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BREED EFFECT ON GROWTH PERFORMANCE OF EGYPTIAN SHEEP REARED UNDER INTENSIVE MANAGEMENT SYSTEM

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SUMMARY

A comparative study on the growth performance of three Egyptian sheep breeds raised under an intensive management system was carried out to improve lamb production using10 Rahmani, 8 Ossimi and 23 Barki male and female lambs. Data was analyzed using the general linear model procedure. The results showed that there was an increase in the lamb's live body weight and a decrease in both lamb's monthly body daily weight gain and periodic average daily gain toward advanced ages with instability in the rate of monthly growth during certain periods. Barki sheep tended to have the same monthly live body weight compared with Rahmani lambs and higher monthly live body weight compared with Ossimi sheep with better growth rate for the periods from birth to two months, five to six months and nine to ten months of age, compared to both Rahmani and Ossimi lambs. Except for the period from weaning to marketing, Barki lambs tended to have the same average daily gains compared to Rahmani sheep and exceeded the Ossimi sheep. On the other hand, the results showed a significant effect of sex on the growth performance of lambs of the three breeds, where the age of the dam and the birth weight of the lamb had no significant effects. It could be concluded that the intensive management system is a good practice for increasing the meat production of Barki sheep.

Keywords: Growth performance; Intensive management; Egyptian sheep

INTRODUCTION

The agriculture sector is a key contributor to the Egyptian economy. It contributes approximately 14.5% of the national gross domestic product (GDP) and accounts for about 28% of jobs, including those held by women in the workforce (USAID, 2018). Recommendations to improve food security for Egyptians include further development of their livestock production systems (Soliman, 2018).

Sheep are a valuable livestock species because of their ability to convert forages, as well as feedstuffs that are not suitable for human consumption, into meat and milk, which are important sources of dietary protein for humans. Therefore, sheep represent a good opportunity for developing countries to increase the production of animal-source foods, especially meat, thereby helping to reduce problems associated with food insecurity. Furthermore, sheep are the most abundant ruminant livestock species in Egypt (FAOSTAT, 2018) in with a population reaching about 1,700,000 head (Central Agency for Public Mobilization and Statistics, 2021). There is great potential to enhance their productivity though the implementation of genetic improvement programs and good management practices.

Egyptian sheep breeds are characterized by high fertility rates, and an extended mating season, but low prolificacy (Gabr *et al.*, 2016). The breeds have adapted over time to local environmental conditions and are geographically distributed across different regions of Egypt, where they are raised in various agro-ecological zones. The main sheep breeds in Egypt are Rahmani, Ossimi and Barki, which together represent 65% of the total sheep population and are primarily bred for meat production (Galal *et al.*, 2005). Rahmani and Ossimi breeds are raised under either intensive or semi-intensive production systems on closed farms. The semi-intensive system is midway between intensive and extensive systems in which animals are allowed to have about four to five hours of grazing within a fenced area during the day while suitable housing is provided at night. The animals are allowed to graze within the enclosure, and they may also provide some food in the form of concentrated mixture ration, kitchen waste, and by-products of crops. The Barki breed, one of the main breeds, is raised under a transhumance or extensive system in the Northern-Western Coast of Egypt, where they enjoy the open air, liberty, and grazing in pastures, selecting the favorable plants and vegetation.

The meat production capacity of sheep to meet market demands can be improved by using breeds that are better adapted to the production system and exploring the desirable characteristics of each breed (McManus *et al*., 2010).

Recently, some Barki sheep breeders have completely shifted the rearing system of Barki sheep from a transhumant system to an intensive one in order to improve mutton production and enhance the net income of their flocks. This phenomenon should be studied to assess its utility and its effect on the profitability of the flock. Breeders must consider several challenges arising from this system change, such as the breed's productivity, the emotional impact on the animals, concentrated rations consumption which is highly competed by other species of farm animals and the high costs associated with the intensive system.

There is limited information about the productive capability of the Barki breed under the intensive production system, especially when compared to the other two main breeds (i.e., Rahmani and Ossimi). Therefore, this investigation aims to explore the effect of this change in the production system on Barki sheep's potential to produce meat, as measured by live body weight and average daily gains of lambs, compared to the potential of Rahmani and Ossimi sheep, which are considered adapted breeds to the intensive system. The present study thus provides insight into the growth performance of the three main Egyptian sheep breeds (i.e., Rahmani, Ossimi and Barki) raised under the intensive production system.

MATERIALS AND METHODS

Experimental animals and management:

The study was conducted at the Experimental Station of the Faculty of Agriculture, Cairo University located in Saft Al-Laban village, Giza Governorate, Egypt (30°02′ N and 31°13′ E, with an altitude of 30 m) from December 2022 to October 2023.

The flock consisted of ewes of three Egyptian breeds: 30 Barki, 10 Rahmani and eight Ossimi ewes.

The animals of the flock were chosen based on the morphological specifications of each breed (Galal et al., 2005). Therefore, these animals are considered a representative sample of the original animals of each breed. These animals were then kept in a closed system at the experimental farm of the Faculty of Agriculture, Cairo University, and mated naturally using a ram of the same breed. Accordingly, the lambs born for each breed are related to each other by relationship (half-siblings). They are raised in closed pens attached to yards and kept with their lambs under an intensive production system. The ages of the ewes ranged from 1.5 to 7 years. Animals were fed on a concentrated mixture (14% crude protein and 2400 Kcal ME per Kg) beside roughages and clover in winter and corn in summer according to NRC requirements (NRC, 2002). Each ewe and lamb, from their weaning to the end of the study, received a concentrate ration of 2% of their live body weight, while ewes received 2.5% of this mixture during the flushing period before mating season. During the period of suckling, each ewe received one kilogram of supplemented concentrate ration. Water was available in front of animals all day round. All animals were routinely provided with basic vaccinations and were washed in dips against ecto-parasites, especially ticks.

The ewes of each breed were mated to a fertile ram of the same breed for 50 days from 21 July to 8 September 2022. Lambing occurs once a year from the end of December 2022 to February 2023. The lambs (N=41) used in the study (i.e., 10 Rahmani, eight Ossimi and 23 Barki) were identified and weighed at birth and kept with their dams in a closed barn until weaning at four months of age.

Studied traits:

All lambs were tagged and weighed within 24 hours of birth and their birth weight, birth type, breed, sex and birth date were recorded.

Live body weights (in Kg) were recorded monthly from birth (LW_0) to ten months of age (LW_{10}) for all lambs and their daily weight gains (g/d) were calculated for this period (ADG_1 toADG_{10}). Also, daily weight gains (g/d) during certain periods of the study, considered commercially important, bwere calculated by taking the difference of weights in grams within these periods and dividing it by the time interval in days as follows:

$ADG_{11} = (LW_4 - LW_0)/120$, $ADG_{12} = (LW_6 - LW_0)/180$, $ADG_{13} = (LW_{10} - LW_0)/300$, $ADG_{14} = (LW_{10} - LW_4)/180$, $ADG_{15} = (LW_3 - LW_0)/90$, $ADG_{16} = (LW_6 - LW_3)/90$ and $ADG_{17} = (LW_{10} - LW_6)/120$. These periods represent growth during the pre-weaning phase, the pre-puberty phase, the whole period of the study until marketing, the whole post-weaning fattening phase, the lactation/suckling phase, the first phase of post-weaning fattening, and the final fattening phase, respectively.

Statistical analysis:

Data on the growth performance of lambs were analyzed using the general linear model procedure (GLM) of SAS software (SAS Institute Inc. 2014. SAS® On Demand for Academics. Cary, NC). Duncan's Multiple Range Test procedure (Snedecor and Cochran, 1989) was applied to test differences among means. Statistical significance was accepted at the 5% level. All tested variables, including live body weight, were tested first for normality using the Shapiro-Wilk test, and all of them showed normal distribution. The following two linear models were used for the analysis of factors that would influence growth performance traits:

$$y_{ijk} = \mu + B_i + G_j + (B*G)_{ij} + b_1(A_k - A) + e_{ijk} \qquad \text{Model (1)}$$

$$y_{ijk} = \mu + B_i + G_j + (B*G)_{ij} + b_1(A_k - A) + b_2(W_k - W) + e_{ijk} \qquad \text{Model (2)}$$

Where y_{ijk} in the model (1) is the lamb's live body weight (LW_0: LW_{10}) or in the model (2) is the lamb's average daily gain (ADG_1: ADG_{17}) on the k^{th} animal

of the j^{th} gender and i^{th} breed. In the two models, μ is the overall mean for the trait; B_i is the fixed effect of the i^{th} breed (i = 1, …, 3); G_j is the fixed effect of j^{th} gender of lamb (j = 1, 2); $(B*G)_{ij}$ is the interaction between breed and gender of lamb; b_1 is the partial regression coefficient of the studied trait on the age of ewe; b_2 is the partial regression coefficient of the studied trait on birth weight of lamb; A_k is the age of the ewe (mother); A is the mean age of ewes; W_k is the birth weight of lamb; W is the mean birth weight of lambs; e_{ijk} is the random residual error (NID with mean = 0 and variance $=\sigma^2e$).
Both statistical model No. (1) and No. (2) were used after ensuring that the experimental error distributions met the conditions of normal distribution.

RESULTS

Monthly Live Body Weight

The results in Table (1) and Fig (1) showed that there was an increase in lamb's overall live body weight means toward advanced ages till the age of 8 months and then as light decrease or stability in weight in the two last months of the study (i.e., LW_9 and LW_{10}). The same trend was also observed for the three studied sheep breeds.

Table 1. Means and standard deviations (SD) of monthly live body weights for the three studied sheep breeds

Live Body Weight$ (Kg)	Overall		Barki		Rahmani		Ossimi	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
LW_0	4.19	0.87	4.06	0.90	4.21	0.79	4.54	0.89
LW_1	9.02	2.43	9.42	2.21	9.31	2.29	7.50	2.91
LW_2	8.43	2.38	9.33	2.42	7.98	1.67	6.44	1.68
LW_3	14.69	3.50	14.80	3.67	15.70	3.43	13.10	2.89
LW_4	17.36	3.97	17.14	3.81	19.39	3.90	15.42	3.82
LW_5	19.40	4.65	18.68	4.35	21.85	4.58	18.41	5.08
LW_6	21.07	4.80	20.87	4.66	23.21	4.44	18.95	5.10
LW_7	22.22	4.77	21.45	4.17	25.46	4.60	20.38	5.22
LW_8	24.45	5.49	23.32	4.92	28.12	4.79	23.11	6.42
LW_9	23.74	4.91	22.92	4.53	26.70	4.09	22.40	5.90
LW_{10}	23.98	5.05	23.18	5.01	26.94	4.16	22.56	5.26

$: LW_0, LW_1, ……, LW_{10} are monthly live body weights of animals from birth to ten months of age.

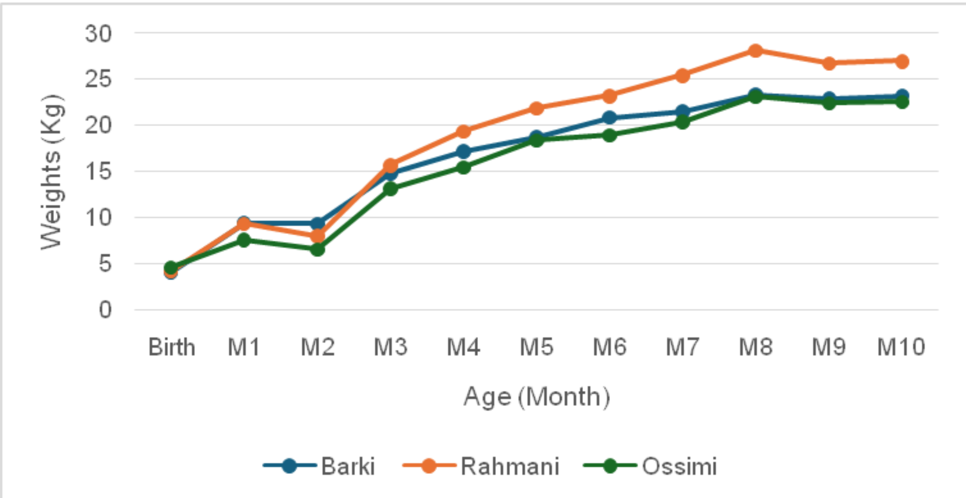

Fig.1.Means of the monthly live body weights for the three studied sheep breeds.

Average Daily Gain

The results in Table (2) and Fig (2) showed that there was a decrease in lamb's overall monthly daily weight gain toward advanced ages till the end of the study with instability in the rate of growth during certain periods (i.e., negative rates such as ADG_2 and ADG_9 or over-increasing rate such as ADG_3). The same trend was also observed for each one of the three sheep breeds but with differences among them in some periods. Barki, Rahmani, and Ossimi showed higher values for ADG_1 and ADG_6, ADG_3 and ADG_4, and ADG_5 and ADG_8, respectively.

Table 2. Means and standard deviations (SD) of monthly average daily gains for the three studied sheep breeds

Average Daily Gain$ (g/d)	Overall		Barki		Rahmani		Ossimi	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
ADG_1	161.0	70.9	179	57.1	170	71.6	99	79.4
ADG_2	-19.5	68.4	-3	77.7	-44	40.1	-35	60.0
ADG_3	208.4	76.3	182	56.3	257	81.4	222	94.5
ADG_4	88.9	49.1	78	49.0	123	35.3	77	48.9
ADG_5	68.5	48.0	51	45.5	82	41.6	101	44.9
ADG_6	53.8	47.1	73	51.2	45	19.9	10	19.7
ADG_7	39.9	54.3	19	55.1	75	42.3	55	41.0
ADG_8	74.8	76.7	62	7 3.0	89	99.2	94	55.3
ADG_9	-23.7	119.0	-13	153.4	-46	56.7	-26	42.6
ADG_{10}	7.3	98.2	8	112.5	6	41.6	5	114.3

$: ADG_1, ADG_2,…,$ADG_{10}$are monthly average daily gains from birth to ten months of age.

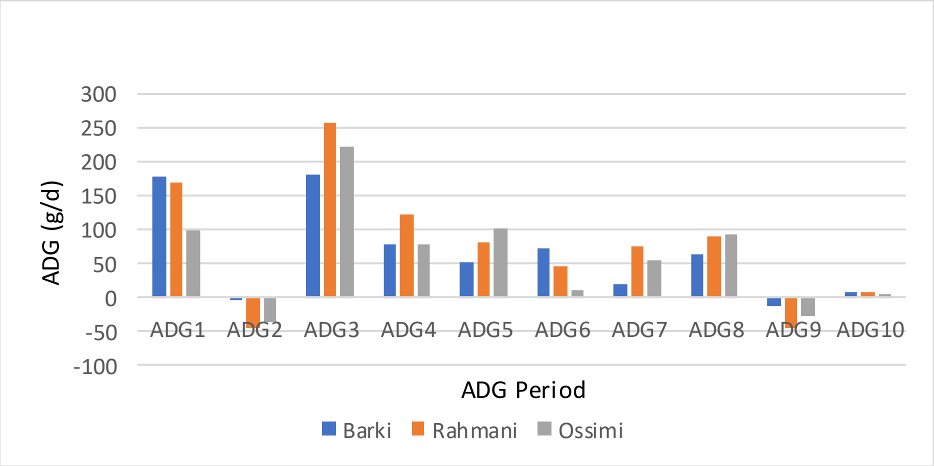

Fig.2.Means of the monthly average daily gains for the three studied sheep breeds.

Periodically Average Gain:

The results in Table (3) showed that there was a decrease in lamb's periodically overall body gain toward advanced ages till the end of the study. For the average daily gains from ADG_{11} to ADG_{14},the highest rate of growth was obtained during the period from birth to weaning at 4 months of age representing the suckling period in which lamb depends on its mother for feeding, and the lowest value was obtained during the period from 4 to 10 months of age representing the whole post-weaning fattening phase in which lamb depends on himself for feeding. The same trend was confirmed for the average daily gains from ADG_{15} to ADG_{17}. The same trend was also observed for the three studied sheep breeds.

Table 3. Means and standard deviations (SD) of periodically average gains for the three studied sheep breeds

Periodically Average Gain$ (g/d)	Overall		Barki		Rahmani		Ossimi	
	Means	SD	Mean	SD	Mean	SD	Mean	SD
ADG_{11}	109.7	29.4	109	27.5	127	28.1	91	27
ADG_{12}	93.8	24.9	93	24.4	106	22	80	25
ADG_{13}	66	16	64	16.2	76	12.5	60	15.6
ADG_{14}	36.8	19.5	33	22.7	42	12.3	40	16.9
ADG_{15}	116.6	34.3	119	36.1	128	30.9	95	26.1
ADG_{16}	70.9	25.5	67	25	83	22	65	28.4
ADG_{17}	24.2	22.5	19	25.3	31	11.7	30	22.5

$: ADG_{11}, ADG_{12}, …,ADG_{17}areperiodicallyaverage daily gains from birth to 4 months of age, from birth to 6 months of age, from birth to 10 months of age, from 4 to 10 months of age, from birth to 3 months of age, from 3 to 6 months of age and from6 to 10 months of age, respectively.

Analysis of Variance:

Monthly Live Body Weight:

Least squares means showed that the lambs of the Barki sheep had the highest monthly live body weight at the age of two months, followed by the lambs of Rahmani and Ossimi sheep, respectively (Table 4). However, at the ages of four, seven, eight, and ten months, Rahmani lambs showed the highest monthly live body weight followed by Barki and Ossimi lambs, respectively. Initially, the birth weight of Barki and Rahmani sheep was similar (4.00 Kg), however, as the age advanced till the age of two months the difference increased in the favour of the Barki sheep and inversed thereafter in favor of Rhamani sheep until the end of the study. In contrast, birth weight was lower in Barki sheep compared to Ossimi sheep (4.00 vs. 4.5 Kg, respectively) and inversed thereafter in the favour of Barki sheep until the age of 10 months. The superiority of Barki lambs at the early period of their life (i.e., from birth to the age of two months) may be explained by the sufficient of milk produced by ewes of this breed compared to the quantity of milk produced by ewes of the other two breeds. However, these results were based on a small sample size of both Rahmani (N=10) and Ossimi (N=8) breeds compared to the Barki breed (N=23). On the other hand, monthly live body weight was higher in male lambs than female ones at the ages of four, five, six, and ten months (Table 4).

Average Daily Gain

The least square means of Barki lambs, compared with the other two breeds, showed the highest monthly average body weight gain from birth to one month and from five to six months of age and the lower monthly average gain from six to seven months of age, while Rahmani lambs showed the highest monthly average body weight gains from two to three months, three to four months and from six to seven months of age. However, Ossimi lambs had the highest monthly average body weight gain only from four to five months of age and the lowest growth rate from six to seven months of age (Table 5).

Generally, the three studied sheep breeds tend to have the same monthly average body weight gains with the superiority of Barki lambs followed by Ossimi and Rahmani lambs, respectively of ADG_2, the superiority of Rahmani lambs followed by Ossimi and Barki lambs, respectively of ADG_8 and the superiority of Ossimi lambs followed by Barki and Rahmani lambs, respectively of ADG_9. This means that Barki sheep, under an intensive management system, tended to have a better growth rate in the periods ADG_1, ADG_2, ADG_6, and ADG_{10} compared with Rahmani and Ossimi sheep, especially until the age of two months as explained previously by the sufficient of milk produced by their dams. On the other hand, monthly average body weight gains were higher in male lambs than those of female ones of ADG_3, ADG_5 and ADG_{10}.

Periodically Average Gain

The lambs of the Rahmani sheep showed the highest periodic average body weight gains except for the period from weaning to marketing (i.e., from 4 to 10 months) followed by Barki and Ossimi lambs, respectively (Table 6).

Rahmani and Barki lambs showed superior average daily gain during the suckling period (ADG_{15}) compared to the Ossimi breed, while no significant differences were observed among the three breeds in average daily gain during early (ADG_{16}) or late fattening periods (ADG_{17}).

On the other hand, periodically average body weight gains were higher in male lambs than those of female ones for all periods of the study except for the period of early fattening (from weaning to six months of age).

DISCUSSION

Under the intensive management system, the results of the present study showed that in the three studied breeds, there was an increase in lamb’s live body weight (Table 1) and a decrease in both lamb’s daily body gain (Table 2) and periodic body gain (Table 3) as they aged. The instability in the rate of daily growth during certain months (Table 2) may be explained by fluctuations in feed supply for lambs and climatic changes, especially temperature variations. The highest rate of growth (Table 3) was observed during the period from birth to weaning at four months of age, representing the suckling period, while the lowest rate was observed from four to 10 months of age when the lambs began feeding independently. This can be attributed to the maternal effect on the growth of the lambs during the suckling period. Similar results in sheep were also reported by several authors (Ganesan *et al.*, 2015; Mahala *et al*., 2019 and Bansal *et al.*, 2022).

Under the intensive management system, Barki sheep tended to have the same monthly live body weight (Table4) as Rahmani sheep, but a higher monthly live body weight compared to Ossimi sheep, with a better growth rate (Table 5) during the periods from birth to one month, five to six months and nine to ten months of age, when compared to both Rahmani and Ossimi sheep. Except for the period from weaning to marketing, Barki lambs tended to have similar periodic average body weight gains as Rahmani sheep, while exceeding Ossimi sheep in this regard (Table 6).

Overall, during the study period from birth to ten months of age, the results showed that Rahmani lambs had superior monthly live body weights, followed by Barki and Ossimi lambs, respectively. However, Barki lambs demonstrated their adaptability to the intensive system showing superiority over the two other breeds during the first two months of age. In other words, Barki sheep under an intensive management system showed a comparable monthly live body weight to Rahmani sheep and a higher monthly live body weight than Ossimi sheep. This suggests that rearing Barki sheep under an intensive system is an effective way to improve their weight and meat production potential, thereby enhancing farm profits compared to extensive or transhumant systems. Economic and financial evaluation would have completed and perhaps consolidated the conclusion of the interest of the Barki breed for intensive management systems.

Table 4. Least square means (LSM)$ with their standard errors (SE) of monthly live body weights# (Kg) for the three studied sheep breeds

Classification	NO.	LW_0 LSM±SE	LW_1 LSM±SE	LW_2 LSM±SE	LW_3 LSM±SE	LW_4 LSM±SE	LW_5 LSM±SE	LW_6 LSM±SE	LW_7 LSM±SE	LW_8 LSM±SE	LW_9 LSM±SE	LW_{10} LSM±SE
Breed:												
Barki	23	4.062 ±0.184	9.391 ±0.496	9.300^{a} ±0.431	14.760 ±0.709	17.101^{ab} ±0.794	18.624 ±0.927	20.797 ±0.954	21.406^{b} ±0.932	23.278^{b} ±1.110	22.898 ±0.993	23.066^{ab} ±0.935
Ossimi	8	4.535 ±0.312	7.486 ±0.840	6.476^{b} ±0.730	13.151 ±1.202	15.465^{b} ±1.346	18.457 ±1.571	19.012 ±1.617	20.425^{b} ±1.579	23.112^{b} ±1.881	22.424 ±1.682	22.566^{b} ±1.585
Rahmani	10	3.991 ±0.305	9.000 ±0.821	7.576^{ab} ±0.713	14.934 ±1.174	18.650^{a} ±1.315	20.868 ±1.535	22.279 ±1.580	24.569^{a} ±1.543	27.588^{a} ±1.837	25.923 ±1.643	25.916^{a} ±1.548
Gender:												
Female	18	4.063 ±0.244	8.198 ±0.656	7.629 ±0.570	13.258 ±0.938	15.995^{b} ±1.051	17.745^{b} ±1.227	19.140^{b} ±1.263	20.866 ±1.233	23.267 ±1.469	22.278 ±1.314	21.683^{b} ±1.238
Male	23	4.329 ±0.204	9.053 ±0.548	7.939 ±0.477	15.306 ±0.784	18.149^{a} ±0.879	20.889^{a} ±1.026	22.251^{a} ±1.056	23.400 ±1.031	26.052 ±1.228	25.219 ±1.098	26.016^{a} ±1.035

#: LW_0, LW_1, …and LW_{10} are monthly live body weight (kg) of animals from birth to ten months of age. $: Means within a column without a common superscript differ significantly ($P<0.05$)

Table 5. Least square means (LSM)$ with their standard errors (SE) of monthly average daily gains# (g/d) for the three studied sheep breeds

Classification	NO.	ADG_1 LSM±SE	ADG_2 LSM±SE	ADG_3 LSM±SE	ADG_4 LSM±SE	ADG_5 LSM±SE	ADG_6 LSM±SE	ADG_7 LSM±SE	ADG_8 LSM±SE	ADG_9 LSM±SE	ADG_{10} LSM±SE
Breed:											
Barki	23	180.42^{a} ±13.34	-4.86 ±13.32	187.73^{b} ±11.98	79.80^{b} ±10.01	52.05^{b} ±9.18	69.99^{a} ±8.3459	21.01^{b} ±10.75	62.76 ±16.00	-18.14 ±25.85	6.92 ±18.97
Ossimi	8	90.86^{b} ±22.85	-28.70 ±22.81	207.26^{ab} ±20.51	72.23^{b} ±17.15	97.60^{a} ±15.71	16.45^{b} ±14.29	52.39^{ab} ±18.40	91.40 ±27.39	-11.23 ±44.29	1.29 ±32.48
Rahmani	10	171.33^{a} ±22.07	-50.37 ±22.03	254.13^{a} ±19.81	126.61^{a} ±16.56	75.97^{ab} ±15.18	43.01^{a} ±13.80	77.70^{a} ±17.77	101.49 ±26.46	-62.97 ±42.76	0.56 ±31.37
Gender:											
Female	18	140.62 ±17.60	-20.79 ±17.57	193.31^{b} ±15.90	93.00 ±13.21	59.88^{b} ±12.11	42.07 ±11.01	60.01 ±14.18	80.24 ±21.11	-38.19 ±34.11	-18.57^{b} ±25.02
Male	23	154.46 ±14.75	-35.15 ±14.73	239.44^{a} ±13.24	92.76 ±11.07	90.52^{a} ±10.15	44.23 ±9.22	40.78 ±11.88	90.18 ±17.69	-23.36 ±28.58	24.42^{a} ±20.97

#: ADG_1, ADG_2, …, ADG_{10} are monthly average daily gains from birth to ten months of age. $: Means within a column without a common superscript differ significantly ($P<0.05$).

Table 6. Least square means (LSM)$ with their standard errors (SE) of periodically average daily gains# (g/d) for the three studied sheep breeds

Classification	NO.	ADG_{11} LSM±SE	ADG_{12} LSM±SE	ADG_{13} LSM±SE	ADG_{14} LSM±SE	ADG_{15} LSM±SE	ADG_{16} LSM±SE	ADG_{17} LSM±SE
Breed:								
Barki	23	$110.78^{ab} \pm 4.90$	$94.18^{ab} \pm 4.63$	$63.77^{b} \pm 2.93$	$32.45^{a} \pm 3.78$	$121.10^{ab} \pm 6.03$	$67.26^{a} \pm 5.39$	$18.17^{a} \pm 4.30$
Ossimi	8	$85.42^{b} \pm 8.38$	$77.21^{b} \pm 7.93$	$58.97^{b} \pm 5.02$	$41.32^{a} \pm 6.48$	$89.81^{b} \pm 10.32$	$64.60^{a} \pm 9.23$	$31.58^{a} \pm 7.37$
Rahmani	10	$125.42^{a} \pm 8.10$	$103.46^{a} \pm 7.66$	$73.75^{a} \pm 4.84$	$39.30^{a} \pm 6.26$	$125.03^{a} \pm 9.97$	$81.88^{a} \pm 8.91$	$29.18^{a} \pm 7.12$
Gender:								
Female	18	$101.54^{b} \pm 6.46$	$84.97^{b} \pm 6.11$	$59.17^{b} \pm 3.86$	$30.92^{b} \pm 4.99$	$104.38^{b} \pm 7.95$	$65.54^{a} \pm 7.11$	$20.46^{b} \pm 5.68$
Male	23	$112.87^{a} \pm 5.41$	$98.26^{a} \pm 5.12$	$71.83^{a} \pm 3.24$	$44.46^{a} \pm 4.18$	$119.58^{a} \pm 6.66$	$76.95^{a} \pm 5.96$	$32.17^{a} \pm 4.76$

#: ADG_{11}, ADG_{12}, … , ADG_{17} are periodically average daily gains from birth to 4 months of age, from birth to 6 months of age, from birth to 10 months of age, from 4 to 10 months of age, from birth to 3 months of age, from 3 to 6 months of age and from 6 to 10 months of age, respectively. $: Means within a column without a common superscript differ significantly ($P<0.05$).

On the other hand, throughout the study period, male lambs tended to have greater monthly live body weight, as well as higher monthly and periodic growth rates compared to female lambs. This superiority of male lambs over females may be attributed to their higher birth weight and the hormonal effects (i.e., sex and growth hormones). Thus, the current results confirm the significant effects of breed and sex on lamb body weight at different ages, while showing no effect of ewe age. Similar findings were reported by various authors (Kucuk, 2004; Thiruvenkadan *et al.*, 2009; Najafyet *al.*,2011 and Momoh et *al.*,2013). Mandal *et al.* (2003) also reported no significant difference in body weight due to the parity of the dam in Muzaffarnagari sheep. The difference in body weight among lambs born in different periods may be attributed to variations in management and environmental conditions. Bansal *et al.* (2022) concluded that the period and sex of lambs had a significant effect on all average daily gain (ADG) traits. However, the type of birth had a significant effect on ADG only from birth and 3 months and the season of birth had a significant effect on ADG between nine and 12 months. In their study, Ganesan *et al.* (2015) suggested that the sex of the lamb, dam weight at lambing, and year of birth were significant non-genetic factors affecting body weight at birth, 3rd, 6th, 9th, and 12th months. They also found that average daily weight gain showed significant differences based on the sex of the lamb, season of birth, and year of birth, with significant differences in dam weight at lambing only for the 3–6-month period.

Generally, for the last period of the study, lambs of the three sheep breeds showed the same periodic average weight gains. Higher ADG in sheep farming is not only essential from the economic point of view but also for higher production and reproduction, survivability, and faster genetic improvement by decreasing generation interval and increasing replacement rate (Prakash et al., 2012 and Gowane et al., 2015). This means that Barki sheep showed their adaptability for rearing under an intensive management system and tended to have the same periodic average body weight gains compared to Rahmani sheep and at the same time exceeded the Ossimi sheep.

The practical importance of this research appears for the sheep breeders in developing countries where there is consumption of mutton meat as one of the main sources to fill the nutritional gap in animal protein for their populations, and where breeds of sheep raised in grazing areas in extensive production systems are applied for the purpose of producing meat, it can be used in a more efficient and profitable production systems for breeders, such as the intensive production systems, which the world is witnessing a shift to using in meat production, especially with the development of animal production techniques and modern herd management systems and the rise in meat prices globally.

Furthermore, for a future experiment, to be more analytical and explanatory of the observed variations in weight and growth, the estimation of the ewe's milk production and/or the digestibility of the feed by the lambs should be added, to support the conclusions.

As is known, using an intensive production system with farm animals has many advantages such as increasing efficiency (Intensive livestock production often involves the use of technological innovations and scientific methods to optimize the growth, milk performance, and reproduction of animals. This can lead to more efficient use of resources, such as feed, and water and a reduction in the amount of land needed for farming) and productivity (By controlling the environment, feeding, and health care of the animals, breeders can produce a large amount of meat and milk in a short period of time. This high yield can help meet the increasing global demand for animal products) of livestock, and the economic benefits (By concentrating on the animals in one place, breeders can save on labor and transportation costs).

This has now prompted breeders in many regions of the world to switch from traditional and local production systems to intensive production systems when raising their animals, despite the high production cost. Therefore, the results of this research provide a practical example for sheep breeders, especially in the developing world, to successfully use the intensive production system instead of other production systems when they want to increase meat production from their sheep.

Breeding and producing the Barki sheep breed under an intensive management system is considered now as one of the means that can be used to raise its meat productivity, as the demand for Barki sheep meat in Egypt increases from the consumer due to the quality of its meat and its low percentage of tail fat , in addition to the consumer's desire to buy small size animals due to the significant increase in the prices of live sheep and their meat in the markets.

When comparing the live weights and growth rates of Barki sheep raised under an intensive management system -like the system used for Rahmani and Ossimi sheep, which are known for being acclimatized to this type of system - it became clear that Barki sheep achieved results like these two breeds and even surpassed Ossimi sheep during certain growth periods. This suggests that breeders should be encouraged to raise Barki sheep using the intensive management system. The results of the present study have practical implications not only for sheep husbandry but also for understanding the factors that significantly influence their growth performance.

CONCLUSION

To improve mutton production from Barki sheep using the intensive management system, the results of the current experiment showed comparable growth performance of Barki lambs to that of Rahmani and Ossimi lambs, both of which are well adapted breeds to the intensive management system. In many cases, Barki sheep even surpassed Ossimi sheep. However, the age of the ewe and lamb birth weight were not significant sources of variation in studied traits. The gender of the lamb showed the superiority of males compared to females in live body weight traits, with males being more efficient in growth rates than females. Therefore, based on this comparative growth performance study, rearing Barki sheep using an intensive management system is recommended to breeders to increase their potential for meat production.

REFERENCES

Abd-Allah, M., S.F. Abass and F.M. Allam, 2011. Reproductive performance of Rahmani and Chios sheep and their lambs under Upper Egypt conditions. Online J. Anim. Feed Res.,3: 121-129. J., http://www.ojafr.ir.

Alsheikh, S.M., 2011. Productive and Financial Assessment of Intensive Brki Sheep Production SysteminMatrouh. Egyptian J. Anim. Prod., 48: 11-18.DOI: 10.21608/ejap.2011.94366.

Bansal, G.K., V. Kumar, R.K. Nagda and R. Hada, 2022. Factors affecting average daily gain in Sonadi sheep. Indian Journal of Small Ruminants (The),28:20-23. DOI:10.5958/09739718.2022.00020.4.

Central Agency for Public Mobilization and Statistics, 2021. Statistical Book, Issue no. 112., Arab Republic of Egypt. http://www.capmas.gov.eg/.

FAOSTAT., 2018. Live animals. http://www.fao.org/faostat/en/#data/QA.

Gabr, A.A., N.A. Shalaby and M.E. Ahmed, 2016. Effect of ewe born type, growth rate and weight at conception on the ewe subsequent productivity of Rahmani sheep. Asian J. Anim. Vet. Adv., 11: 732-736.DOI: 10.3923/ajava.2016.732.736.

Galal, S., F. Abdel-Rasoul, M.R. Anous and I.Shaat, 2005. On station characterization of small ruminant breeds in Egypt. In: (Iniguez, L.C.,Ed) Characterization of Small Ruminant Breeds in West Asia and North Africa, Vol. 2, International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria, pp: 141-193.

Ganesan, R., P. Dhanavanthan, D. Balasubramanyam and P. Kumarasamy, 2015. Growth modeling and factors affecting growth traits in Madras red sheep. Indian Journal of Animal Research, 49:20-25. DOI:10.5958/0976-0555.2015.00004.7.

Gowane, G.R., L.L.L. Prince, F.B. Lopes, C. Paswan, and R.C. Sharma, 2015. Genetic and phenotypic parameterestimates of live weight and daily gain traits in Malpurasheep using Bayesian approach. Small RuminantResearch, 128: 10-18.https://doi.org/10.1016/j.smallrumres.2015.04.016.

IWTO, 2022. International wool textile organization. In Dilworth J (ed.), International Year Book and Statesmen's Who's Who, Consulted online on 12 December 2022 http://dx.doi.org/10.1163/1570-6664_iyb_SIM_org_38824.

Kucuk, M., 2004. Growth characteristics of Hamdani, Karakul and Morkaraman lambs in suckling period. Indian Veterinary Journal, 81:172-175.
https://api.semanticscholar.org/CorpusID:89264054

Mahala, S., S. Saini, A. Kumar, L.L.L. Prince and G.R. Gowane, 2019. Effect of non-genetic factors on growth traits of Avikalin sheep. Small Ruminant Research, 174: 47-52. DOI: 10.1016/j.smallrumres.2019.03.006.

Mandal, A., K.P. Pant, D.K. Nandy, P.K. Rout and R. Roy, 2003. Genetic analysis of growth traits in Muzaffarnagari sheep. Trop. Anim. Hlth. Prod.,35: 271-284.DOI: 10.1023/a:1023303715385.

McManus, C., S.R. Paiva and R.O. Araújo,2010. Genetics and breeding of sheep in Brazil. RevistaBrasileira de Zootecnia, 39:236-246.DOI :10.1590/S1516-35982010001300026.

Momoh, O.M., E.A. Rotimi, and N.I. Dim, 2013. Breed effect and non-genetic factors affecting growth performance of sheep in a semi-arid region of Nigeria. Journal of Applied Biosciences, 67: 5302-5307. www.m.elewa.org.https://dx.doi.org/10.4314/jab.v67i0.95053.

Najafy, M., G. Rahimi, Z. Ansari, H. Baneh and Z. Yosefi, 2011. Effects of Environmental Factors on Phenotypic Growth Traits in Naini Sheep. Research On Animal Production, 2: 12-22.
http://rap.sanru.ac.ir/article-1-134-en.html.

NRC, 2002. Nutrient Requirements of Sheep. 6th Rev. Ed., National Academy of Sciences, National Research Council, Washington, DC., USA.

SAS Institute Inc. SAS® OnDemand for Academics: User's Guide. 524. (2014).

Snedecor, G.W. and W.G. Cochran, 1989. Statistical Methods. 8th Edition, Iowa State University Press, USA, p 503.

Soliman, M., 2018. Food security in Egypt.www.njf.nu/assets/490/7-Food-security-in-Egypt.pdf.

Thiruvenkadan, A.K., K. Karunanithi, M. Murugan, K. Arunachalam and R. Narendra Babu, 2009. A comparative study on growth performance of crossbred and purebred Mecheri sheep raised under dry land farming conditions. S. Afr. J. Anim. Sci., 39: 121-125. Peer-reviewed paper from: 10th World Conference on Animal

Production Proceedings.DOI:10.4314/sajas.v39i1.61325.
USAID., 2018.United States Agency for International development. Agriculture and food security. https://www.usaid.gov/egypt/agriculture-and-food-security.

تأثير السلالة على أداء النمو للأغنام المرباة تحت نظام الرعاية المكثف

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تم إجراء دراسة مقارنة لأداء النمو لثلاث سلالات من الأغنام المصرية لتحسين إنتاج لحم الضأن، المرباة في ظل نظام الرعاية المكثف باستخدام ١٠ حملان رحماني، ٨ أوسيمي، ٢٣ برقي من الذكور والإناث. تم تحليل البيانات باستخدام النموذج الخطي العام لبرنامج SAS. أظهرت النتائج أنه في السلالات الثلاثة كان هناك زيادة في وزن الجسم الحي للحملان وانخفاض في معدل زيادة الوزن اليومي للحملان ومعدل زيادة وزن الجسم لفترات معينة تجاه الأعمار المتقدمة مع عدم استقرار فى معدل النمو اليومى خلال بعض الأشهر. في ظل نظام الرعاية المكثف، تميل أغنام البرقي إلى الحصول على نفس الوزن الحي الشهري مقارنة بأغنام الرحماني ووزن حي شهري أعلى مقارنة بأغنام أوسيمي مع معدل نمو أفضل فى الأشهر من الولادة إلى شهرين، ومن خمسة إلى ستة أشهر ومن تسعة إلى عشرة أشهر من العمر، مقارنة بأغنام الرحماني والأوسيمي، باستثناء الفترة من الفطام إلى التسويق، وأيضاً تميل حملان الأغنام البرقي إلى الحصول على نفس متوسط زيادات وزن الجسم خلال الفترات المدروسة مقارنة بأغنام الرحماني وفي نفس الوقت تتجاوز أغنام أوسيمي. أما بالنسبة للعوامل الأخرى فقد أظهرت النتائج تأثير الجنس (P<٠,٠٥; P<٠,٠١; P<٠,٠٠١) على صفات أداء النمو لحملان السلالات الثلاثة، إلا أنه لم يكن هناك أي تأثيرات معنوية لكل من عمر الأم والوزن عند الولادة للحملان (P> ٠,٠٥). وخلاصة القول أن نظام الرعاية المكثف هو ممارسة إدارية جيدة لزيادة إمكانات سلالة البرقي لإنتاج اللحوم.