point where two imaginary liens passing though length and width of the neck meat

Dewlap: Mid-ventral point of dewlap

Chest : Where a vertical line at the level of the heart meats the middle one of three lines drawn horizontally to divide one side of barrel into four horizontal compartments

Abdomen: Parallel to chest at the same level with umbilicus and

Hind quarter: Parallel to haunch and about three inches below the pin bone

Statistical analysis: Statistical analysis such as variance, mean, standard deviation, correlation coefficient, regression coefficient and coefficient of determination (r) were done to get some clean picture from the collected data. The recorded and calculated data were analyzed using Completely Randomized Design (CRD) for comparison of means among the treatments.

Results and Discussion

Skin thickness of crossbred cows: The skin thickness were measured from five regions of each crossbred (Indigenous X Sahiwal) cow. The skin thickness of neck varied from 2.49 to 5.37 mm experimental cows. The minimum, maximum and the mean thickness of neck were 2.49, 5.37 and 3.33 + 0.8 mm. respectively. The minimum, maximum and the mean skin thickness of Dewlap were 3.00, 5.52 and 4.12 + 08 mm, respectively. It was reported that the thickness of dewlap was thicker than the neck. On the other hand, the skin thickness

of chest was thinner than dewlap and neck. The minimum maximum and the mean skin thickness of chest were thicker than the neck. On the other hand, the skin thickness of chest was 2.00, 4.50 and 2.93+0.06 mm. respectively, The minimum, maximum and the mean skin thickness of abdomen were 3.10, 6.02 and 4.23+0.09 mm respectively and the minimum, maximum and the mean skin thickness of hindquarter were 2.75, 8.21 and 4.20+0.09 mm. respectively. It was found that the thickness of dewlap, abdomen and hindquarter were almost similar but the thickness of neck was medium and the thickness of chest was the lowest. This variation in skin thickness in the present investigation was considered to be due to management and climatic influences.

The results of present study were agreed by Prajapati *et al*. (1993). They reported that the mean values of skin fold thickness was 9.82 mm blow neck 9.69 mm middle of neck 14.35 mm in thoracic region and 15.17 mm in flank region. Skin fold thickness was lower in the first than subsequent lactation's. The thickness of skin increased from upper to lower and anterior to posterior regions of the body and was thicker during the summer than in winter or monsoon season. They also reported that the correlation's of these measurements with milk yields were not significant. Manna (1973) found the average skin thickness of local cattle was 3.45 mm. Many other researchers have shown that tropical cattle having significantly thinner skin than temperate breeds and the skin thickness in crossbreds was found to be intermediate.

Bangladesh is a sub-tropical country and here temperature is high in maximum time. Tropical cattle having significantly thinner skin than temperate breeds and the skin thickness in crossbreeds was found to be intermediate (Walker, 1957). In the same climatic conditions, thickness of skin may be very in male and female. Goldsberry and Calhoun (1959) found thickness in both male and female of Herefords and in Aberdeen angus the male has a thicker skin than that of female. The thickest of skin is low (8 mm) in male than female (9.5 mm) in ventral brisket of Hereford. Thickness of skin tissue and of fleece were similar regardless of diet (Mercik *et al*., 1988). Skin of younger animals are thin and of insufficient strength and the skins of matured animals are too thick and sufficient strength.

A comparative analysis on skin thickness of different regions of body of cows were analyzed and shown in Table 1. From the Table 1 it is observed that average skin thickness of neck, dewlap, chest, abdomen and hindquarters of cows were 3.33, 4.12, 2.93, 4.23 and 4.20 mm respectively. Statistical analysis showed that skin thickness of different region of body differ significantly ($p<0.01$) highest and lowest skin thickness was found in hindquarter and chest region respectively. It was similar to the work of Copenhaver and Johnson (1964) from his experiment it was observed that skin thickness of dorsal or external surface were thinner on the ventral surfaces.

Effect of milk yield: The average milk yield (cow/day) over a period of second and third lactation are normally varied. It was said that 3rd lactation milk yield is higher than 2nd lactation. Gradually increase in lactation yield from first to fourth were reported by Mudgal *et al*. (1990); in crossbreeds from first to fifth lactation by Chowdhary and Barhat (1979) reported that milk yield for the Deshi Zebu cattle of Astern India and Bangladesh gradually increase from first to the third lactation with a little change thereafter. Generally increase from first to second lactation is the largest between any two consecutive lactation's, which does not coincides with the present figures. In the early lactation all the female animals were not only in production stage but were also in growing stage and both with the processes lead to drain of energy reserve of the body. Another important cause of gradual increase to upward lactation order may be the culling of inferior producer in the earlier lactation. The maximum yield is expected when cow have grown fully at about 3rd to 4th lactation in crossbred cattle. Chowdhary and Barhat (1979) have shown a gradual increase in milk yield of the cow from the first lactation till such time that the lactation maturity was attained. It was also reported that the rate of increase in lactation yields and yields per day of lactation decreased with increasing age. They, however, reported that crossbred attained their full physiological maturity by the fifty lactation.

Relationship between milk yields and skin thickness: The correlation co-efficient between skin thickness at the different 5 regions and the milk yield are shown in Table 2. The correlation co-efficient between the skin thickness of neck, dewlap, chest, abdomen, hindquarter and average thickness of skin with average milk production (yield) were $r = 0.545+0.12$, $-0.304+0.11$, $r = -0.409+0.10$, $r = -0.383+0.08$, $r = -0.562+0.21$ and $r = -0.537+0.23$ respectively (Table 2). The correlation co-efficient (r) between skin and average milk yield were found negative correlation. Skin thickness of dewlap in crossbred cows showed minimum correlation ($r=-0.562+0.21$) in case average milk yields, ($r = -0.518+0.254$) in morning milk yield and ($r = -0.43+0.10$) in evening milk yield. The correlation coefficient (r) between average skin thickness with present milk yield was $r = -0.545+0.124$. It was also negative correlation. From this study it was reported that if the in dependable variable (skin thickness increase, milk production would be decreased.

Bhatnagar and Kumar (1980) found the correlation co-efficient (r) of neck, dewlap, chest, abdomen, rump, hindquarter and udder with average lactation yield of Sahiwal cows were -0.263 + 0.145 -0.284 +0.145, -0.441+0.135, -0.460+0.134, -0.332+0.142, 0.356+0.141 and -0.440 + 0.135 respectively and incase of Brown Swiss X Sahiwal cows were -0.269 + 0.094, -0.299 + 0.093, -0.200 + 0.096, -0.250 + 0.094, -0.216 + 0.095, -0.249 + 0.095 and -0.258 + 0.04 respectively. This result partially agreed with the present study.

On the other hand, Deshi and Sharma (1962) observed in Hariana cattle no correlation between skin thickness and milk production. It is possible that the correlation between these two characters might vary according to the dairy temperament of breed. Variability in the average lactation yield due to the skin thickness observed at different five regions for the crossbred cows did not seem to high. Kadiev (1973) found the only significant values for skin thickness over the shoulder (0.126), second lactation milk yields (0.123). Skin thickness was not significantly correlated with only of the performance trait. On the other hand, Rahman and Gill (1991) found a highly significant negative correlation between skin thickness of mammary gland and test milk yield.

The co-efficient of determinations indicate that skin thickness was responsible for 10 to 32% variability in mil yield in morning 1.5 to 18.5% variability in evening and 9 to 31% in average milk yield of crossbred cows. It was showed that the co-efficient of determination (r) of dewlap with milk yield is the lowest (r = 0.092). It means, dewlap is low responsible (9 percent) for variability in milk yield. On the other hand, hindquarter is the high responsible (31.5%) for variability in milk yield. Finally the co-efficient of determination indicate that skin thickness was responsible for 29 percent in milk yield in indigenous x Sahiwal crossbred cows (Table 3). It reported from the study that 29% of the variation in milk yield of cows depends on skin thickness and 71% depends on other factors.

Simple regression analysis of peak yield was able to explain 35 percent variation (r = 0.35) being significant) in first lactation milk yield reported by Shive *et al*. (1995). In the multiple linear regression analysis of different body measurement (included average skin thickness)were able to explain only 12.9% of variation (r = 0.129) in first lactation milk yield but when the body length was excluded from the explanatory variables, the rest of the characters were able to explain 12.3% of the variation in the first lactation milk yield (Table 4).

The regression equation for average milk yield and the skin thickness of neck, dewlap, chest, abdomen, hindquarter and average thickness are Y = 4.775 - 0.458x, Y = 4.252 - 0.240x, Y = 4.850 - 0.377x and Y = 5.393 - 0.566x (Table 5) respectively. Simple regression analysis of skin thickness (x) in dependable variable on milk yield (Y) dependable variable.

Regression co-efficient (Table 5) indicated that an increase in skin thickness by 1 mm at different places would cause a decrease in average milk yield from 0.24 to 0.45 litre per day in crossbred cows. Clearly it was reported that if 1 mm. average skin thickness increase 100 litre, 27 litre ad 127 litre milk production will decrease in morning, evening and average lactation (if the average lactation period is 225 days) respectively. Skin thickness decrease by 1 mm. at different places will cause an increase in average lactation yield by 133 to 252 litre in Brown Swiss. Sahiwal cows as against the corresponding figures amongst Sahiwals ranging from 76 to 246 litre reported by Bhatnagar and Kumar (1980).

Relation of skin thickness: The relation between milk production and skin thickness are shown in Table 6. Form the table it is evident that skin thickness of neck, dewlap and abdominal region had no effect on milk production of the dairy cows. Although milk production did not differ significantly but milk production of low skin thickness cows was higher than the medium and high skin thickness cows. On the other hand, skin thickness of hindquarter had significant effect ($p<0.05$) on milk production. It was found that average milk production of low, medium and high skin thickness of hindquarter cows were 3.55, 3.27 and 2.79 litre per day respectively. Morning and evening milk production of low, medium and high skin thickness from hind quarters were 2, 208, 2.045, 1.61 and 1.345, 1.226 and 1.044 litre per day respectively. When milk production was calculated on the basis of average skin thickness of all regions together than it was found that per day milk production of low, medium and high skin thickness group was 3.45, 3.339 and 2.828 litre respectively. It is lear that milk production of low skin thickness group was higher than that of medium and high skin thickness group. This might be a fact that low skin thickness cows did not deposited extra fat in their body and utilized most of her energy for milk production. Similarly high skin thickness cows probably might have deposited fat in their body and did not convert all their intake energy for milk production.

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