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COMPARATIVE STUDY OF SKIN STRUCTURE IN EGYPTIAN AND IMPORTED CATTLE BREEDS AND THEIR CROSSES IN RELATION TO HEAT TOLERANCE

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The structure, distribution, and dimensions of skin strata and sweat glands have been investigated in 52 animals ageing one and two years old. These animals represented, native cattle, Friesian, Shorthorn and Hereford, their crosses and grades with Native cattle. Serial vertical and hroizontal sections were made using paraffin wax method. The following results were obtained:

The Friesian breed was superior to the Shorthorn and Herford ones even in many cases to the Native cattle. It possessed the most desirable and beneficial skin characters involved in adaptability to hot climate. It showed the least values in cornium and epidermis thickness 7 and 18 micron at one year old, and 7 and 13 micron in 2 years old animals, respectively.

On the other hand, Friesians showed the greatest number of sweat glands per cm^2 of skin, 4270 and 2393 at one and two years of age. The measurements of the gland were also greater than in the other breeds, 260 micron, 360 micron 0.089 mm^2 and 360 micron, 340 micron; and 0.143/mm^2 for circumference length and surface of single gland in young and old animals. This lead to a great surface of sweating tissue per cm^2 of skin 3.75 cm^2 at the two ages respectively.

The Shorthorn breed showed opposite results to those of Friesians. It possessed the thickest cornium, epidermis, 8 and 26u and 9 and 25u at one and two years old, respectively. The Shorthorn showed the smallest sweating surface per gland 0.085 mm. and 0.095 mm. and per cm^2 of skin 2.25 cm^2 and 2.2 cm^2 at one and two years of age, respectively.

The Hereford group showed values close to those of Shorthorn. It was characterised by fine woolly unmedullated hair and a strong pilimuscle, the characters responsible for the heat preservation against cold conditions.

Grading Native cattle with Friesians and Shorthorns caused an increase in the values, for most of the characters in the ½ blood animals than the puce parent followed by a decrease in the ¾ Friesian blood and in the higher grades in Shorthorn. The cross of Hereford with Native cattle showed values closer to the Native parents in case of the thickness of skin strata. The number of sweat glands decreased in this cross than in native cattle while the length of the single gland increased.

The reaction of temperate zone cattle breeds to the specific climatic conditions in the tropical and stubtropical countries has been a field of extensive studies in the last three decades. Many authors reported that the economic characteristics of the temperate zones breeds deteriorate when they are imported in the

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tropics, as the animals failed to show their comparatively high capacity of production and reproduction. The different environmental factors of the new habitat play the major part in this respect ; climatic factors, especially temperature, are the most effective. However the different temperate zone breeds vary in their adaptability to the new environmental conditions of the tropics and sub-tropics, according to their capacity of heat tolerance. A great part of this capacity is imposed on the skin which is the intermediate organ between the animal's body and the environmental conditions. The skin micronatomical structure has a significant value in this respect.

The skin thickness and depth or thickness of its strata vary with age, sex, species, breed and body region as represented by different authors Yamane and Ono (1936) ; Badreldin and Ghany (1952) ; Hafez *et al.*, (1955); Dowling, (1955) and Nay and Hayman (1956).

The blood vessels arising from the subcutaneous trunks give off twigs that supply the capillary nets of the fat deposits and sweat glands. Then they contribute branches to the capillary networks of the sebaceous glands and the arrectors pilorum and terminate finally in the subepidermal capillary nets. From these arise the radicals of the veins, which lie alongside the arteries and recieve venous branches from the other two capillary areas in the skin : the superficial subepidermal, the intermadiate one of the glands, and the deeper one of the fat deposits. The connective tissue between the glands lacks capillaries (Trautomann & Fiebiger, 1957). Capillaries or fine arterioles running from the sub-sebaceous gland level almost vertically to the sub-epidermal level supply the sebaceous gland through fine branches. (Findlay & Yang, 1958 ; and Goodall & Yang, 1954).

Goodall and Yang (1954) observed three plexuses of blood vessels in the skin of Ayrshire calves and embroys. The first lies bleow the corium, the second at a level between that of the seweat glands and the sebaceous glands and the third extends from beneath the epidermis to above the second plexus and forms a dense network of many fine blood vessels. The second plexus is connected with the first by few large vessels, snd consists of a coarse netrowk of arteries and veins running horizontally and encircling groups of several hair follicles. From these vessels branches go vertically downwards to supply the hair follicles snd the sweat glands. The thrid plexus is formed of horizontal fine vessels, which originate from vertical arterial and venous branches giving off the horizontal branches at different levels, so that the plexus extends over a considerable depth beneath the epidermis and above the second plexus. The three plexuses of blood vessels were observed in Egyptian cattle and buffaloes at the same levels of that in Ayrshire. Shafie (1958), Hafez *et al* (1955) found that the sebaceous glands of buffaloes are more highly supplied with blood capillaries than that of cattle.

Sweat Glands :

The structure of sweat glands in bovines is reported for many of the temperate and tropical cattle breeds by Yamane and Ono (1936), Findlay and Yang (1950), Findlay (1953), Hafez *et al* (1955), Dowling (1956) and Nay and Hayman (1956). This assembly of the glands and hair follicle designated as the hair unit was found also in buffaloes (Hafez *et al*, 1955).

The different bovines vary in the shape and volume of their sweat gland. The temperate zone breeds possess mostly tubular more or less coiled type of varying length with fairly constant small diameter as in Ayrshires (Findlay and Yang, 1948), and Shorthorns (Nay, 1959). On the other hand, most of the tropical breeds have a baggy type of sweat glands of varying length, and in some cases slightly coiled with wide diameter as in Formosa cattle (Yamane and Ono, 1936),. Egyptian cattle (Hafez and Shafie, 1954), and Sindhi and Sahiwal (Nay, 1959). The Zebu X Shorthorn corssbred animals, and Santa Gertrudis, acquire a club-shaped, intermediate type with a wider baggy lower end and a narrower more or less coiled upper and (Nay, 1959). The body of the sweat gland in buffaloes is oval and convoluted, and the duct is twisted at its attachment to fhe body Hafez *et al.*, (1955b).

The inner secretory layer of the sweat gland in cattle consists of flat polyhedral cells, and the outer layer of myoepithelial cells which form a net of myofibrils enveloping the gland (Nay, 1959). In buffaloes the glandular wall is composed of two structures, an outer myoepithelium and an inner layer of glandular epithelium (Hafez and Shafie, 1954). The myoepithelial cells of the sweat glan ds of Zebu cattle were proved to be essentially similar in structure and arrangement to those found in the sweat glands of Ayrshire cattle. Therefore that it is unlikely that ahy difference in function between the sweat glands of both tropical and nontropical breeds of cattle, can be sacribed to a difference in the myoepithelial cell layer of the glands. In both breeds the mayofibrils extended to the entire length of the lyoepithelial cells and the longitudinal axes of the cells were parallel to the longitudinal axes of the glands (Goodall & Yang, 1951).

Kelley (1932) mentioned differences between Zebu and Zebu X Friesian crossbreds in the number of sweat glands per unit area of skin with Zebu having the greatest number. Yamane and Ono (1936) compared numbers of sweat glands per unit area on each of 21 body regions in Zebu cattle, Friesian, and Formosa buffaloes. The Zebu had the greatest number of glands while the Friesians had the least, which agrees with Nay and Hayman (1956). Burcev (1937) clamied that the number of sweat glands per unit area of ear skin did not depend on either age or sex in Red German cattle. Hafez *et al.*, (1955) stated that there are age differences in the density of sweat glands in buffaloes, calves having a greater number of sweat glands than adults. Table II represents the number of sweat glands per Sq. Cm. of skin as reported by different authors for bovine breeds.

Both volume and activity of sweat glands are associated with each other. The remarkably great sweating rate of the crossbreds appears to have enabled them to maintain a lower body temperature under stress than pure Jerseys, and to achieve more rapid return to the normal temperature after exposure to heat stress (Hayman and Nay, 1958).

Findlay and Yang (1950) stated that there was a significant negative correlation between the number of sweat glands and the area of secretory surface of single sweat gland in Ayrshire cattle 3-4 years old. They stated too that the ventral region of the neck, the axilla and upper hindleg had the largest area of secretory surface per Sq. Cm. of skin. Egyptian cattle have a greater area of secretory surface per Sq. Cm. of skin than byffaloes (Hafez *et al*, 1955).

Yamane and Ono (1936) stated that the Formosa buffaloes posess apocrine sweat glands. Also Hafez *et al* (1955) came to the same conclusion in Egyptian Buffaloes. They also represented the successive stages of apocrine secretion. This type of secretion was also reported in the temeprate zones cattle breeds, Ayrshire, by Findlay and Yang (1948). The rate of secretion by this aporcine process is slow and the sweat is viscous with low water content, resulting in less efficiency in regulating the body temperature through water vaporization from skin surface. The tropical cattle breeds are more efficient in this respect since they possess merocrine glands, as stated in Formosa cattle by Yamane and Ono (1936). The Egyptian cattle possess both merocrine apocrine glands with abundance of the fromer type (Hafez *et al*, 1955). The merocrine secretion type gives more watery sweat and at a higher rate than the apocrine process.

The blood supply of sweat gland in buffaloe is very poor (Hafez and Shafie, 1954). The sweat glands in skin of Ayrshire calves and embryos have a poor blood supply as compared qith the heir folicles. It is known that the human eccrine sweat glands have a rich blood supply (Maximow and Bloom, 1948). If blood supply is regarded as an index of the gland activity, then the bovine sweat gland may not be very active (Goodall and Yang, 1954). The sweat glands are supplied by sympathetic nerves (Trautmann and Fiebiger, 1957). Muto (1925) claimed pharmacologically that the glands were suppl-ied with parasympathetic nerve fibres.

The aim of this work was to study the microanatomy of the skin with special extensive study of the sweat glands. in different types of temperate zone breeds in comparison with the Egyptian Native cattle. The effect of crossing and grading with these breeds was also studied.

Material and Methods

This work was carried out in the Animal Breeding Dept. Faculty of Agriculture, Cairo University, U.A.R. The study comprised 52 animals ageing 1-2 year old. Breeds included were: Native cattle, Friesian, Dairy Shorthorn, and Herford, grades of Friesian and Shorthorn, and the first cross of Hereford with Native cattle. The skin samples were obtained from the Tahreer Province and the experimental farm of Faculty of Agriculture, Cairo University.

Histological procedure:

Skin biopsies of 2 cm^2. were cut off from the shoulder region without anaesthesia, washed in saline solution and fixed in Formole saline 5% for 48 hours. Aftr washing in running water for 6 hours, the hair was clipped out. The sampleswere cut into small pecies 4 $\times$ 6 mm. the length being parallel to the slope of hair to proivde a correct orientation for the vertical sections cutting. Dehydration lasted for 24 hours in each of 70%, 90%, 95% alcohol and 12 hours in absolute alcohol (100%). Clearing was accomplished in two changes of Benzol, 12 hours each. Embedding in paraffin wax (m.p. = 48°C) was carried out under a vacuum of 67 cm. Hg. in a vacuum oven. The wax was changed every 3 hours throughout 24 hours. Vertical and horizontal serial sections were cut at a 20 u thickness by a rotary microtome. Staining was carried out for two minutes in a compound solution of 35 ml. 1% aqueous Methyl Blue solution and 45 ml. 0.25% aqueous Eosin solution completed to 100 ml. by water. The sections were permanentaly mounted in Canada balsam.

Measurements :

A microprojector was used for studying the sections. Vertical sections were used to measure the cornium and epidermis thickness. Ten measures at a right angle from the skin surface were obtained in each case.

Horizontal sections directly under the epidermis, the sub-epidermal stratum, were used for counting the hair follicles per cm². of skin which denotes the number of sweat glands in this arwa due 50 the association between both structures in the hair follicle unit, 10 fields counts were used to obtain the mean value of density in each case.

The mean circumference of the sweat glands was obtained from 25 measurements of different glands at their atmost wide part, the center of the gland, in horizontal sections by means of curvimenter in the projector. The mean length of the glands was considered to be half the mean value of the longitudinal lining of 25 glands in the vertical sections, in order to secure the central longitudinal axis, the measure was restricted only to those sections of the glands passing through the gland duct. By this method (Findlay, Yang 1948 and Hafez *et al* 1955), the gland was considered as a cylinder its surface equals the horizontal circumference lultiplied by the length (in this case ½ the longitudinal lining). The total sweating surface per cm.² of skin equals the mean surface of the gland multipiled by the mean density of the glands per cm.² of the skin.

Results

Cornium :

At one year of age, Native cattle and Friesians showed the same cornium thickness, while Shorthorn had the thickest, and Hereford the thinnest cornium. The advancement of age induced an increase in cornium thickness to a great extent in Native cattle and moderate value in Shorthorns and Herefords, while it had no effect in Friesians. Crossing with Friesian increased the thickness in the ½ Friesian and decreased it in the 3/4 Friesian. Shorthorn grades showed a thin cornium in case of the ½ Shorthorn cross, while the higher grades possessed a thick cornium equal to the pure Shorthorns. The ½ Hereford cross had a thicker cornium than the pure Herefords (Fig. 1.).

Epidermis :

There were clear breed differences in the thickness of epidermis. Epidermis thickness in Native cattle was 57 micron which was double that of Shorthorn and three folds that of both Friesians and Herefords breeds. The age effect was very great in the case of Native cattle when the edpidermis thickness was reduced to its half value, the reduction was less in Freisian, very slight in Shorthorns while the Herefords showed slight increase. Crossing induced slight increase in epidermis thickness over the values of pure Friesian and Hereford and a decrease in case of Shorthorn grades (Fig. 1).

The Pili Muscle:

Native cattle had fine and smooth pili muscle. Friesians and Shorthornt had more developed thick pili muscle. The Herefords had strong muscles which branch to two or three branches, interweaving with the fiber bundles of the dermis (Plate 1).

Blood Vessels :

The main blood vessels of the skin passed in the dermis at its deep layer, giving branches ascending upwords. The connective tissue between the hair follicles and glands lacked capillaries. At the sweat gland level, the arteries, branched giving rise to small arterial branches and arterioles, the branching was most abundant in Friesians (Plate 2). In the subsebaceous gland level a plexus of blood vessels gave few capillaries supplying the sebaceous glands in all breeds. However, it was less conspicuous in the Hereford. Each hair follicle was encircled by a lobe of capillaries in the sub-epidermal level. Friesians showed much blood supply in this level than the other breeds.

Sweat Glands:

1. *Structure and Characteristics:*

The sweat glands were elongated and rarely convoluted in all breeds except the Shorthorn which had some convoluted glands. The duct of the gland penetrated the pili muscle at its base and it then passed between the sebaceous gland lobes. All breeds had straight duct of sweat gland.

2. *Density:*

Each hair follicle was associated with a sweat gland, so the density of the hair follicles per cm^2 of skin denotes the density of the density of the sweat glands (Plate 3) which varied according to age, breed, and crossing. At one year of age pure Friesians had the highest number, 4270, while the Shorthorn had the lowest value, 2637, the Herefords showed a value of 3384 which is less than Friesian but more than Native cattle, 3010. The average number at two years of age decreased in all breeds. At this age the Friesians had also the highest value followed by the Native cattle, the Shorthorns and lastly the Herefords Grading with Friesian caused a reduction in the sweat gland number in the $\frac{1}{2}$ Friesian cross then an increase in the 3/4 Friesian than the pure. This effect

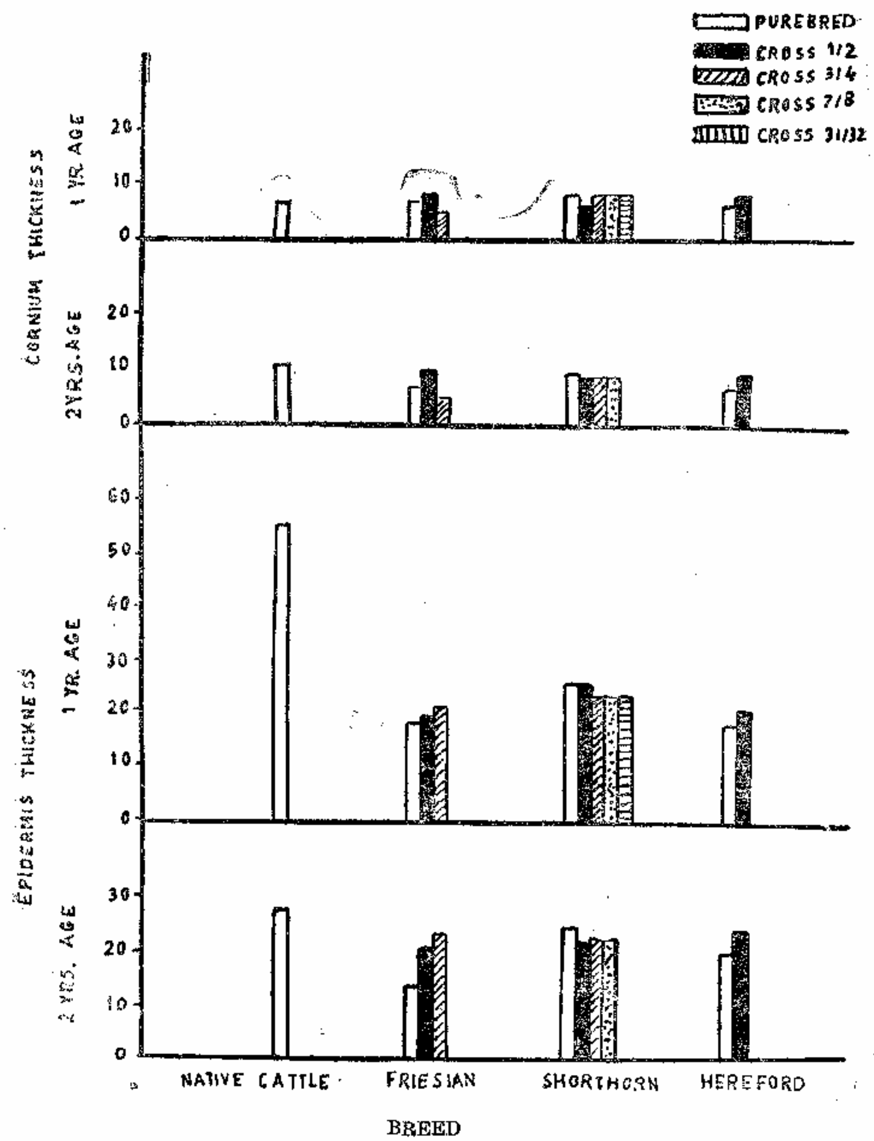
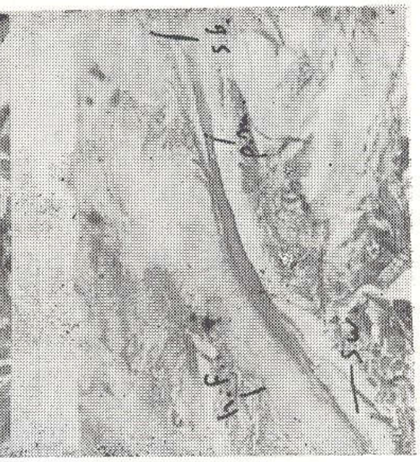
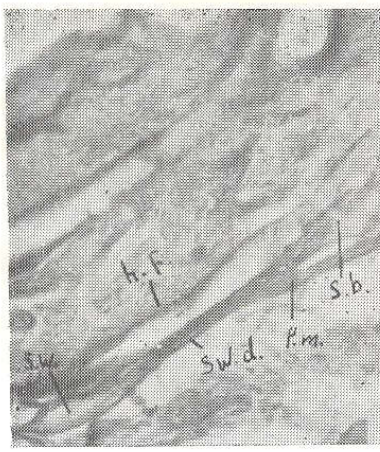


FIG. 1.—Cornium and epidermis thickness in different cattle breeds and crosses of 1 and 2 years old.

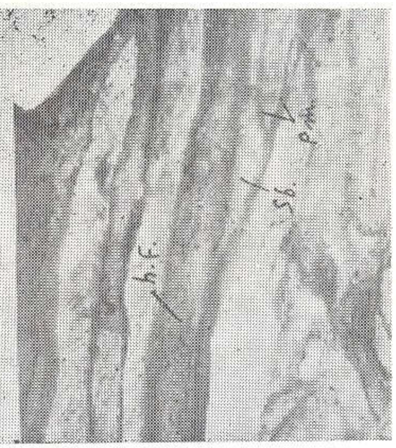
EGYPTIAN



FRIESIAN

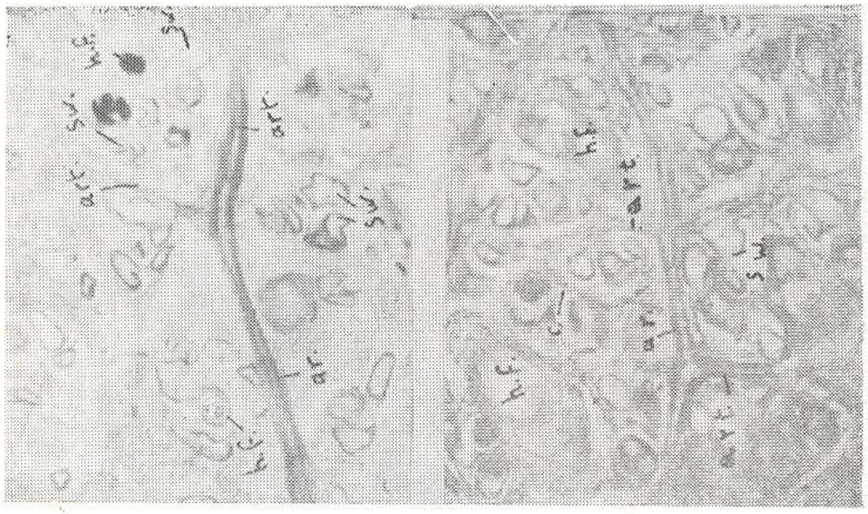


SHORTHORN

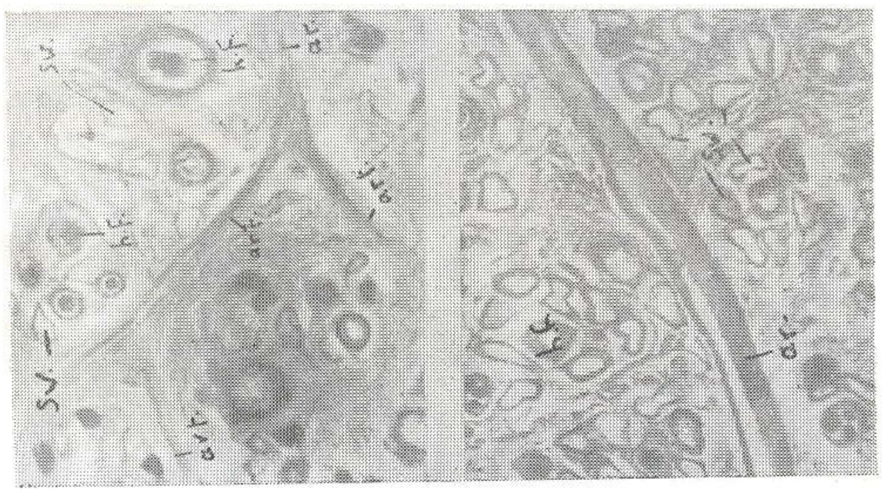


HEREFORD

PLATE 1.—Pili-muscle (×90) in skin of cattle breeds.
h.f. hair follicle, p.m. pili-muscle, sb. sebaceous gland, sw. sweat gland, sw.d. sweat gland duct.



EGYPTIAN FRIESIAN



SHORTHORN HEREFORD

PLATE 2.—Blood vessels and capillaries (×90) in the sweat gland stratum in skin of cattle breeds.
ar. artery, art. arteriole, c. blood capillary, h.f. hair follicle, sw. sweat gland.

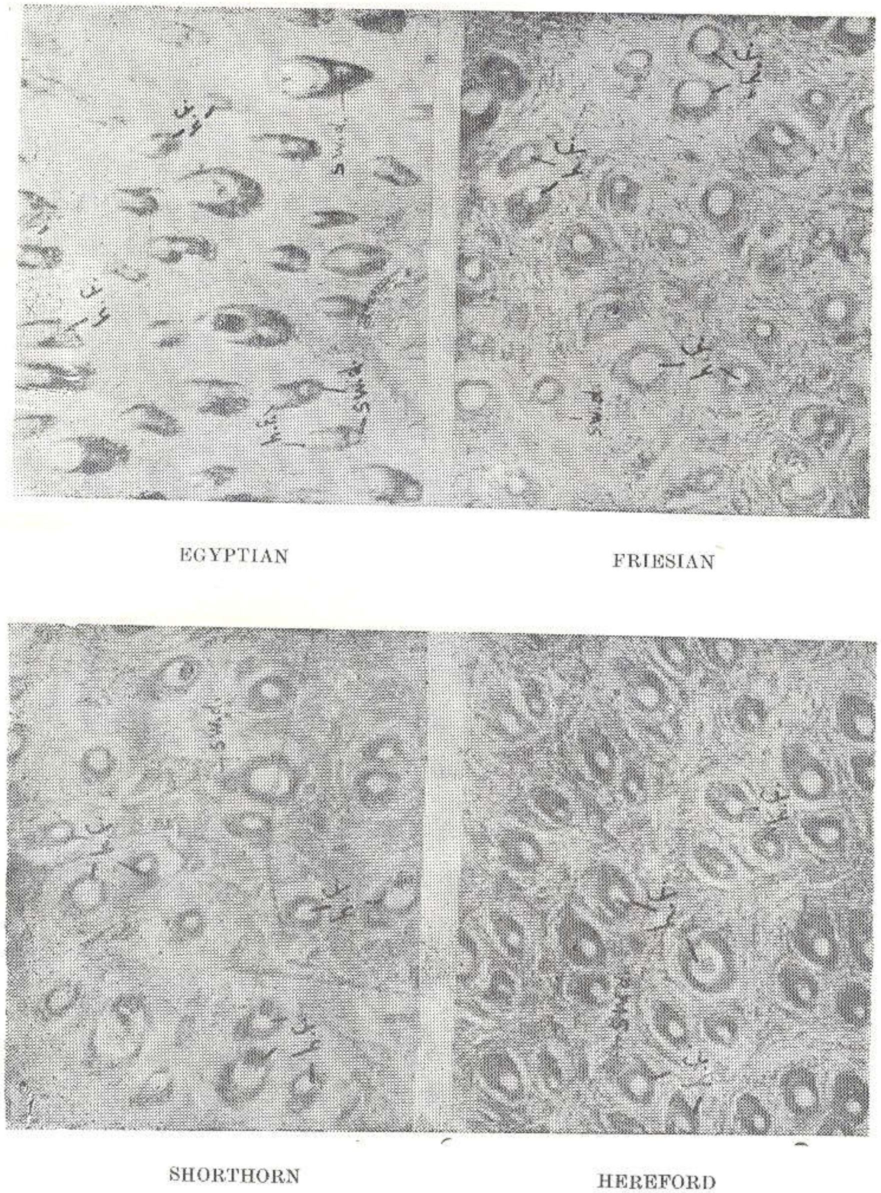


PLATE 3.—Hair follicles density ($\times 90$) in skin of cattle breeds.
h.f. hair follicle, sw.d. sweat gland duct.

of crossing was clearer in the older animals, reducing the number in the ½ and ¾ Friesian, to less than in both Friesian and Native cattle parents. Grading with the Shorthorn gave no clear trend. Crossing with Hereford caused clear reduction in the number off sweat glands in both one and two years of age. (Table 1).

TABLE 1.—AVERAGE NUMBER OF SWEAT GLANDS PER CM² OF SKIN IN DIFFERENT CATTLE BREEDS AND CROSSES OF 1 & 2 YEARS OLD.

Age/year	Breed	Native cattle	Friesian	Shorthorn	Hereford
1	pure	3010±180	4270±180	2637±90	3308±90
	cross ½	—	3141±72	2847±63	2304±45
	cross ¾	—	4315±180	2448±90	—
	cross ⅞	—	—	2833±45	—
	cross	—	—	3411±180	—
2	pure	2717±144	2893±63	2313±72	2164±72
	cross ½	—	1896±54	1736±124	1959±54
	cross ¾	—	2672±72	4121±180	—
	cross ⅞	—	—	2655±72	—

3. *Circumference*:

The circumference of the sweat glands at one year of age was nearly the same in all pure breeds, while it enlarged greatly by age in both Friesians and Herefords. Crossing with the temperate zones breeds did not affect the circumference of Friesian grades while it increased it in Shorthorn and Hereford crosses than the parents at one year of age. In 2 years old animals, the pure Friesian and Hereford achieved a greater circumference than the crosses (Table 2).

4. *Length*:

The length of the sweat glands varied according to age, breed, and crossing. At one year of age pure Shorthorns had the longest, while Native cattle had the shortest length. The Herefords showed a lower value than Friesians but greater than the Native cattle. The average length increased with age in all breeds except the Herefords, which decreased, but at a high rate in Friesians and

TABLE 2.—CIRCUMFERANCE AND LENGTH OF SWEAT GLANDS IN DIFFERENT CATTLE BREEDS AND CROSSES OF 1 & 2 YEARS OLD (MICRON)

Measurement		Circumferance				Length			
Age-year	Breed	Native cattle	Friesian	Shorthorn	Hereford	Native cattle	Friesian	Shorthorn	Hereford
1	pure . . .	260 ± 8	260 ± 10	240 ± 8	260 ± 12	285 ± 20	340 ± 10	355 ± 4	320 ± 20
	cross 1/2 .	—	270 ± 4	290 ± 8	320 ± 16	—	350 ± 24	320 ± 12	380 ± 12
	cross 3/4 .	—	260 ± 6	350 ± 10	—	—	260 ± 17	375 ± 18	—
	cross 7/8 .	—	—	280 ± 8	—	—	—	310 ± 10	—
	cross 31/32	—	—	260 ± 6	—	—	—	320 ± 20	—
2	pure . . .	290 ± 8	360 ± 20	250 ± 10	350 ± 18	355 ± 10	410 ± 8	380 ± 18	315 ± 30
	cross 1/2 .	—	300 ±1.4	380 ± 10	330 ± 12	—	400 ± 10	365 ± 15	355 ± 10
	cross 3/4 .	—	300 ± 10	260 ± 8	—	—	325 ± 17	340 ± 17	—
	cross 7/8 .	—	—	250 ± 14	—	—	—	330 ± 10	—

Native cattle, and a slight increase in the Shorthorn. Crossing with the Friesian breed induced a slight increase in the sweat gland length in the one year old ½ Friesian while it decreased it greatly in 3/4 Friesian to come evenly maintained in the old animals. In general, Shorthorn grades showed lower values than pure ones, especially in the 2 years old animals. Crossing with Hereford caused the gland length to surpass the values in both parents (Table 2).

5. *Surface of single gland* :

The surface of single sweet gland according to age, breed, and crossing. Friesian possessed the biggest surface, followed by Shorthorns then Herefords, while Native cattle had the least surface at one year of age. The average surface at two years of age increased in all but at a high rate in Friesians by Native cattle, then the Hereford whiles Shorthorn had the least increase and posses sed the smallest value. The half corsses of Native Friesian, Shorthorn, and Hereford possessed a greater gland surface than the parents except the 2 years old Friesian. As in most of the characteristics the ½ Friesian was greater in gland surface than the parents at one year of age while the ¾ Friesian had a small value even lower than the Native cattle parent at the two ages. The Shorthorn grades showed greater values than parents in the first year of age, with the advancement of age it became lower than the parents due to the greater rate of increase in the gland surface in pure than in graded animals except the ½ Shorthorn (Table 3).

TABLE 3.—SURFACE OF SINGLE SWEAT GLAND IN DIFFERENT CATTLE BREEDS AND CROSSES OF 1 & 2 YEARS OLD (M.M.^{2}).

Age/year	Breed	Native cattle	Friesian	Shorthorn	Hereford
1	pure	0.074	0.089	0.085	0.083
	cross 1/2 . . .	—	0.095	0.093	0.122
	cross 3/4 . . .	—	0.068	0.133	—
	cross 7/8 . . .	—	—	0.087	—
	cross 31/32 . .	—	—	0.083	—
2	pure	0.103	0.143	0.095	1.115
	cross 1/2 . . .	—	0.120	0.102	0.117
	cross 3/4 . . .	—	0.098	0.089	—
	cross 7/8 . . .	—	—	0.083	—

6. *Total sweating surface per cm.² of skin* :

Total sweating surface per cm.² of skin varied according to breed, and crossing. In young and old animals Friesians had the greatest sweating surface per cm.- of skin which is nearly 50% more than the other breeds even the Native cattle, while Shorthorns had the smallest surface. (Fig. 2). The effect of age was slight in the case of Friesians and Shorthorns, however, it caused an increase in the sweating surface in Native cattle and a decrease in Herefords (Table 4). Crossing Native cattle with temperate breeds cuased a decrease in sweating surface in the Friesian grades, but did not affect the Hereford cross, while it tended to increase the surface in the Shorthorn grades than in the European parent (Fig. 2).

TABLE 4.—TOTAL SWEATING SURFACE PER CM² OF SKIN IN DIFFERENT CATTLE BREEDS AND CROSSES OF 1 & 2 YEARS OLD (CM.²)

Age/year	Breed	Native cattle	Friesian	Shorthorn	Hereford
1	pure	2.25	3.75	2.25	2.75
	cross 1/2	—	2.95	2.65	2.80
	cross 3/4	—	2.90	3.20	—
	cross 7/8	—	—	2.45	—
	cross 31/32	—	—	2.85	—
2	pure	2.80	3.75	2.20	2.40
	cross 1/2	—	2.30	1.80	2.30
	cross 3/4	—	2.60	3.65	—
	cross 7/8	—	—	2.20	—

Discussion

Skin strata in Friesians are thinner than in the studied breeds facilitating the water path through the skin by the way of insensible perispiration. This efficiency of perispiration is augmented by the abundance and wide distribution of blood vessels in the skin of the Friesians. Blood vessels and capillaries determine to a great extent the amount and rate of blood flow in the skin. This blood flow affects skin temperature, heat convection, amount of insensible perispiration and the sweating activity. (Findlay & Yang, 1948; Goodall & Yang, 1954; and Shafie, 1958).

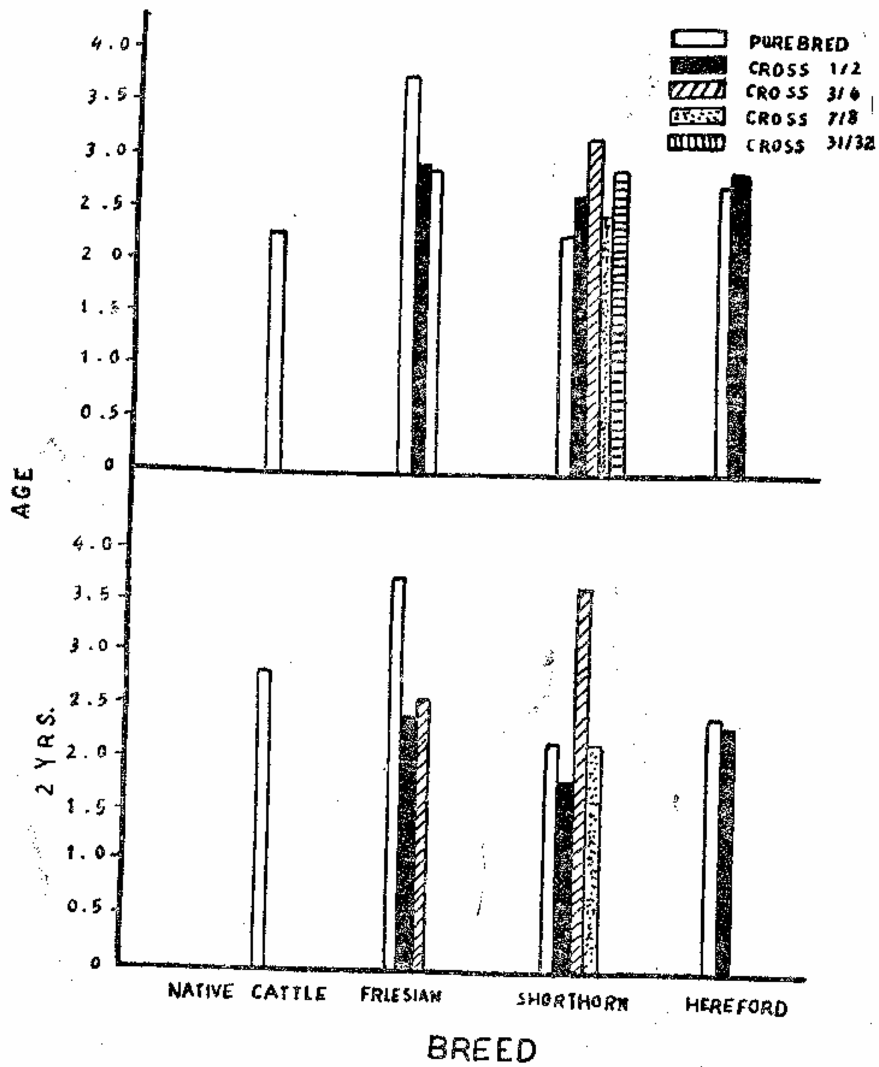


FIG. 2.—Total sweating surface per cm^2 of skin in different cattle breads and crosses of 1 & 2 years old cm-1.

Total sweating surface in Friesians is the largest due to the greatest number of sweat gland, and the largest circumference and length of single sweat gland. This large surface is accompanied by a rich blood supply then the other breeds. This blood supply provides copious fluid required for the sweat gland secretion, It is clear from the present study that Friesian had a greater sweating surface than the dairy Shorthorn and the Horeford breeds. The surface in the Friesian is also greater than that in Ayrshire as reported by Findlay and Yang (1948). It is worth noticing that the Friesian possesses a greater sweating surface than the Egyptian native cattle.

These histological construction of the Friesian skin coincides with the results obtained for the reaction of the Friesian in hot climates. the Friesian showed a slight increase in body temperature by the effect of increase in air temperature Shafie *et al*, (1969) in comparison to Shorthorn Badreldin & Ghany, (1952). Moreover, the Friesian breed was more tolerable to direct solar radiation than the Shorthorn Asker *et al* (1952 & 1953, Shafie et al, 1969).

The Shorthorn cattle have the thickest cornium, and epidermis, so the diffused water path is more hardly than in the case of Friesian, especially the blood vessels and capillaries are less than in the case of Friesian. Total sweating surface is less in Native cattle than in all breeds, and the blood supply to the glands is not so much. This affects the sweat gland secretion. The percentage of medullated hair is less in Shorthorn than Friesian and Hereford. This would provide a smaller opportunity for the vaporization of moisture and consequent absorption of heat from the skin (Findlay & Yang, 1950; and Dowling, 1956).

Hereford cattle is equal to the Friesian in the thickness of cornium, and epidermis layer, however its significance in perispiration in Hereford is controversed by the barrier of the long woolly hair coat which hinders water vaporization from skin surface. Total sweating surface in Hereford is equal to that of the Shorthorn and Native cattle, thus making the Hereford inferior to the Friesian in secretion activity of the sweat glands.

The pili muscle is very strong and branches in the skin of Hereford. When the pili muscle contracts as in conditions of external cold, pressure will be exerted on the capillares. This will probably supplement cutaneous vaso-constriction under cold condition and the peripheral blood flow will be reduced with consequent increased heat conservation. This function of the muscle is additional to its function in increasing heat insulation by the erection of hair (Findlay & Yang 1948, and Findlay 1950). Friesian and Shorthorn show strong pili muscles but less than Hereford, and larger than Native cattle.

From the skin histological study, it is apparent that the Friesian breed is the best temperate one equiped for heat dissipation which makes it more successful than both Shorthorn and Hereford for thriving under the climatic conditions of the arid sub-tropical zones.

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دراسة مقارنة لتركيب الجلد فى الأبقار المصرية والمستوردة والخليطة من حيث علاقته بالتنظيم الحرارى

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الملخص

يختلف ركيب الجلد باختلاف انواع الحيوانات . وقد درست فى هذا البحث العلاقة بين تركيب الجلد واثره فى التنظيم الحرارى للجسم فى انواع الأبقار المصرية والفريزيان والشورتهورن والهرفورد والخليطة . وشملت التجربة ٥٢ حيوانا تراوحت اعمارها بين سنة وسنتين . وكانت الدراسة هستولوجية اذ عملت قطاعات رأسية وافقية لعينات من الجلد اخذت من هذه الأنواع فى مراحل عمرها المختلفة . وفيما يلى النتائج التى حصل عليها :

كان الفريزيان افضل الحيوانات فى تركيب الجلد من حيث موافقته للظروف البيئية الحارة فهو يفوق الشورتهورن والهرفورد وفى حالات كثيرة المصرى . وكان سمك البشرة والطبقة القرنية اقلها ففى عمر سنة كان سمك الطبقة القرنية ٧ ميكرون وكذلك عمر سنتين .

أما البشرة فقد كان سمكها عمر سنة ١٨ ميكرون و١٣ ميكرون فى عمر سنتين . كذلك كان عمق الغدد الدهنية وجيب الشعرة والغدد العرقية أقل منها فى الأنواع المختلفة المستخدمة فى التجربة فكان العمق فى عمر سنة ٧ر مم للغدد الدهنية ، ٢ر١ مم لجيب الشعر ، ٤ر١ مم للغدد العرقية وفى عمر سنتين ٩ر مم للغدد الدهنية ، ٧ر١ مم لكل من جيب الشعرة والغدة العرقية .

ومن جهة اخرى فقد كان عدد الغدد العرقية فى مساحة سم٢ من الجلد فى الفريزيان أكثر منها فى الأنواع الأخرى . فقد كان عددها ٤٢٧٠ فى عمر سنة و ٢٨٩٣ فى عمر سنتين . كذلك كانت مقاييس الغدد العرقية أكبر من كل الحيوانات المستخدمة ففى عمر سنة كان محيط الغدة ٢٦٠

ميكرون وطولها ٣٦٠ ميكرون أما مسطح الغدة الواحدة فقد كان ٠٫٨٩ مم٢، وفى عمر سنتين كان محيط الغدة ٣٦٠ ميكرون وطولها ٣٤٠ ميكرون ومسطح الغدة الواحدة ١٫١٤٨ مم٢ . وهذا يؤدى أكبر مساحة السطح المفرز للعرق فى السنتيمتر المربع من الجلد الذى كان ٣٫٧٥ مم٢ فى عمرى سنة وسنتين .

كان الشورتهورن عكس الفريزيان فى صفات تركيب الجلد . فعند عمر سنة كان سمك الطبقة القرنية ٨ ميكرون وسمك البشرة ٢٦ ميكرون . وعند عمر سنتين كان سمك الطبقة القرنية ٩ ميكرون وسمك البشرة ٢٥ ميكرون . وهذه الطبقات أسمك منها فى الفريزيان . أما مساحة السطح المفرز للعرق فهو أقل الأنواع فقد كان مسطح الغدة الواحدة ٠٫٠٨٥ مم فى عمر سنة و ٠٫٠٩٥ مم فى عمر سنتين أما مساحة السطح المفرز فى سنتيمتر مربع من الجلد فقد كان فى عمر سنة ٢٫٢٥ سم٢ وفى عمر سنتين ٢٫٢ سم٢.

أما الهرفورد فقد كان قريب الشبه بالشورتهورن ويتميز بوجود شعر رفيع صوفى الملمس قليل النخاع كذلك يتميز بوجود عضلة الشعر القابضة القوية المتشعبة المسئولة عن وقاية الحيوان أثناء الجو البارد .

وقد أدى الخلط والتدريج بين الفريزيان والشورتهورن مع المصرى الى زيادة كثير من القيم المقاسة فى الخليط ½ عن الأصيل متبوعا بنقص هذه القيم فى ¾ فريزيان وفى الشورتهورن أما خليط الهرفورد (½) فكان يتميز بتشابه سمك طبقات الجلد فيه مع الماشية المصرية . فى حين كان عدد الغدد العرقية أقل منه فى الماشية المصرية .