RELATIONSHIP OF SKIN MEASUREMENTS AND MILK PRODUCTION LEVELS IN CATTLE BREEDS MAINTAINED IN THE TROPICS

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SUMMARY

The relationships between mean skin thickness or hair follicle depth of the skin from the midside (12th rib) area and milk production levels of pure Friesian (Holstein) cattle breeds, their 3/4 and 7/8 crosses with White Fulani zebu, and pure White Fulanis, maintained in South-Western Nigeria were studied.

A strongly positive linear correlation (r=0.9), significant at 1% level was found between skin thickness and hair follicle depth, and milk production levels in these breeds.

The results indicate that for cows maintained in a hot humid tropical environment, comparative midside skin thickness and hair follicle depth could be used as indices of the milk production potential of cows. It could be a useful field tool for selection of cows for milk production when considered along with other characteristics.

INTRODUCTION

An increasing number of temperate breeds of cattle are constantly being imported into tropical environments either for direct use in milk production or to upgrade indigenous breeds of cattle for improved milk production. Where cows and bulls (rather than frozen semen) have been imported for this or other purposes, the criteria for selection have not been clearly defined. There is therefore considerable need for indices that will be useful in assessing milk producing capacity of temperate and indigenous breeds and which could be used as ready tools of selection of animals for this purpose.

Nay and Jenkinson (1964) examined the possibility of using skin measurements as such an index, and found that cows with the least hair follicle depth would be expected to give the highest milk yield in temperate environments. In another study, Finzi and Cenni (1962) had shown that an overall negative correlation existed between milk yield and the mean

skin thickness of Friesian cattle in Italy.

Although skin and skin parameters would at first appear unrelated to milk production, it is to be recalled that mammary glands (udders) are skin derivatives and that a close phlogenetic relationship exists between mammary glands and the glands of the skin (Linzell, 1959).

Studies on skin structures of various cattle breeds maintained in the tropics have been in progress in our laboratory and it was deemed necessary that this be extended to investigate the relationship that may exist between some skin measurements and milk production levels in cattle in a hot humid tropical environment.

MATERIALS AND METHODS

Biopsv skin samples were taken from the midside (12th rib) site of 40 pure Friesian (Holstein) cattle 25 (34 and 7/8) crossses of Friesian and White Fulani and 40 White Fulani (zebu) all adult animals maintained at the Agege Dairy Farm which is located in the humid tropics of South-Western Nigeria. The milking cows sampled for this study were in general managed intensively (zero grazed) and green soiled on elephant grass and cynodon species during the rainy season and on maize silage in the dry season supplemented with brewer's grain and up to 7.5kg of concentrates per day (Aribisala, 1965; Schuman, 1968). A milking schedule of twice a day was practiced while the average age of calving for the different breeds was 48 months for the pure White Fulani, 32 months for the 3/4 and 7/8 Friesian/White Fulani croses and 29 months for the pure Friesian.

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The skin samples were measured for total skin thickness using tuberculin callipers immediately after removal from the animals (Amakiri, 1974). Hair follicle depth (FD) was also measured in histological skin sections using the methods previously described (Amakiri and Hill, 1975).

Data of first, second and third lactation milk production levels for these animals were obtained from the records kept at the station. The means of these lactations were taken as the index of milk production for that breed in line with the suggestions of Mahadevan (1951) after relevant corrections for lactation length and age at first calving had been applied to them us-

ing the correction factor models suggested by Lasley (1972) and Ngere et.al. (1973).

Correlative and various statistical analysis between skin thickness and hair follicle depth parameters and milk production levels were then computed using the methods of Bishop (1966) and Alder and Roessler (1972).

RESULTS

The results of skin thickness (mm), hair folicle depth (mm) and milk production levels (kg) of the Friesian, White Fulani and their crosses as well as the corrected figures are given in Table 1.

TABLE 1
Skin measurements and milk production levels in various breeds of cattle

Breed	Mean milk Production per lactation (kg)	Mean Lactation length (days)	Corrected for Lactation length and age at first calving	Skin thickness (mm)	Hair follicle depth (mm)
Friesian Friesian zebu	$\dots 2888.20 \pm 387.50$	305 ±	3278.12	7.33 ± 0.25	1.66 ± 0.23
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7/8	$\dots 2557.90 \pm 450.22$	$305 \pm$	2954.37	6.63 ± 0.13	1.55 ± 0.15
White Fulani	1009.30 ± 120.08	$215 \pm$	1403.94	4.30 ± 0.25	1.12 ± 0.07

The thickness (mm) of the midside skin was highest in the pue Friesian (7.33) followed by the 1/4 and 7/8 Friesian -White Fulani crosses (6.63) whereas the lowest thicknesses were recorded inhe White Fulani breed (4.30). Differences in skin thickness were very significant (P 0.05) between the crosses and the Friesian. There was no significant difference in skin thickness between the 1/4 and 7/8 crosses when considered separately. Similarly, hair follicle depth measurements (mm) were significantly higher (P 0.01) in the pure Friesian (1.66) and their crosses (1.55) than in the White Fulani (1.12).

The average lactation production levels, using the first, second and third lactations, duly corrected for length of lactation and age at first calving, was highest in the pure Friesian (3278 kg) followed by the Friesian — zebu crosses (2954 kg). The White Fulani cattle gave a low production level of 1403 kg. Using the production level of the White Fulani as 100%, the corresponding levels for the Friesian-zebu and Friesians would be 211% and 234%, respectively. Within and between breed differences in milk production per lactation were highly significant (P 0.01).

DISCUSSION

There appears, from the results of this study to be strong evidence that midside skin thickness and hair follicle depth are highly correlated with milk production and that these could therefore be useful as indices of milk production potential of cattle breeds in an equatorial or tropical environment. Finzi and Cenni (1962) in a similar study using 3 skin sites observed that the mammary gland site had a significantly negative correlation with milk yield; the other sites (the neck and 11th rib) gave a non-significant positive and negative correlation, respectively. Thus, they found as did Nay and Jenkinson (1964) that various skin sites and measured parameters had different relationships with milk production. It is held that quantitative traits such as milk production are multifactorially inherited and sex-linked in their expression and therefore that the chances of correlating some or all of the genes responsible for production factors with visible characters were remote. However, it would appear from this study that the relationship between skin characters and milk production is probably more stable when various breeds of different origins are compared. especially in view of recent findings that the skin is thinner and hair follicle depth shallower in tropical than in temperate cattle (Dowling, 1955; Jenkinson and Nay, 1972, 1973; Amakiri and Hill, 1975).

From the significant correlations established by Finzi and Cenni (1962) and Nay and Jenkinson (1964), cattle possessing thinner skin and shallower follicle depth would best be selected for milk production purposes in temperate environments. In the tropics, the converse would appear to be operative i.e. cattle with greater skin thickness and follicle depth would be expected to give higher milk yields as the results of this study indicate. Although the upper and lower critical skin thickness and follicle depth levels are not known, Jenkinson and Nay

(1972, 1973) classified temperate cattle into two groups on the basis of hair follicle depth (FD) viz those with FD 1.5mm and others with FD 2.0mm whereas the majority of tropical cattle had skins with FD 1.5mm.

Although biopsy skin samples were used in this study, skinfold measurements could equally be used and would submit this method of selection of cattle for milk production purposes easily to practical field application.

The suggested use of skin thickness and hair follicle depth as indices of milk production would be inadequate without any corrections for several non-genetic factors knwon to influence milk yield of cattle such as husbandry and management systems, ages of animals, nutritional status of the cow, length of lactation period, number of milkings per day and seasonal affects (Lasley, 1972; Barrett and Larkin, 1974). Relevant correction factors for length of lactation period and age at first calving have therefore been applied to the milk production figures. No correction was made for seasonal effects and other environmental factors since all experimental animals were exposed to similar husbandry systems.

Any selection system based on skin thickness and follicle depth parameters would also have to consider the fact that a thick skin is incompatible with adaptation to a hot environment and so would constitute a disadvantageous character after the critical upper level. However, since the animals under study have been in this environment for sometime and the production levels, skin thickness and hair follicle depth figures are data obtained after initial acclimatization, it could be assumed that any major disadvantageous effects of thick skin and depth of follicle on the animal may have already exerted their influences.

It is worthwhile to conclude that skin thickness and hair follicle depth could be used as indices of milk production potential in cattle in a hot humid environment, considered along with other parameters

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affecting milk production. It is recognised that these would apply up to a critical skin thickness and follicle depth levels. It is desirable that further studies be undertaken (i) on newly imported animals so that chronological changes in skin parameters and other adaptational characters could be effectively monitored (ii) on various other local dairy breeds of cattle so that the nature of the relationship between milk production and skin measurements could be further evaluated.

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