

Growth and Mature Size in Fat - Tailed Barki Sheep

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RECORDS of live body weight for 491 male and 538 female desert Barki sheep were utilized to study their growth and mature body weight.

Sex, age of dam and year affected ($P < 0.05$) live body weight. Male lambs had significantly higher values for live body weight compared to female ones on all occasions. Such differences, however, were more pronounced with the advancement of age. Elder ewes tended to give birth to heavier lambs.

Average daily gain was found to be 133, 55 and 26 g from birth to weaning, weaning to yearling and yearly to mature size in males, respectively with corresponding values of 124, 53 and 19 g for females.

Mature size was found to be 41.11 kg at 983 days (2.7 yr) for ewes and 54.38 kg at 1166 days (3.2 yr) for rams.

Keywords : Barki sheep, growth, sex, age of dam and year.

Defining the mature body weight of a breed is important in calculating feed requirements of a given production system (Blackburn *et al*, 1987) while characterising the pattern followed to reach that weight, growth curve, allows the producer to make use of different inherent potentialities at different growth phases and to possibly manipulate that pattern for more efficient production (Fitzhugh, 1976). Studies on growth of different Egyptian breeds of sheep covered mainly the earlier period of life (first year) (Aboul - Naga *et al*, 1972 and Galal *et al*, 1972). Information on changes in live body weight, as indication for growth, in later stages seems to be lacking. This work was initiated to study growth pattern up to maturity in Barki sheep and determine their mature size.

Material and Methods

Data

Data utilized in this study were accumulated through 15 successive years (from 1963

to 1977) representing records of 491 male and 538 female pure Barki single born lambs. Data dealt with weights of both male and female lambs from birth to weaning (4 mo old) at biweekly intervals and from weaning to 17 mo old at monthly intervals. Weights recorded thereafter were taken at yearly intervals just before the mating season. Weights were recorded to the nearest quarter of kg and adjusted to age.

Management

Fahmy *et al.* (1969 a, b) described the system of flock management in detail. Animals included in this study were raised at the Ras El - Hekma Experimental station which is located in the north western coastal semi - arid zone, where rainfall is irregular and seasonal with an average of 150 mm / year resulting in a short grazing season from December to March. During this period, wheat or barley straw together with minimum amounts of concentrates (0.25 kg / head / day) were offered to the flock according to pasture condition. In summer sheep were fed on concentrates, wheat or barley straw and berseem hay (*Trifolium alexandrinum*). Vitamin A was supplemented periodically, whenever felt necessary, and animals were watered twice daily. When the flock was transferred to Maryout in 1972, this being a newly reclaimed area, berseem was fed in winter and lucerne (*Medicago sativa*) in summer, plus straw and concentrates in both seasons. Shearing took place in May while the mating season was during June - July. After weaning lambs were given good quality roughage *ad libitum* plus small amounts of the concentrate mixture (100 - 250 g / head / day) . At almost six months of age males were separated from females. A small number of males were usually kept to be used as future sires and the surplus male lambs were fattened and marketed before the age of one year while almost all ewe lambs were kept for breeding. The ewes were first exposed to rams at the age of 17 - 18 mo.

Statistical procedure

The following linear model was used to analyze body weights at different ages (Y_{ijkl}):

$$Y_{ijkl} = \mu + Y_i + S_j + A_k + SA_{jk} + e_{ijkl}$$

where, μ is the overall mean, Y_i is the i th year effect, S_j is the j th sex effect, A_k is the k th age of dam, SA_{jk} is the interaction between the i th sex and k th age of dam effect and e_{ijkl} is the random error.

Growth curve analysis

Several methods of describing age weight models for analyzing growth curves for various species have been proposed ; Gompertz (Winsor, 1932), Brody (Brody, 1945), simple and multiple regression (Rao, 1958), Richards (Richards, 1959) and logistic (Nelder, 1961). Their specific attributes and limitations have been thoroughly reviewed (Fitzhugh, 1976). Best fitting, computational ease and biological interpretation of the function parameters are the most important criteria for comparison among these methods. Judging by these criteria the multiple regression function was the most preferable one over the others in this study. For the period from birth to 16 week of age a

single linear regression was utilized while for those from weaning to 192 weeks old a curve - linear equation was fitted. The least squares means of body weights, at the periods outlined previously were the dependent variables, in these linear equations, while age was the independent variable. Separate equations were fitted for males and females.

Mature size

Mature size, defined as the live body weight at which the animal ceased to grow or when estimated growth rate changes from an increasing to a decreasing function, was estimated as : $B_0 - B_1^2 / 4B_2$, where B_0 is the initial body weight , B_1 is the partial regression of weight on age and B_2 is the partial quadratic coefficient for regression of weight on age square.

Results and Discussion

Age - weight relationship

Average live body weight at selected ages, of physiological and / or productive significance, are presented in Table 1. Fig. 1 illustrates the relationship between weight and age up to 192 wk of age. Values obtained in this study for birth, weaning and yearling weights are quite close to those obtained previously on the same flock by Fahmy *et al.* (1969 a , b) while higher than those reported by Galal *et al.* (1972). Average live body weight increased with age up to 144 weeks then declined thereafter.

Sex, age of dam and year affected ($p < .05$) live body weight at different stages. Male lambs had significantly higher values for live body compared to female ones in all cases. Such differences, however, were more pronounced with the advancement of age.

Elder ewes tended to give birth to heavier lambs, the heaviest lambs were born to ewes ranging in age between 4 - 8 years of age, however, the significant effect on lambs weight was more pronounced up to weaning and ceased after 44 weeks of age (results are not shown here). Effect of the age of the ewe on lambs' weight is possibly due to differences in the rate of development of the uterine environment.

Results revealed no sex by age of dam interaction. The significant effect of the year on all live body weights of lambs reflects differences among different years in environmental and feeding conditions. Live body weight increased with the increase in age in both sexes, the rate of such increase differed according to different stages. Average daily gain was found to be 133, 55 and 26 g from birth to weaning, weaning to yearling and yearling to mature size (age) in male lambs, respectively; corresponding values for female ones were 124, 53 and 19 g. These results show that the rate of gain declined with the advancement of age. Higher values for weight gains in Barki sheep were obtained by Fahmy *et al.*, (1964), being 163 and 68 from birth to weaning and from weaning to yearling age for male lambs; corresponding values for females were 160 and 48 g.

TABLE 1. Least squares means (M), standard error (SE) for weights (Kg) at different ages (Weeks).

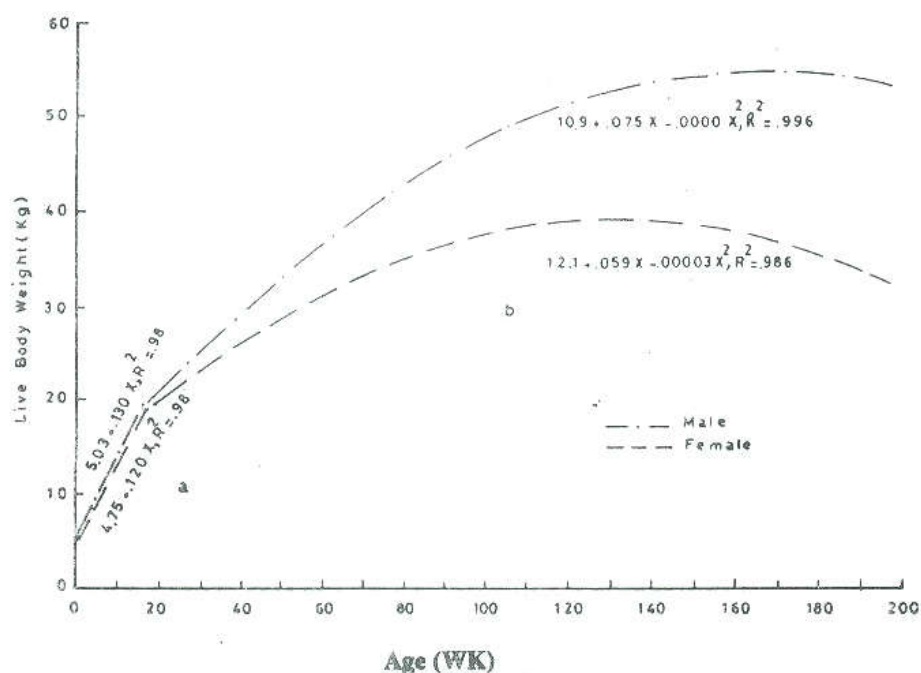
Factor	Birth		16 wk		32 wk		52 wk		96 wk		108 wk		144 wk		192 wk	
	No.	M±SE	No.	M±SE	No.	M±SE	No.	M±SE	No.	M±SE	No.	M±SE	No.	M±SE	No.	M±SE
General mean	1029	3.59±0.02	906	17.99±0.20	748	25.26±0.32	566	31.92±0.52	416	41.20±0.51	275	43.87±0.84	176	47.50±1.21	115	45.25±1.44
Sex																
Males	491	3.69±0.03	437	18.61±0.24	359	26.76±0.40	259	33.16±0.63	141	45.56±0.74	73	49.35±1.25	35	54.32±1.71	17	52.28±2.42
Females	538	3.49±0.03	469	17.37±0.24	389	23.81±0.40	307	30.65±0.61	275	36.83±0.56	202	36.40±0.82	141	40.69±0.99	98	38.22±1.08
Age of dam (yr)																
2	173	3.32±0.05	163	17.47±0.35	143	24.38±0.57	112	31.04±0.81	67	41.15±1.03	50	45.15±1.50	34	49.72±1.75	22	43.60±2.55
3	200	3.46±0.04	177	17.74±0.33	145	25.33±0.55	117	32.33±0.74	75	41.67±0.94	50	42.00±1.32	33	43.16±1.71	24	49.30±2.19
4	156	3.89±0.05	134	18.80±0.38	121	26.77±0.62	99	33.01±0.84	75	41.98±0.96	46	45.57±1.42	18	48.17±2.29	11	50.13±3.15
5	131	3.73±0.05	119	18.63±0.39	95	26.16±0.67	71	32.41±0.94	56	41.80±1.06	32	45.44±1.65	21	45.12±2.02	11	48.31±3.97
6	102	3.64±0.06	88	17.39±0.50	66	25.95±0.80	45	32.97±1.08	39	41.91±1.24	29	42.39±1.76	17	47.10±2.43	13	38.94±3.94
7	86	3.68±0.06	74	17.75±0.50	65	24.89±0.81	52	32.31±1.07	34	40.95±1.40	22	44.10±2.55	15	49.95±3.86	11	48.30±3.94
8	72	3.64±0.07	61	19.32±0.55	44	24.66±0.98	32	30.70±1.33	36	39.89±1.35	19	42.12±2.35	17	46.66±2.63	16	44.63±2.42
9	109	3.60±0.06	90	16.83±0.46	68	24.14±0.81	38	30.50±1.23	34	40.22±1.51	27	44.25±2.07	21	44.55±2.43	7	38.81±4.05

Mature size and degree of maturity

Mature size was found to be 41.11 kg at 983 days (2.7 yr) for ewes and 54.38 kg at 1166 days (3.2yr) for rams indicating that Barki sheep are small sized, slow growing animals compared to other local breeds. This probably is one of the breed's main adaptability mechanisms enabling the animals to withstand the harsh arid conditions, including poor feeding and scarce natural vegetation prevailing in the western coastal desert where the breed is dominant.

Mousa (1989) used Brody's function to estimate the mature weight of Ossimi and Rahmani sheep, the other two main Egyptian breeds. His estimates were 65.09 and 77.93 kg for males and 41.95 and 49.34 kg for females for the two breeds, respectively. When the same function was utilized on the present data the obtained estimates for Barki males and females were 57.96 and 40.3, respectively. Ossimi and Rahmani sheep breeds had been developed in the Nile Valley, where feed is more abundant and this may explain their higher growth rate and larger mature size as compared to the desert Barki sheep.

Degree of maturity, defined as the weight of an animal at immature stage relative to its mature weight, is shown in Table 2. Unlike sexual maturity, female Barki Sheep were earlier in their body weight maturity compared to the males.



a - From birth to weaning (16 weeks of age) by a single linear regression.

b - From weaning to 192 weeks old by a multiple regression.

Fig. (1) Weight - age relationship in Barki Sheep.

In the present study, birth weight represented 7 and 8% (estimated from the multiple regression equation) and 6 and 9% (estimated from Brody's function) for males and females, respectively. Such values are higher than the values obtained for other local breeds: 4.8 and 4.1 (for males) and 6.9 and 6.3 (for females) for Ossimi and Rahmani, respectively (Mousa 1989). This may reflect a relatively more developed uterine environment in Barki compared to other breeds, it may also indicate that the animals of this study could have achieved higher value for mature size if kept under more favourable conditions.

In conclusion, the single linear regression can be used to describe the growth of Barki sheep from birth to 16 week of age and the curve linear function for those from weaning to 192 weeks old in Egypt.

TABLE 2. Degree of maturity (%) at different ages for Barki sheep.

Age	Multiple Regression ¹		Brody ²	
	Male	Female	Male	Female
Birth	.07	.08	.06	.09
1 mo	.17	.21	.16	.22
2 mo	.24	.29	.22	.30
3 mo	.29	.37	.28	.37
4 mo	.34	.42	.32	.43
6 mo	.42	.50	.39	.51
8 mo	.49	.58	.46	.59
10 mo	.53	.65	.50	.66
12 mo	.57	.72	.54	.73
18 mo	.72	.83	.67	.84
24 mo	.84	.90	.79	.87
36 mo	1.00	.99	.94	1.00
48 mo	.96	.93	.90	.95

1 - Mature weight calculated from the Multiple Regression equation.

2 - Mature weight calculated from Brody's function.

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دراسة عن النمو والوزن الناضج في الأغنام البرقى

مرفت مختار ، * حسين منصور ، أحمد يونس وجسنيب الجباس
معهد الصحراء - المطرية - القاهرة
* كلية الزراعة - جامعة مين شمس - شبرا الخيمة - القاهرة -
مصر .

أجريت هذه الدراسة بهدف التعرف على النمو والوزن الناضج في
الأغنام البرقى . واستخدم فيها سجلات اوزان ٤٩١ ذكر و ٥٢٨
أنثى .

كان تأثير كل من الجنس وممر الأم والسنة على الوزن الحى
ضعفيا . ولقد حصلت الذكور على أوزان مرتفعة معنويا في كل
الاعمار مقارنة بالاناث وكافيت الفروق أكثر وضوحا مع تقدم العمر .
أعطيت الاناث الكبيرة في العمر حملانا ذو أوزان مرتفعة عند
الميلاد مقارنة بالاناث الصغيرة .

وجد ان متوسط الزيادة اليومية هي ١٢٣ ، ٥٥ ، ٢٦ جرام للذكور
من الميلاد وحتى الفطام ، ومن الفطام وحتى ممر سنة ومن عمر
سنة وحتى الوزن الناضج على التوالي . وكانت القيم المقابلة
للاناث هي ١٢٤ ، ٥٣ ، ١٩ جرام .

وصلت الاناث للوزن الناضج (٤١ ، ١١ كم) عند عمر ٩٨٢ يوما
في حين وصلت الذكور للوزن الناضج (٥٤ ، ٣٨ كم) عند عمر ١١٦٦
يوما .