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# STUDIES ON THE SKIN OF FLEISCH MERINO, OSSIMI AND THEIR CROSSES IN THE U.A.R.

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A total of 140 skin samples were collected from lambs of four breed groups of sheep ; Merino, Ossimi, ¼ M.O. and 3/4 M.O. at monthly intervals from birth up to six months of age in order to study the trend of follicle development as well as the effect of crossing on the sequence of development.

In general, there was a decrease in the number of primary wool follicles per unit area of skin parallel to the advance in age, while secondary follicles showed a continuous increase till 60 days of age and slight decrease thereafter irrespective of breed.

The S/P ratio at 180 days of age was specific to each breed group with the cross having values somewhere between that of their parents, although the difference between the 3/4 M.O. and the purebred Merino was not significant.

No differences were found between breed groups in the mean number of follicle groups per unit area of skin. This led to the postulation that difference in density of follicles are attributed mainly to the number of secondary follicles rather than to the number of follicle groups per unit area of skin.

Sheep has long been of no primary interest to the Egyptian farmer. This is mainly due to the nature of sheep being grazing animals that depend essentially on natural range, if economic feeding is to be considered. Therefore, the local types of sheep raised in Egypt are considered as carpet wool breeds with more emphasis on mutton. The problem is thus, a defficiency in apparel wools to fulfill the domestic needs.

Since 1960, systematic breeding programmes have been set up to establish new strains of sheep that produce semifine or medium wools. The up-grading of Ossimi (local carpet wool breed) with Fleisch Merino was practiced by the Ministry of Agriculture for several generations to evolve a nucleus for semifine wool sheep that can exist and adapt itself to the local environmental conditions.

The object of this study was to investigate carefully the development of the wool follicle population from birth up to six months of age and the trend of follicle density as affected by crossing and up-grading. Therefore, the study included two pure breeds, viz., Fleisch Merino and Ossimi, (their first crosses and 3/4 Merino) — Ossimi.

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## Materials and Methods

Animals used in this study included lambs born in November 1966 belonging to the Ministry of Agriculture Research Station at Sakha.

Skin samples from the mid-right side were collected from five individuals of each breed group viz., Merino (M), Ossimi (O), ½ Merino [Ossimi (½ MO) and 3/4 Merino] — Ossimi (3/4 MO). The samples were collected at monthly intervals from 24 hours after birth till six months of age. Thus seven skin samples were taken from each individual consequently making a total of 140 skin samples from the four breeds at subsequent ages. The area of skin excised from each individual was approximately 1 $cm^2$, taken immediately to the wool laboratory on campus where the histological technique recommended by Clarke (1960) was performed with some minor modifications to study the wool follicle population.

The study comprised the number of primary wool follicles (P), the number of secondary wool follicles (S), the ratio of primary to secondary wool follicles (S/P) and the number of follicle groups per 1.5 $mm^2$ of skin tissue.

Statistical analysis was carried out as suggested by Snedecor (1961) and Huntsberger (1961).

## Results

*Primary follicles*

The number of primary wool follicles per 1.5 $mm^2$ of skin varied significantly from one breed group to the other (Table 1 & 2) and the differences between different ages within one breed were significant ($P < 0.05$). The interaction of the effect of breed with that of age to express the character in question was also significant ($P < 0.01$).

The greatest difference observed between breeds in the number of primary follicles was that between Merino and Ossimi, while ¾ M.O. possessed an equal mean value to that of the Merino (48.1). The ½ M.O. possessed a mean value (23.1) lying somewhere between those of the parental breeds, though with some decline towards its dam.

It was also observed that the mean number of primary follicles per 1.5 $mm^2$ of skin tissue is in a continuous decline with the advance in age. Thus the highest mean number of primary follicles was that attained at 24 hours of age (93.5) while the lowest was that possessed at 180 days of age. A regression line of the number of primary follicles on age (Figure 1), is driven to indicate clearly the regression trend for which a coefficient was estimated to be 0.206.

A similar regression trend was also observed for each individual breed, although the degree of slope varied from one breed to the other according to the corresponding ages.

A graphical representation of the number of primary wool follicles per unit area of skin versus age is shown in figure (2).

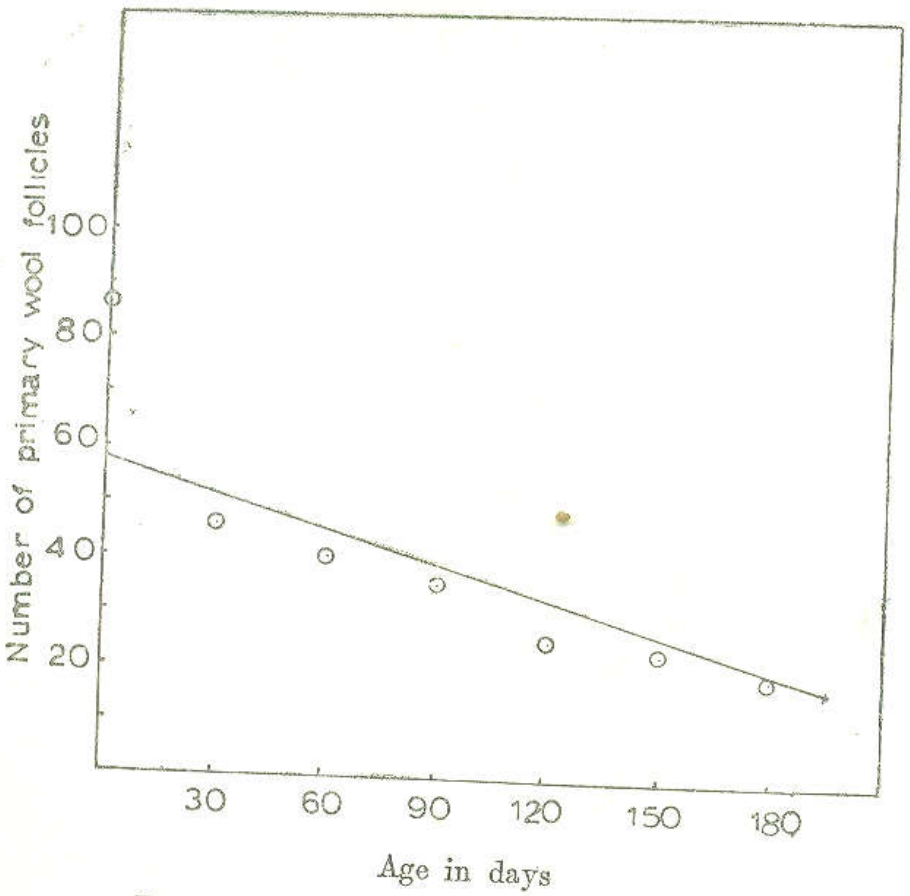


FIG. 1.—Regression of primary follicles on age

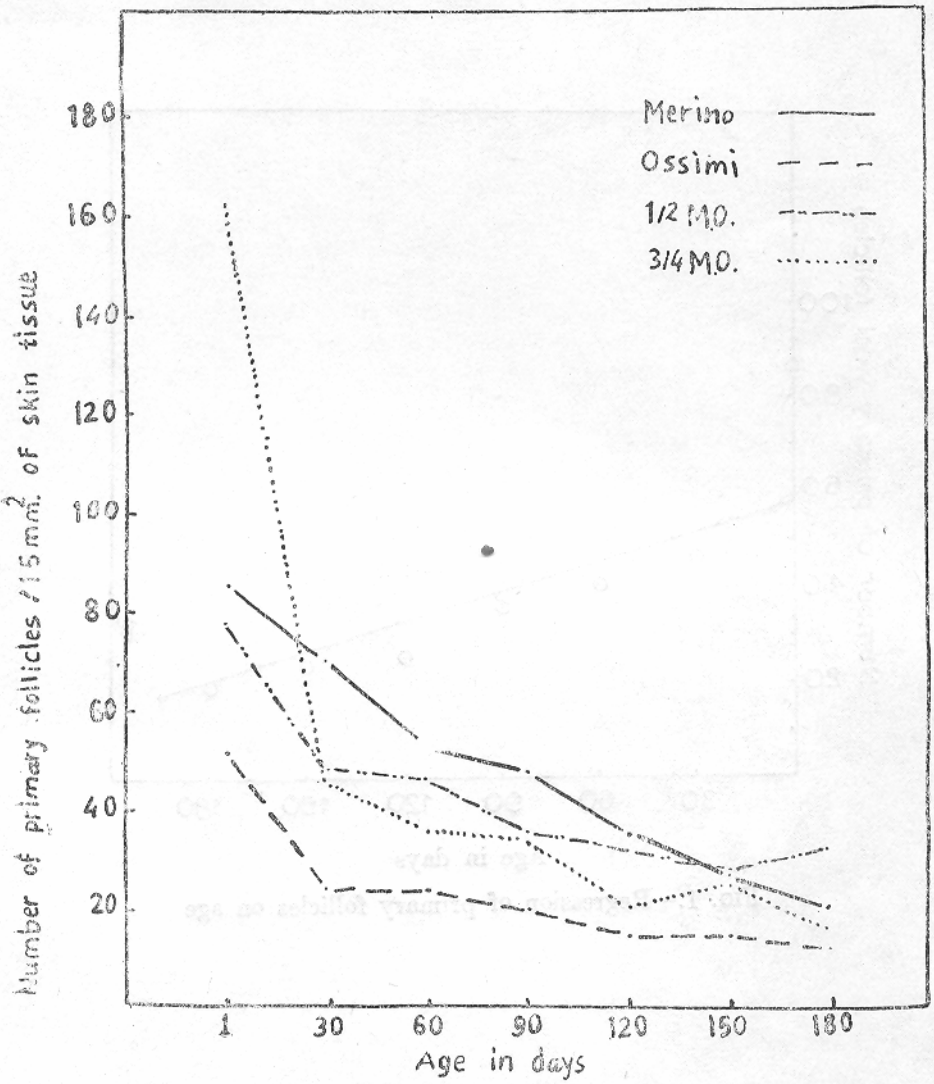


Fig. 2: Primary wool follicles vs. age in four breeds

*Secondary follicles*

Both breed and age had significant effects ($P < 0.01$) on the number of secondary follicles per unit area of the skin. On the other hand no significant effect was observed for the interaction between breed and age ($P < 0.05$) on the expression of this character.

Merino sheep showed the highest mean secondary follicle density (162.8) while Ossimi exhibited the lowest among the four breeds (35.1). The ½ M.O. possessed a mean value intermediate between those of its parental breeds (77.3), and the ¾ M.O. also showed a mean value intermediate (131.4) between its parental breeds ; Merino and ½ M.O. (Table 1).

A general increase in the mean number of secondary follicle per unit area of skin was observed for the four breeds from 24 hours up to 60 days of age after which a singificant ($P < 0.05$) decrease was observed till 180 days of age . The differences between subsequent ages were significant ($P < 0.05$) except between 60 days, 30 days and 90 days, between 90 days, 150 and 30 days, between 30 days, 120 and 150 days, between 120 and 150 and between 120 days and 180 days of age.

A similar increase to that of the pooled secondary follicle numbers was also observed among each breed individually with some fluctuations corresponding to the subsequent ages. This is well represented graphically in figure (3).

The maximum secondary follicle density for Merino was that attained at 60 days of age (231.0) followed by a decrease toill 120 days of age. At 150 days of age another increase was noticed but decreased again at 180 days of age.

For Ossimi, the maximum secondary follicle density (53.5) was attained at 60 days of age and decreased thereafter till 180 days of age.

For the ½ M.O., the maximum secondary follicle density (95.5) was attained at 60 days of age followed by a decrease till 150 days of age when another slight increase was observed at 180 days of age.

For the ¾ M.O., the maximum secondary follicle density (183.4) was attained at 30 days of age followed by fluctuating density till 150 days of age where a great drop in density occurred and observed clearly at 180 days of age.

The value of maximum secondary follicle density observed for Merino was the highest among all breeds, followed in sequence by that for the ¾ M.O., ½ M.O. and Ossimi.

*Secondary follicle percentage and ratio of secondary to primary follicles* (S/P)

Significant ($P<0.01$) differences were found between the different breeds in their secondary follicle percentage and consequently in their S/P ratios (Tables 1 & 2). The effect of age on the percentage of secondary follicles and S/P ratios was also significant ($P< 0.01$) and the effect of interaction between the two variables was significant ($P< 0.05$).

TABLE 1.—MEAN NUMBER OF FOLLICLE TYPES PER 1.5 MM² OF SKIN TISSUE IN FOUR BREEDS OF SHEEP.

| Age | Merino (M) | | | | Ossimi (O) | | | |
|---|---|---|---|---|---|---|---|---|
| | P(1) | S(2) | S/P(3) | F.G.(4) | P | S | S/P | F.G. |
| 24 hours | 84.7±20.4 | 70.0±33.4 | 0.94±0.55 | 24.5±5.9 | 50.7±12.3 | 25.7±25.2 | 0.66±0.70 | 18.8±3 0 |
| 30 days | 70.1±21.7 | 166.5±87.4 | 2.69±1.34 | 21.7±11.3 | 24.3±5.4 | 33.7±11.32 | 1.56±0.69 | 13.1±2.1 |
| 60 days | 53.2±18.1 | 231.0±65.8 | 4.84±1.81 | 19.5±4.9 | 24. ±8.98 | 53.5±11.12 | 2.45±1.97 | 11.9±1.5 |
| 90 days | 46.9±20.5 | 195 8±39.4 | 4.76±1.57 | 15.9±4.7 | 20.2±4.82 | 40.8±9.35 | 2.15±0.76 | 11.2±1.62 |
| 120 days | 34.6±6.0 | 156.6±00 | 4.50±2.85 | 13.4±7.7 | 15.2±2.08 | 37.2±9.88 | 2.46±0.44 | 10.8±1.44 |
| 150 days | 26.6±12.6 | 165.8±50 0 | 6.87±1.68 | 10.2±3.4 | 14.8±4.05 | 29.6±4.68 | 2.23±0.62 | 9.4±0.98 |
| 180 days | 20.4±8.3 | 154.1±36.7 | 7.53±2.23 | 9.8±1.7 | 12.3±2.87 | 24.9±3.79 | 2.16±0.64 | 9.6±0.81 |
| Mean.. .. | 48.1 | 162.8 | 4.59 | 16.4 | 23.1 | 35.1 | 1.95 | 12.1 |

(1) Primary follicles
(2) Secondary follicles
(3) Ratio of S : P follicles
(4) Follicle groups

TABLE 1 (*continued*)

| Age | 1/2 M.O. | | | | 3/4 M.O. | | | |
|---|---|---|---|---|---|---|---|---|
| | P | S | S/P | F.G. | P | S | S/P | F.g. |
| 24 hours | 76.9±22.8 | 35.0±22.1 | 0.49±0.27 | 26.7±5 5 | 161.5±41.1 | 20.5±59.9 | 0.11±0.31 | 52.3±17.3 |
| 30 dsys | 47.5±23.8 | 91.5±56.6 | 1.92±0.49 | 18.2±6.3 | 44.5±73.8 | 183.4±138.4 | 4.55±1.58 | 21.1±6.8 |
| 60 days | 45.5±25.6 | 95.5±23.7 | 2.00±0.88 | 18.8±7.3 | 35.6±8.4 | 165.3±41.0 | 4.81±1.15 | 18.8±5.1 |
| 90 days | 36.4±21.1 | 90.1±43.0 | 2.61±0.38 | 14.7±3.1 | 33.5±18.6 | 177.8±69.4 | 5.63±1.22 | 17.6±8.8 |
| 120 days | 31.5±21.9 | 78.4±38.7 | 2.56±0.82 | 12.1±5.8 | 21.2±4.5 | 138.1±17.7 | 6.72±191 | 12.4±2.6 |
| 150 days | 27.7±13.4 | 47.5±38.0 | 2.88±0.75 | 12.8±2.7 | 24.9±9.0 | 152.6±45.1 | 6.62±2.35 | 13.0±2.8 |
| 180 days | 31.7±2.2 | 76.4±15.8 | 2.41±0.42 | 10.5±0.7 | 15 2±2.6 | 82.2±14.9 | 5.78±1.81 | 9.2±0.7 |
| Mean | 42.5 | 77.3 | 21.2 | 16.3 | 48.1 | 131.4 | 4.89 | 20.6 |

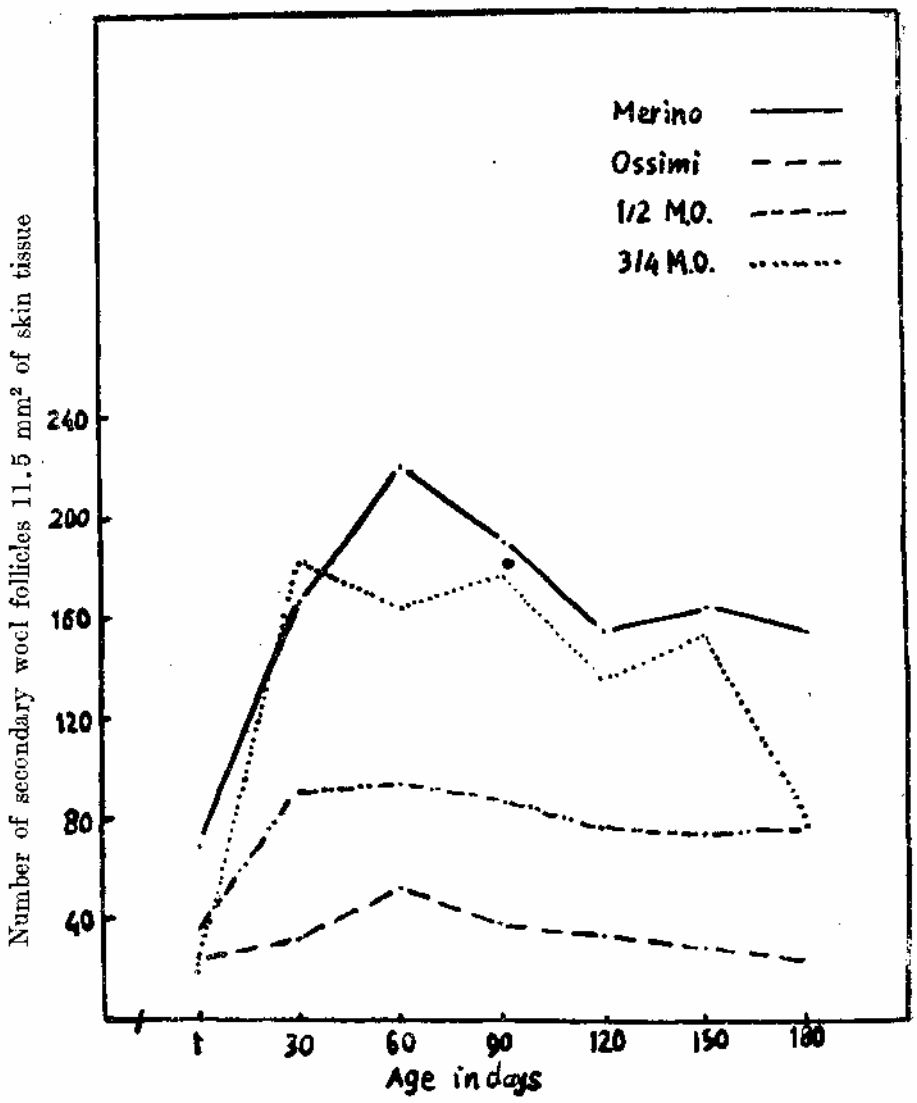


Fig 3: Secondary wool follides vs age in four breeds

Calculations of the mean values of the S/P for the different breeds revealed that ¾ M.O. possessed a mean S/P (4.89) slightly larger than that for Merino ; the difference however was not significant. The ½ M.O. showed a mean S/P of 2.12 which was intermediate between the ratios of its parental breeds. Ossimi showed the lowest ratio (1.95) among the four breeds studied.

An increase in the pooled S/P ratios with advancing age was observed starting by 24 hours till 150 days of age after which a slight insignificant decrease occurred and showed up a 180 days of age. The increase, however, was more rapid between 24 hours and 30 days of age with less intensity between 30 and 60 days of age and a gradual increase thereafter till 150 days of age.

In respect of breed, it was evident that the S/P in Merino increased rapidly from birth to 60 days of age, and was followed by a slight decrease till 120 days of age when another increase occurred up to the end of the experiment. In Merino the S/P ratio attained at 180 days of age (7.53) was the highest for all breeds at their maximum ratios.

Ossimi also showed a rapid rise in the S/P ratio between birth and 60 days of age, after which some insignificant fluctuations occurred till the end of the experiment. The highest S/P ratio registered for Ossimi (2.46), was that at 60 days of age, nevertheless it was the least maximum observed for all breeds.

In the ½ M.O. the rapid rise in the S/P ratio started from birth and continued till 90 days of age ; fluctuations occurred thereafter till the end of the experiment. The maximum S/P ratio (2.88) registered was that attained at 150 days of age, which was higher than that for Ossimi.

In the ¾ M.O. the most rapid increase in the S/P ratio was that observed between birth and 30 days of age, however, it continued till 120 days of age but at al ower rate. A depression occurred at 150 days of age followed by another depression registered at 180 days of age. The maximum S/P ratio was attained at 120 days of age, which was less than that for Merino, but higher than those of the ½ M.O. and the Ossimi. The trend of the S/P curve for each breed can be seen in figure 4.

*Follicle groups*

The differences between breeds in the mean number of follicle groups per 1.5 $mm^2$ of skin tissue (Table 2), were not significant, however the effect of age as well as the interaction between age and breed were significant ($P<0.01$).

From table 2, it was evident that signficant differences ($P<0.05$) existed between most of the pooled mean numbers of follicle groups between breeds ; the only insignificant difference was that between Merino (16.4) and ½ M.O. (16.3).

A gradual decrease in the pooled mean follicle group numbers with the advance in age was also observed ; the highest (30.6) was that observed at 24 hours, while the lowest (9.8) was at 180 days of age.

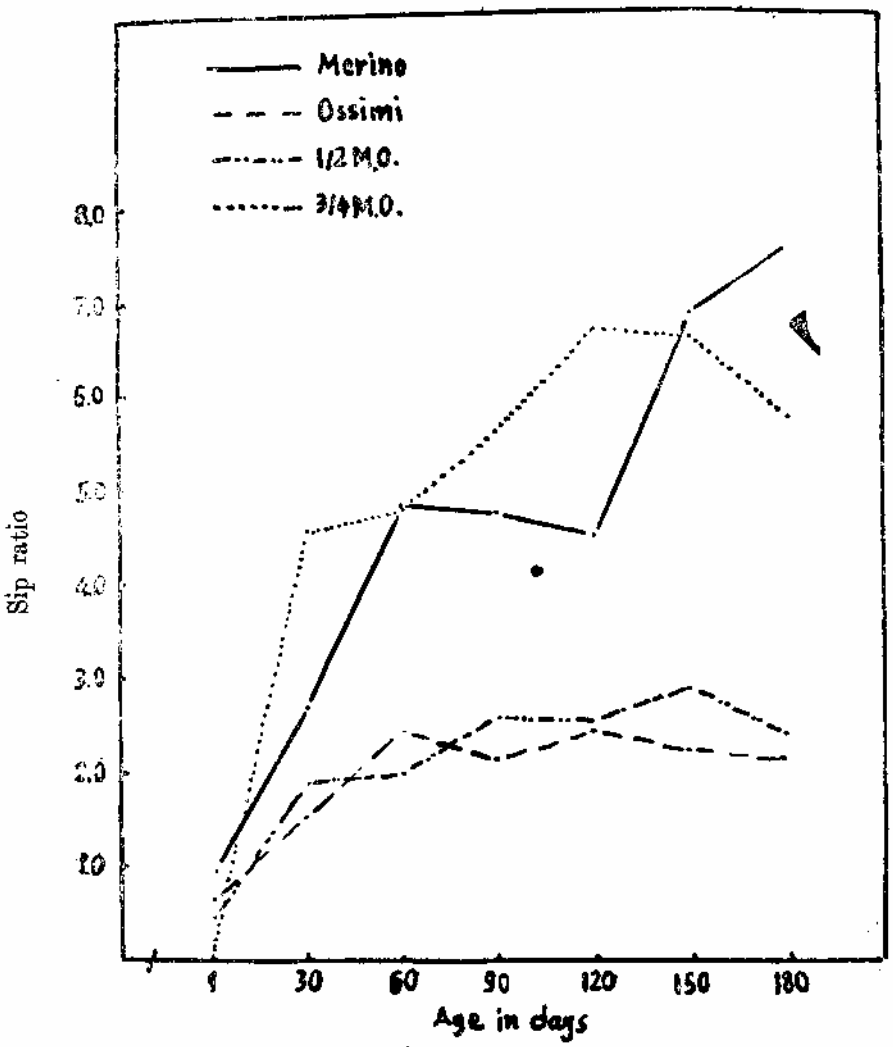


Fig 4 : The S/P ratio vs age in four breeds

TABLE 2.—ANALYSIS OF VARIANCE OF FOLLICLE TYPES AND FOLLICLE GROUPS PER 1.5 MM$^2$ OF SKIN TISSUE IN FOUR BREEDS OF SHEEP

| Source of variation | Primary follicles | | | | Secondary follicles | | | |
|---|---|---|---|---|---|---|---|---|
| | D.F. | S.S. | M.S. | F. | D.F. | S.S. | M.S. | F. |
| Breed | 3 | 12358.82 | 4119.61 | 3.35* | 3 | 308025.83 | 102675 | 52.90** |
| Age | 6 | 54786.16 | 9131.02 | 7.42** | 6 | 125185.15 | 20864 | 10.75** |
| Age X Breed | 18 | 22157.62 | 1230.98 | 10.30** | 18 | 34943.01 | 1941 | 1.25 |
| Residual | 93 | 21642.24 | 119.30 | | 93 | 144258.42 | 1551 | |
| Total | 120 | 110944.84 | | | 120 | 612412.41 | | |

TABLE 2 (*contd.*)

| Source of variation | Secondary follicle% | | | | Follicle groups | | | |
|---|---|---|---|---|---|---|---|---|
| | D.F. | S.S. | M.S. | F. | D.F. | S.S. | M.S. | F. |
| Breed | 3 | 2679.07 | 893.02 | 7.87** | 3 | 773.3 | 257.8 | 2.29 |
| Age | 6 | 15601.26 | 2600.21 | 22.92** | 6 | 4065.6 | 677.6 | 6.01** |
| Age X Breed | 18 | 2041.83 | 113.44 | 1.83* | 18 | 2028.3 | 112.7 | 6.30* |
| Residual | 93 | 5760.17 | 61.94 | | 90 | 1610.9 | 17.9 | |
| Total | 120 | 26082.33 | 217.35 | | 117 | 8478.1 | 72.46 | |

* Significant. ** Highly significant.

It was also observed that Merino and Ossimi followed the same general trend of the pooled mean follicle group numbers, i.e. decreased with advancing age. However the decrease in follicle group numbers was more uniform in Merino than that in Ossimi. In ½ M.O., the decrease in the number of follicle groups was greater between 24 hours and 30 days of age then fluctuating till 180 days of age. In ¾ M.O., a great decrease occured between birth and 30 days of age which brought the number of follicle groups to about 2/5 that observed at birth. The decrease seen there after was fluctuating within limited boundaries.

The number of follicle groups per unit area of skin (Fig. 5) was almost similar in all four breeds as the differences between breeds were not significant ($P<0.05$).

## Discussion

The results obtained in this work showed that the ¾ M.O. were much similar to the pure Merinos in the mean density of primary follicles and that these two breeds were more dense in primary follicles than Ossimi with the ½ M.O. having almost an intermediate value between its parental breeds. This result is in accordance with those found by Stepanov and Kablov (1962), Batu and Oczan (1962) Sugai and Kuramoto (1963) and Marai and Shafei (1964). Explanation may be based on the fact that different breeds possess different follicle population densities which are a genetic maximum that may or may not be attained (Wildman 1965).

Shedding of primary wool fibres starts by the second month of age, with some deviations as to the timing from one breed to the other. It seems likely that shedding starts earlier in those breeds which attain their maximal secondary follicle density at an esrlier age. Thus shedding of primary fibres may occur at earlier ages in the fine wool breeds while it is somewhat late in coarse wool breeds.

The regression in the number of primary follicles per unit area of skin with advancing age up to six months is attributed mainly to the expansion of the skin surface area which accompanies the lambs' growth, varying within wide limits between breeds and individuals according to variation in the rate of growth. In addition, some primary follicles may cease to grow during the first three months after birth. This result was confirmed by different authors (Carter 1943 and Burns 1953*a*, 1953*b* and 1955).

Both breed and age, greatly affected the secondary follicle density. Fraser and Short (1960) observed the difference in secondary follicle density Between Merino and breeds of British origin and that crosses between the two breeds possessed intermediate secondary follicle values. Similar results were also shown by Stepanov and Kablov (1962), Batu and Oczan (1962), and Marai and Shafei (1964).

The low secondary follicle value observed in the Ossimi is similar to that found by Badreldin *et al.* (1961). Apparently, and as stated by Fraser (1952) and Cockrem (1956), the coarseness of the fleece is associated with a decrease in the number of secondary follicles which can complete their development.

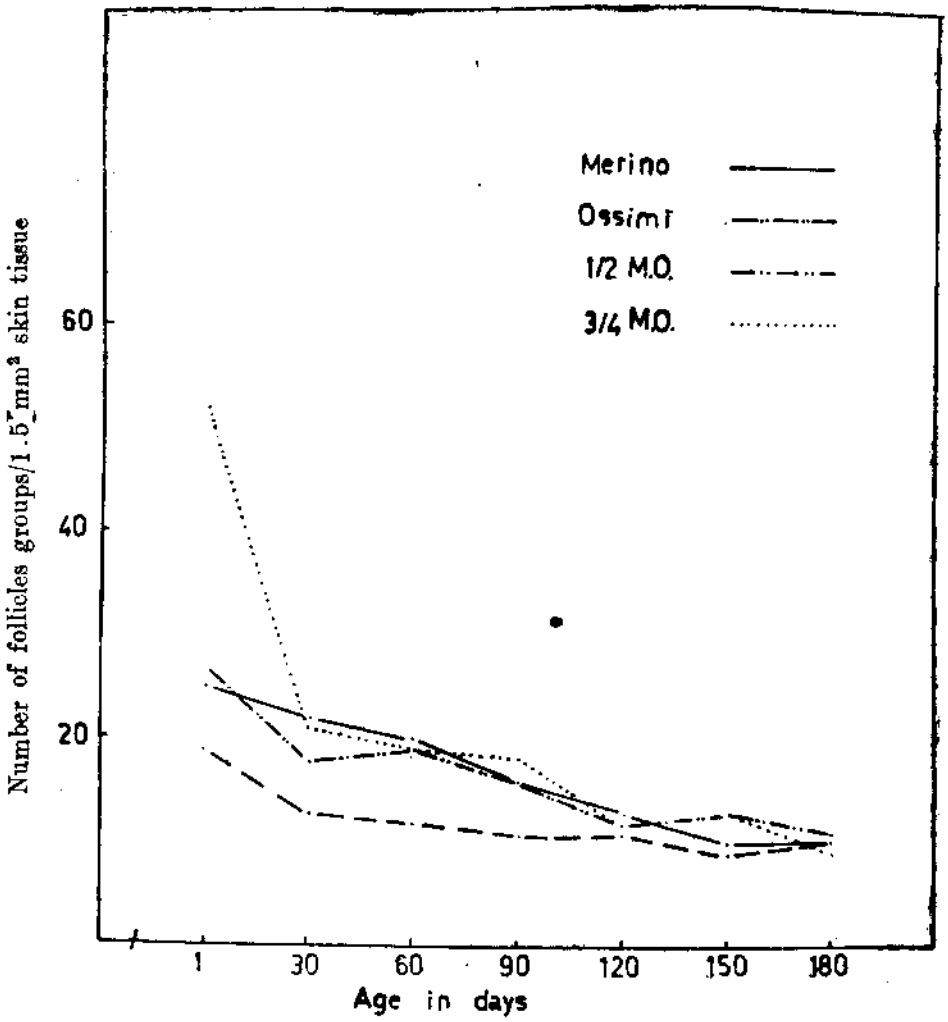


FIG. 5.— Groups of follictes vs. age in four breeds

The correlation between the number of secondary follicles and age demonstrates that secondary follicles may continue developing up to three months of age, although breed differences may exist as to the time at which secondary follicles cease to develop. This result is in agreement with those of Carter (1943), Burns and Clarkson (1949), Burns (1953, 1955), Short (1955), Schinckel (1955), Ryder (1957), Margolena (1959), Badreldin *et al.* (1961) and Lyne (1961).

Merino, at 24 hours of age had quite a few secondary follicles, and it attained its maximum secondary follicle density at the age of 60 days. Relative to Merino, the other three breeds started from almost similar values but less than that observed for Marino. This result indicates that the development of secondary follicles producing coarser wool, may be retarded, although a clear cut explanation needs further investigation.

The sudden drop in the number of secondary follicles observed in the 3/4 M.O. at 180 days of age is attributed in part to the high growth rate at this age accompanied by greater skin expansion, in addition to the degeneration of some secondary follicles.

With respect to the S/P ratios, breed as well as age differences were evident, although the difference between Merino and 3/4 M.O. was negligible in their mean ratios. The present results conform with those reported by Burns and Clarkson (1949), Burns (1953, 1955), Daly and Carter (1955), Fraser and Short (1960), Lyne (1961), Gurau *et al.* (1963), Kupatz (1965), Vinogradova (1964,1965) and Wildman (1965).

The observed decrease in the S/P ratio at 150 days of age was also observed by Burns (1953, 1955) and Lyne (1961) in Romney lambs at 9 months of age. The ratio of secondary to primary follicles, being a function of two variables, viz.; primary and secondary follicles, is thus a fluctuating parameter. However, the ratio obtained at 180 days of age can not be considered as stable to indicate the mature ratio in most breeds.

Different breeds of sheep may possess equal numbers of follicle groups per unit area of skin at 6 month of age, or that the differences in the number of follicle groups, if present, may be of no significance. The diffrent densities and S/P ratios observed between different breeds could therefore be attributed mainly to the different numbers of secondary follicles contained in the group rather than to the different numbers of follicle groups per unit area of skin.

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# دراسات هستولوجية على جلد المرينو والأوسيمى وخليطهما فى الجمهورية العربية المتحدة

## الملخص

عملت قطاعات مكروسكوبية فى جلود ١٤٠ رأسا من المرينو والأوسيمى ونصف المرينو و ٣/٤ مرينو على فترات شهرية من الميلاد لغاية عمر ستة شهور لدراسة تطور بصيلات الصوف وتأثير الخلط بين الأنواع عليها . وقد تبين من نتائج الدراسة بصفة عامة ان هناك نقصا متواليا فى عدد البصيلات الأولية بالنسبة لوحدة مساحة الجلد مع زيادة العمر بينما زاد عدد البصيلات الأولية بزيادة العمر حتى الـ ٦٠ يوما حيث كانت الزيادة بعد ذلك طفيفة بصرف النظر عن اختلاف النوع .

وكانت النسبة بين البصيلات الثانوية والأولية فى عمر ١٨٠ يوما مميزة لكل نوع من أنواع الأغنام كما كانت هذه النسبة فى الأفراد الخليطة وسطا بين نظائرها فى آباء هذه الأفراد الا أن الفروق بين ٣/٤ المرينو والمرينو الأصيل لم تكن معنوية .

هذا ولم يتضح وجود فروق معنوية بين الأنواع فى متوسطات عدد البصيلات مما يبعث على القول بأن الفرق فى غزارة البصيلات يرجع أصلا الى عدد البصيلات الثانوية اكثر منه الى البصيلات الأولية .