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A STUDY OF SOME BODY MEASUREMENTS IN A CROSS BETWEEN MERINO AND BARKI SHEEP LIVING UNDER DESERT CONDITIONS : I - GROWTH RATES (1)

By

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Since 1958, Hungarian Combing-wool Merino sheep were crossed with local Barki sheep at Ras El-Hekma Desert Research Station in the Western Desert, for the improvement of wool production. In this semi-arid area, sheep and other livestock, including camels and goats, subsist on sparse vegetation and insufficient water, while climatic conditions are often severe especially during sandstorms in March and April, or during the hot and humid late summer months. Under these conditions, the production of thrifty, normally-growing lambs is necessary. During the lambing seasons of 1959/60 and 1960/61 it was observed that Merino lambs produced locally were unthrifty and of low body weights and viability as compared to pure Barki lambs of the same age.

Therefore, a study of growth in some body measurements of crossbred lambs as compared with pure Merinos and Barkis was carried out during the 1961/62 lambing season. The purpose was to evaluate the ability of crossbred lambs and Barki backcrosses to grow normally under desert conditions. The growth of lambs during the first year of their life was investigated.

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(1) Extracted from an M. Sc. thesis submitted by the senior auther to the Faculty of Agriculture, Ain Shams University, Cairo.

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MATERIALS AND METHODS

The animals used in the present study consisted of 106 lambs born during the 1961/62 lambing season (fromNovember to January). They consisted of 35 Barki (18 males and 17 females), 18 Merino (9 males and 9 females), 33 Merino x Barki, or MB (14 males and 19 females, obtained by crossing Merino rams with Barki ewes) and 20 backcross, or MBB lambs (11 males and 9 females, obtained by backcrossing a Merino x Barki ram with Barki ewes). Only single lambs were used in this study, as the number of twins born in most breeding groups was limited.

Lambs were identified soon after birth, using metal ear-tags. Birth weights were recorded within 24 hours after birth. Lambs were kept with their mothers until weaning, which took place when the lambs were about 130 days old. During this time, natural pasture was available, but as grazing was poor, due to low rainfall, concentrate feed and barley straw were also given. After weaning, feeding consisted of about $\frac{1}{4}$ to $\frac{1}{2}$ kg. pelleted concentrate mixture per lamb daily, with wheat or barley straw *ad lib*. Lambs were allowed to drink twice daily in the morning and in the afternoon. Next autumn, the lambs used to graze, but due to severe drought, they were also given berseem hay plus straw and concentrate feed.

Body weights and measurements were taken every two weeks during the first two months of life. After this period, data were collected every four weeks, up to 52 weeks of age. Body weight was taken to the nearest ½ kg. Other measurements included height at withers, height at hook, length from shoulder to hook, depth at chest, width at shoulder, width at hook and circumference at heart girth. These measurements were taken to the nearest half centimeter, using a tape for measuring circumference (close to the skin after parting the wool), and wooden calipers for the other dimensions. Adjustments for individual measurements to different ages, from 2 to 52 weeks, was carried out by simple linear interpolation between the data of two successive periods. Growth during these short periods was assumed to be linear.

Statistical analysis of absolute daily gain in body weight was carried out using the method of disproportionate subclass numbers as described by Snedecor (1956).

RESULTS AND DISCUSSION

1.—*Growth Curves* :

The growth curves for the different body measurements in both sexes of the four breed-groups are shown in figures 1 to 16. The Merino x Barki and backcross (Merino Barki x Barki) lambs generally excelled the two parental breeds in growth of all measurements and body weight, the backcross being superior to the other groups. This may be attributed to heterosis, which was evidently retained in the backcross lambs. Heterosis in sheep crosses has been reported by many workers including Miller (1935), Bonsma (1939), Miller and Dailey (1951) and Asker *et al* (1952).

Merino lambs were markedly slower in growth of all measurements except length than the other groups. Barki lambs, on the other hand, tended to grow at a comparatively steady rate. The poor performance of the Merinos may be due to the fact that Merino lambs are generally slow in growth during the first year of life (Kammlade, 1947). Another probable cause may be the lower milking ability of Merino ewes as compared to Barki ewes (Ghanem, 1963). After weaning, the severe conditions, both nutritional and climatic, which were imposed by the desert environment upon the non-adapted Merino lambs may have adversely affected their growth from weaning until the end of the study.

Male lambs grew in all measurements at a faster rate than females in the four breed-groups studied. Hammond (1932), Karam *et al* (1948) and Ghoneim *et al* (1956 & 1957) similarly reported that male lambs grew at a faster rate than females. Sex differences, however, were exaggerated in the case of the backcross lambs.

2.—*Absolute Daily Gain* :—

On studying the growth curves it was evident that growth during the pre-weaning period proceeded at a much higher rate in all measurements than the following period, from weaning to yearling age. Accordingly, the absolute daily gain was

calculated for two periods, from 2 to 16 weeks and from 16 to 52 weeks for each measurement in each sex and breed-group. The formula given by Brody (1945) was used.

$$\text{Absolute daily gain} = \frac{W_2 - W_1}{t_2 - t_1}$$

in which : W_2 = average final measurement.

W_1 = average initial measurement.

t_2-t_1 = period of growth in days.

During the first preweaning period (table 1) males were generally superior to females in most measurements and breed groups. The crossbred lambs of MB and MBB groups generally exceeded the pure breeds except in height and length measurements of the MB group. The MBB males excelled the MB's, while there was a tendency towards the reverse in the females. Merino lambs exhibited the poorest gain except in height at hook of females and length of males, while Barki lambs were intermediate between the crossbreds and the Merinos.

TABLE 1.

Average Absolute Daily Gain in Body Measurements of the Four Breed-groups During The Period from 2 to 16 weeks of age

Measurements	Male				Female			
	Barki	Merino	M×B	MBB	Barki	Merino	M×B	MBB
Body weight, kg. .	0.155	0.149	0.164	0.179	0.149	0.122	0.149	0.145
Ht. at withers, cm.	0.140	0.126	0.111	0.146	0.106	0.116	0.114	0.148
Ht. at hook, cm. .	0.145	0.142	0.129	0.161	0.124	0.137	0.131	0.134
Length, cm. . . .	0.142	0.161	0.143	0.162	0.146	0.129	0.146	0.155
Depth at chest cm.	0.078	0.067	0.078	0.093	0.077	0.068	0.080	0.079
Width at shoulder, cm.	0.051	0.048	0.055	0.056	0.048	0.042	0.054	0.050
Width at hook, cm	0.048	0.044	0.049	0.058	0.051	0.044	0.050	0.050
Circumference, cm	0.226	0.218	0.242	0.242	0.217	0.202	0.236	0.228

A sudden decrease occured in absolute daily gain from weaning to yearling ages (table 2), to about one fourth to one third of the corresponding values during the suckling period. Males were inconsistantly higher than females during the second period. Among male lambs the Barkis made the best gains followed by MBB, MB and Merino in descending order. Among the females the MBB group was superior, followed by MB, Barki and Merino respectively. The poor performance of the Merino lambs may indicate their poor adaptability to desert conditions, while the relatively higher gains attained by the crossbred groups may be due to heterosis.

TABLE 2.

Average Absolute Daily Gain in Body Measuremen's of The Four Breed-groups During The Period From 16 to 52 Weeks of Age.

Measurements	Male				Female			
	Barki	Merino	M×B	MBB	Barki	Merino	M×B	MBB
Body weights, kg.	0.067	0.038	0.063	0.064	0.048	0.036	0.052	0.050
Ht. at withers, cm.	0.032	0.021	0.034	0.029	0.029	0.022	0.031	0.031
Ht. at hook, cm.	0.035	0.020	0.035	0.034	0.032	0.021	0.035	0.034
Length, cm. . .	0.039	0.025	0.035	0.038	0.035	0.030	0.033	0.032
Depth at chest, cm	0.020	0.013	0.016	0.022	0.015	0.013	0.016	0.018
Width at shoulder. cm.	0.015	0.010	0.013	0.015	0.012	0.013	0.013	0.015
Width at hook, cm.	0.013	0.008	0.012	0.015	0.012	0.010	0.012	0.013
Circumference, cm.	0.078	0.050	0.081	0.083	0.071	0.065	0.085	0.089

For statistical analysis, absolute gain in body weight was measured for individual lambs during two periods from birth to 16 weeks and from 16 to 52 weeks of age. The averages and standard deviations obtained are shown in table 3, while the analysis of variance (method of weighted means) is presented in table 4. Breed and sex were highly significant sources of variation during the two periods while their interaction was non-significant. On testing the weighted mean differences among the four breed-groups it was found that Merino lambs had significantly lower absolute gain in body weight than the other three breed-groups during the two growth periods. The latter groups, however, did not differ significantly among each other.

TABLE 3—Absolute Gain in Body Weight (Kg.) by Different Breed-groups During Two Growth Periods

Growth Period		Males Barki	Males Merino	Males M×B	Males MBB	Females Barki	Females Merino	Females M×B	Females MBB
Birth—16 weeks	N	18	9	14	11	17	9	19	9
	$\bar{X}$	18.3	17.6	19.3	21.1	17.9	14.6	17.7	17.3
	SD	± 3.56	± 1.95	± 2.62	± 3.05	± 2.42	± 1.87	± 2.15	± 2.22
16—52 weeks	N	17	7	11	11	15	9	19	8
	$\bar{X}$	17.1	10.4	15.7	16.2	12.2	9.0	13.2	12.9
	SD	± 3.96	± 4.33	± 3.94	± 4.95	± 2.39	± 3.33	± 2.69	± 1.80

TABLE 4—Analaysis of Variance in Absolute Gain in Body Weight from Birth to 16 weeks and from 16 to 52 weeks of Age

Source of variation	Birth-16 weeks d.f.	Birth-16 weeks M.S.	16 — 52 weeks d.f.	16 — 52 weeks M.S.
Breed group	3	35.63**	3	99.97**
Sex	1	87.00**	1	256.40**
Breed X sex	3	14.67	3	12.90
Individual	98	6.87	89	12.19

** $P < 0.01$

3.– *Instantaneous Relative Growth Rate.*

The instantaneous relative rate of growth in both sexes of the four breed-groups was calculated for the preweaning period (table 5), and the weaning to yearling period (table 6) The formula given by Brody (1945) was used :

$$\text{Instantaneous relative growth rate} = \frac{\log_e W_2 - \log_e W_1}{t_2 - t_1}$$

TABLE 5

Instantaneous Relative Growth Rate

in Different Breed-groups during the Period from 2 to 16 weeks of Age

Measurements	Male Barki	Male Merino	Male M×B	Male MBB	Female Barki	Female Merino	Female M×B	Female MBB
Body weight % .	1.17	1.14	1.16	1.19	1.18	1.09	1.10	1.12
Ht. at withers % .	0.31	0.28	0.24	0.31	0.24	0.27	0.25	0.34
Ht. at hook % .	0.31	0.30	0.27	0.33	0.27	0.30	0.28	0.29
Length %. . . .	0.38	0.42	0.37	0.42	0.41	0.35	0.38	0.41
Depth at chest %	0.40	0.36	0.40	0.47	0.40	0.38	0.42	0.41
Width at shoulder	0.40	0.37	0.42	0.44	0.38	0.35	0.43	0.41
Width at hook %	0.50	0.45	0.49	0.60	0.55	0.49	0.52	0.54
Circumference %	0.42	0.42	0.45	0.44	0.41	0.40	0.44	0.44

TABLE 6

Instantaneous Relative Growth Rate

in Different Breed-groups During the Period from 16 to 52 weeks of Age

Body weight % .	0.23	0.15	0.20	0.20	0.18	0.16	0.18	0.18
Ht. at withers % .	0.06	0.04	0.06	0.05	0.05	0.04	0.06	0.06
Ht. at hook % .	0.06	0.04	0.06	0.06	0.06	0.04	0.07	0.06
Length %. . . .	0.08	0.05	0.07	0.07	0.07	0.06	0.07	0.06
Depth at chest %.	0.08	0.06	0.06	0.08	0.06	0.02	0.06	0.07
Width at shoulder	0.09	0.06	0.07	0.09	0.07	0.08	0.07	0.09
Width at hook %	0.09	0.06	0.09	0.10	0.09	0.08	0.09	0.10
Circumference %	0.11	0.07	0.11	0.11	0.10	0.09	0.11	0.12

$\log_e W_2$ = natural logarithm of final measurement.

$\log_e W_1$ = natural logarithm of initial measurement and

$t_2 - t_1$ = growth period in days.

The results were generally similar to those of the absolute daily gain. The two crossbred groups exceeded the pure breeds in all measurements except height and length, in which the MB group showed poor growth rate during the preweaning period. This is due to the fact that the average heights and length of the latter group were relatively higher at 2 weeks old than those of the other breed-groups. In other words the MB group probably made relatively higher gains in height and length during the first 2 weeks of age, and / or during the intauterine period.

During the pre-weaning period growth rate was highest in the case of body weight, followed in descending order by circumference, width at hook, depth at chest, width at shoulder, length from shoulder to hook, height at hook and height at withers. A slight change in this order occurred during the second period (from 16 to 52 weeks), in which circumference came second after body weight, followed by width at hook, width at shoulder, length, and depth at chest. Heights at hook and at withers still exhibited the least growth. Similar ranking among body dimensions in growth rate were observed by Ragab *et al* (1953) and Badawi and Hamada (1959) in Egyptian breeds and by Hamada (1955) in British breeds of sheep.

4.—*Yearling Data As Percentages of First Measurements* :

The relative increase in body weight up to 52 weeks expressed as percentage of witht at 2 weeks, was higher than that of body dimensions in lambs of both sexes, in the four breed-groups (table 7). Among body dimensions, the highest relative increase was in width at hook followed by circumference, width at shoulder, depth at chest, length from shoulder to hook, height at hook and height at withers respectively. Few minor exceptions occurred which did not materially change this order.

TABLE 7

Body Weights and Measurements of Male and Female Lambs at 52 Weeks of Age, As Percentages of Weights and Measurements at 2 weeks

Measurement	Male				Female			
	Barki	Merino	M×B	MBB	Barki	Merino	M×B	MBB
Body weight . .	559.1	443.3	515.5	528.7	498.3	436.8	466.6	469.2
Ht. at withers .	156.5	144.7	147.2	153.2	145.0	144.3	146.1	149.7
Ht. at hook. . .	157.2	147.3	151.0	159.0	151.1	147.9	152.0	153.5
Length	177 7	171.0	171.2	182.5	178.8	164.4	171.6	176.3
Depth at chest .	179.2	164.0	173.6	194.8	171.8	168.0	177.2	180.4
Width at shoulder	184.6	167.0	181.1	192.2	173.3	173.0	184.2	186.9
Width at hook .	205.3	182.0	201.3	232.4	215.7	198.6	208.1	216.9
Circumference . .	197.4	180.4	203.3	201.8	191.1	188.3	204.0	207.7

Males generally excelled females, except in width at hook, in which the reverse was observed in the case of Barki, Merino and MB groups. The superiority of females in width at hook may be associated with the expected relatively greater increase in width of pelvic bone in female, which is one of the female secondary sex characters.

Barki lambs reached relatively higher weights than other breed groups at 52 weeks as compared to their weights at 2 weeks. In body dimensions the backcross lambs of both sexes were superior to the other three breed groups. While Barki males surpassed MB in all measurements except circumference, the females of the latter groups were lighter than Barki females in all measurements except length and width at hook. Merino lambs showed the lowest percentage measurements at 52 weeks as compared to those at 2 weeks of age. This ascertains the low adaptability of that breed under desert conditions.

SUMMARY

Growth during the first year of life was measured on 106 single lambs of both sexes belonging to four breed-groups raised at Ras El-Hekma Desert Research Station in 1961-62. The groups were Hungarian Merino, Barki, their first cross (from Merino rams × Barki ewes) and the Braki backcros (from Merino Barki ram × Barki ewes). Periodic measurements were taken of body weight, height at withers and hook, width at shoulder and hook, length from shoulder to hook, depth at chest and circumference at heart girth. The results indicate that :

(1) The crossbred lambs generally excelled the lambs of the two parental breeds.

(2) Merino lambs were significantly slower in growth than lambs of the other three breed-groups.

(3) Barki lambs tended to grow at a steady rate throughout the first year of life.

(4) Growth was most rapid in body weight followed by width at hook, circumference, width at shoulder, depth at chest length from shoulder to hook, height at hook and height at withers respectively.

(5) Growth during the preweaning period was three to four times faster than that from weaning to yearling age in all measurements

(6) Male lambs grew at a faster rate than females in all measurements except length and width at hook.

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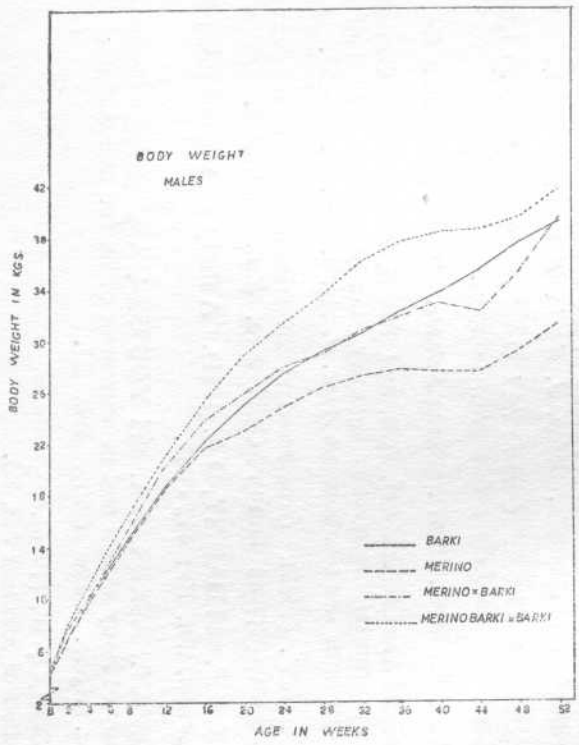
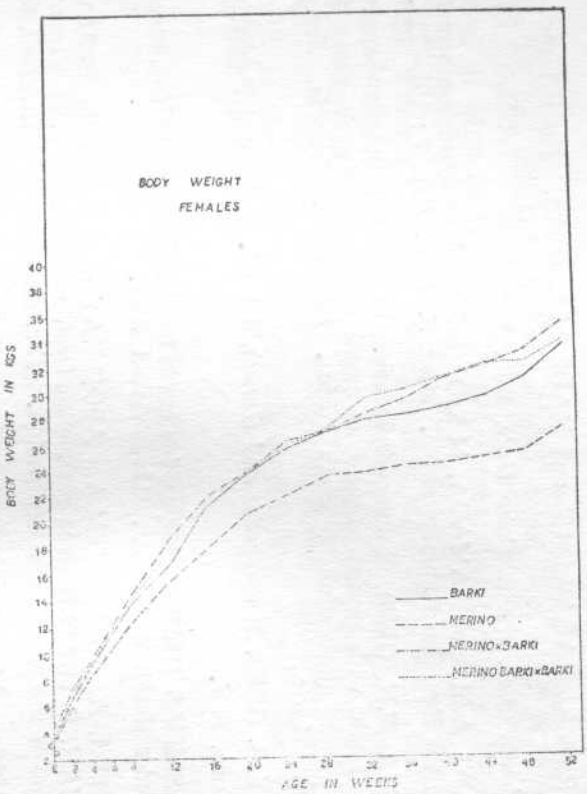


FIG. 1



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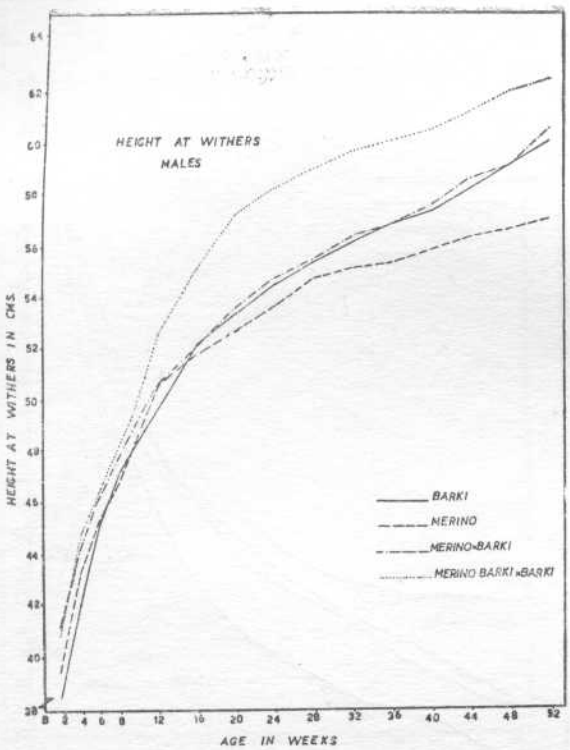

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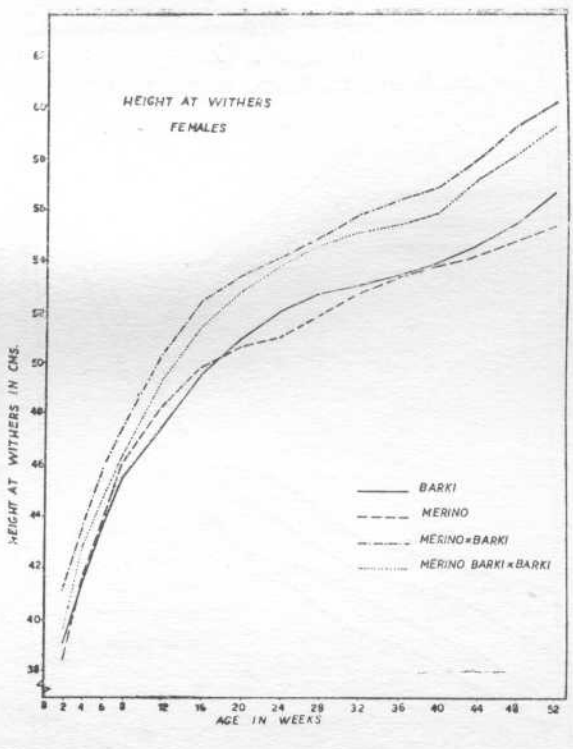

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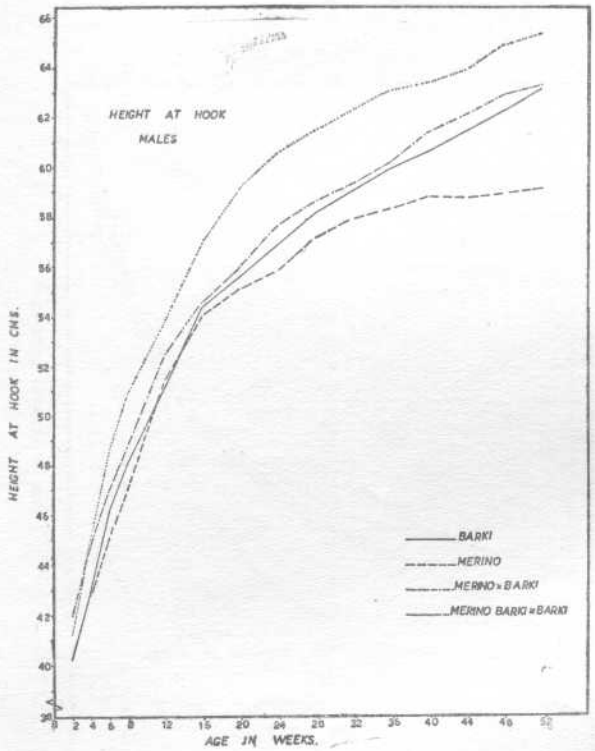

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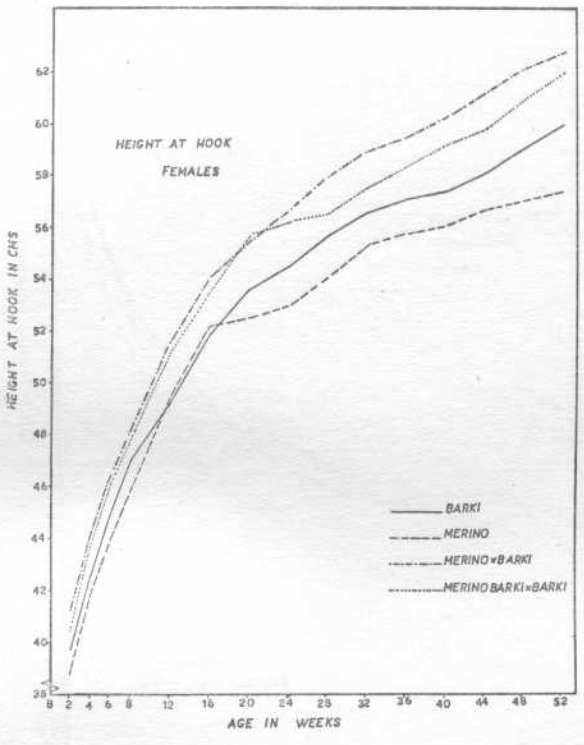

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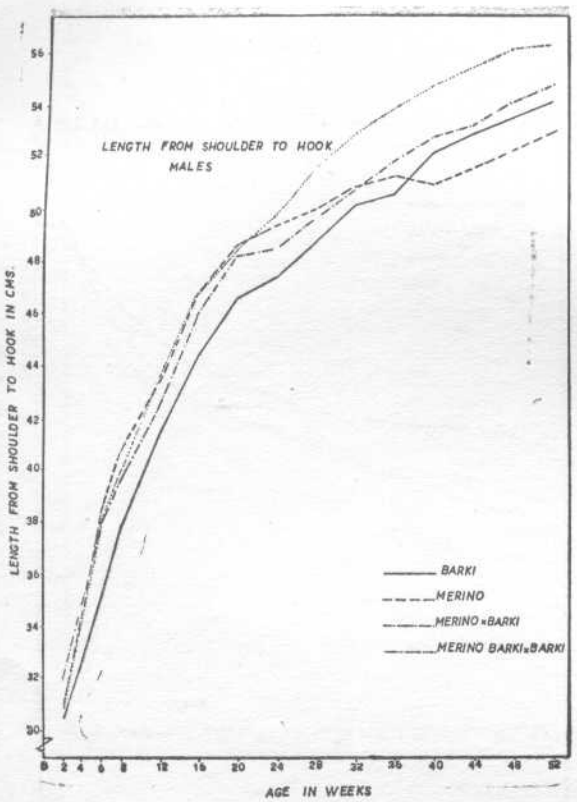

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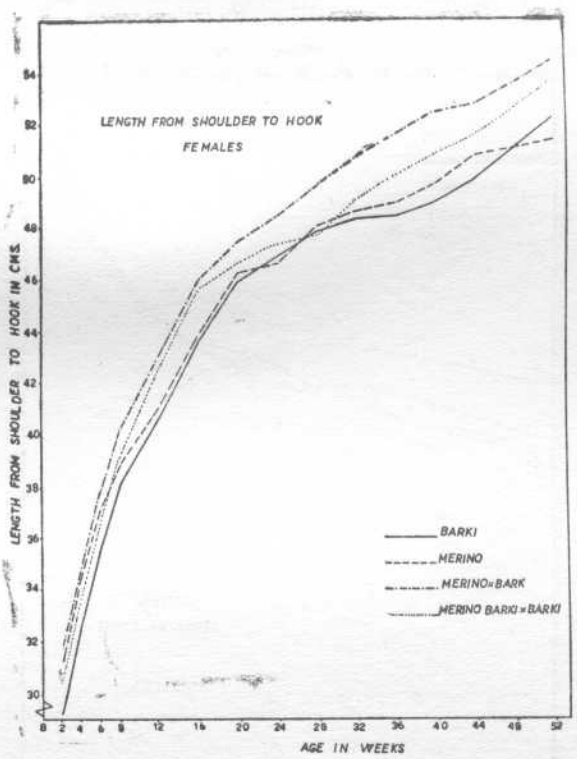

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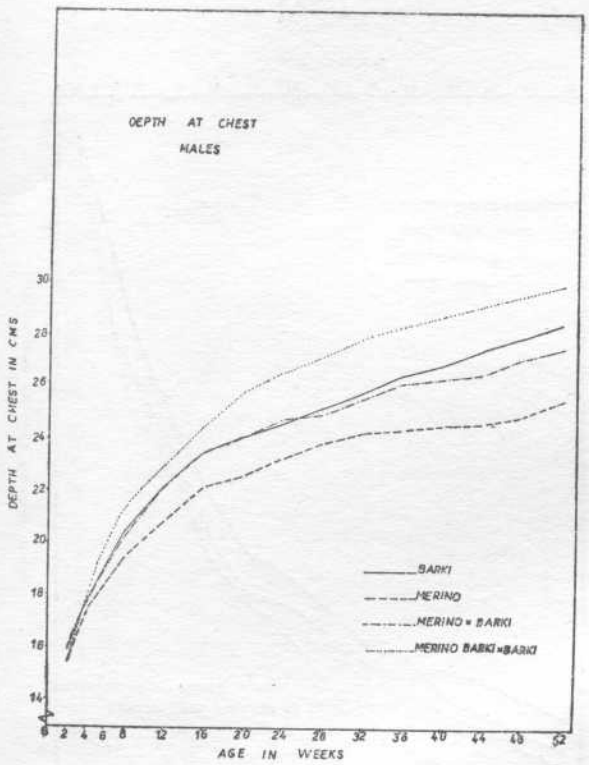

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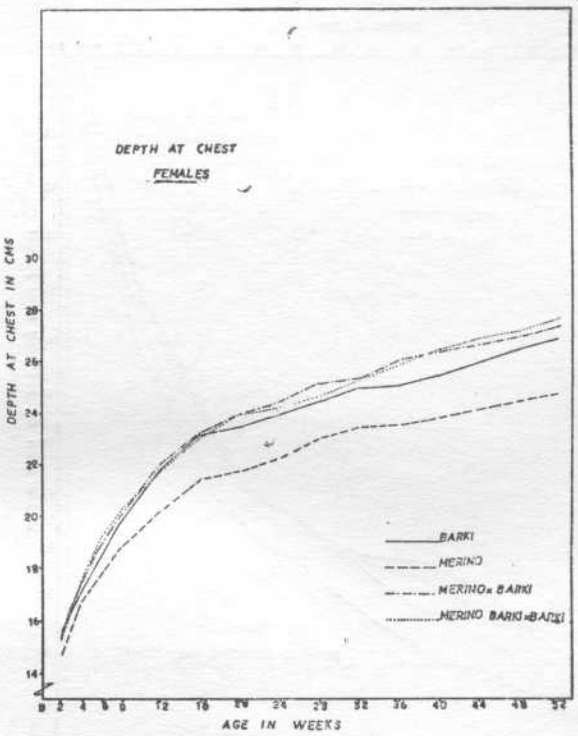

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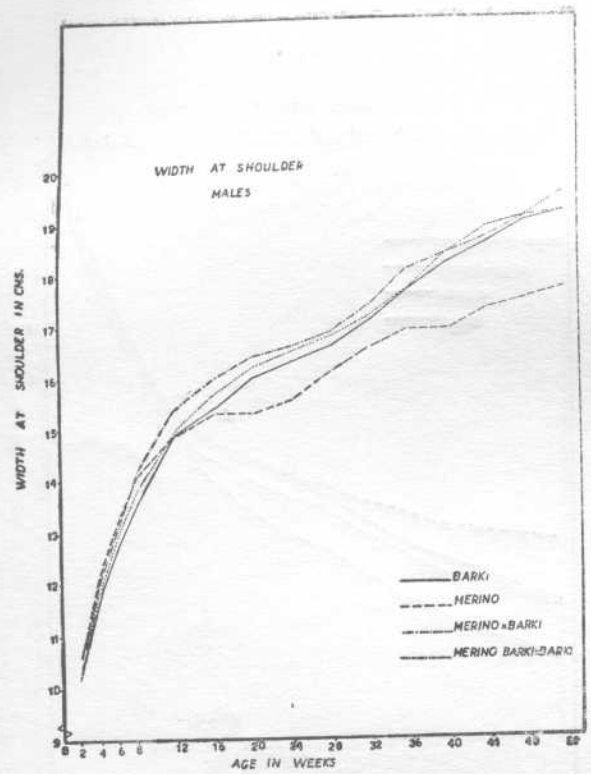

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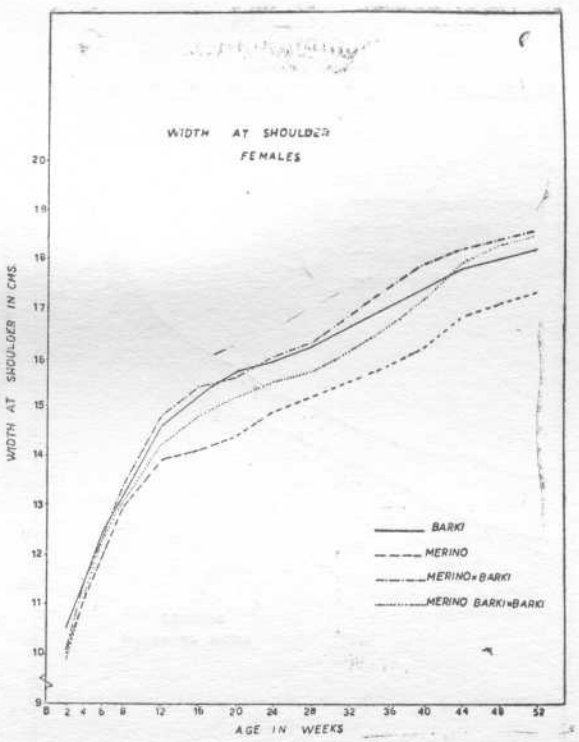

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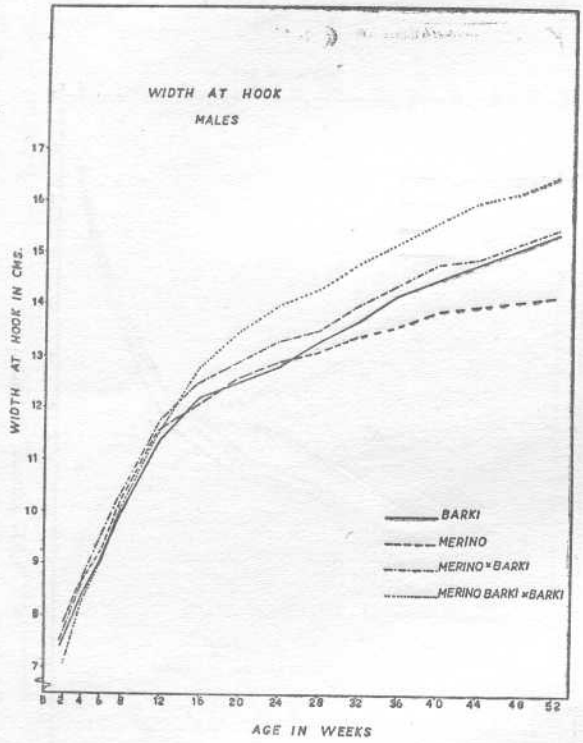

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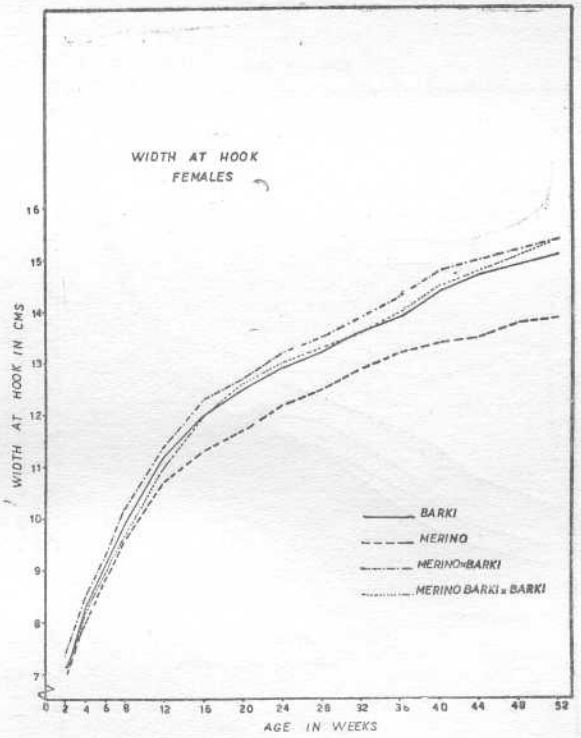

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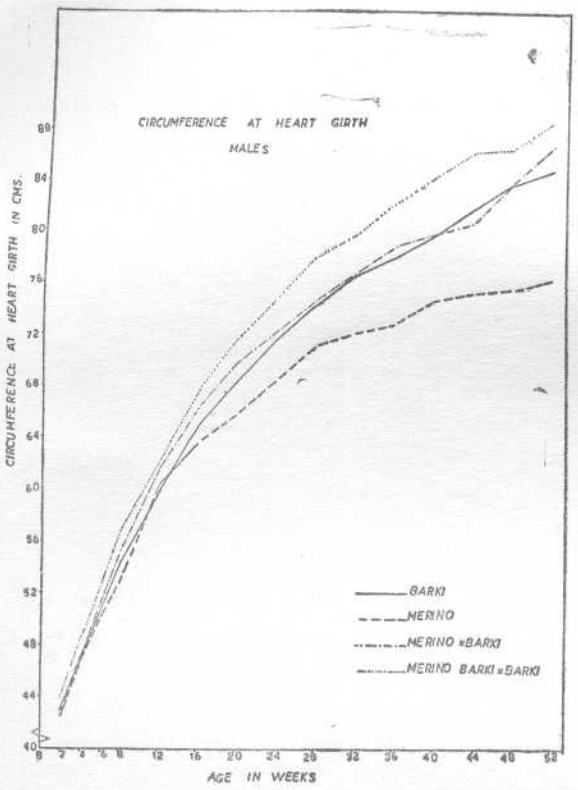

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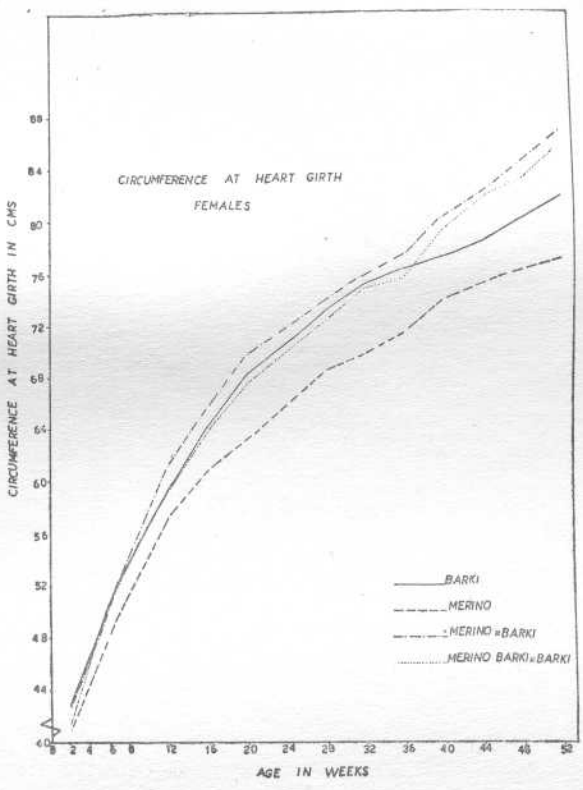

FIG. 16