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Research Article
Effect of Ewe Born Type, Growth Rate and Weight at Conception on the Ewe Subsequent Productivity of Rahmani Sheep

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Abstract

Background and Objective: Generally, the major factors that affect profitability in sheep production are the total number and the total weight of lambs produced per ewe. Therefore, the aim of this study was to determine the effect of born type, growth rate, growth trend of Rahmani ewes as a lamb and the weight at conception on their subsequent productivity. **Materials and Methods:** The data used in the present study were collected from 1728 Rahmani ewes during the period from 1991-2001.These animals were maintained at El-Serw Experimental Station belonging to Animal Production Research Institute, Ministry of Agriculture, Egypt. The studied traits were number of lambs born per ewe lambing (NLB), number of lambs weaned per ewe lambing (NLW), weight of lambs at birth (WLB) and weight of lambs at weaned (WLW). **Results:** The ewe from single born affected significantly ($p<0.05$) the lambs weights of birth and weaning but not the total number of lambs born. The increase of ewes growth rate as a lamb (>100 g day^{-1}) during their rearing period from birth and from weaning to a year of age resulted a significant increase in the total number and weight of lambs born and weaned. Ewes that gained from 80 g day^{-1} growth rate before their weaning and continued with >100 g day^{-1} from weaning upto a year of age had the profitable values of all tested parameters for produced lambs. The lambs number, weights of birth and weaning were increased significantly ($p<0.05$) with advancing weight of their ewes at conception (>50 kg). **Conclusion:** In summary, the ewes born type, growth rate as a lamb and their weight at conception has detrimental effect on total number and weights of lambs produced.

Key words: Ewe as a lamb, ewe born type, ewe growth rate, ewe growth trend, weight at conception, ewe productivity, litter weight, litter size, Rahmani sheep

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The local Egyptian sheep breeds are characterized by extended breeding seasons, high fertility and low prolificacy. Rahmani sheep is one of the most meat breed among Egyptian breeds. Rahmani characterized by low prolificacy comparing with other breeds in different countries[1]. Generally, the major factors that affect profitability in sheep production are the total number and the total weight of lambs produced per ewe. Thus, there is an increasing interest in improving productivity through increasing the number of lambs weaned per ewe and increasing lamb growth rate[2]. This will led to an increase in the number of marketed lambs which offers greatest opportunity for increasing efficiency of lamb meat production. Thus, the ewe productivity can be measured by litter size at birth and at weaning as well as litter weight of lambs at birth and at weaning. However, the breed, size, age of a ewe, the birth type, lamb's sex as well as maintenance and feeding conditions are known to have an important impact on the birth weight and weaning weight of lambs[3-7]. Moreover, the increase in the ewes pre-mating weights resulted in a proportional increase in the birth weight and weaning weight of the lambs[5-7].Therefore, most studies indicated that to increase efficiency of sheep production, selection based on female production, reproduction and growth of lambs would be valuable. While, unfortunately, little attention addressed to the connection between the ewes traits as a lamb and its subsequent productivity. The aim of this study was to determine the effect of born type, growth rate and growth trend of Rahmani ewes as a lamb as well as the weight at conception on their litter size, the lambs produced weights of birth and weaning.

MATERIALS AND METHODS

The data used in the present study were collected from 1728 Rahmani ewes during the period from 1991-2001.These animals were maintained at El-Serw Experimental Station belonging to Animal Production Research Institute, Ministry of Agriculture, Egypt. Intensive production system of three matings (May, January and September) per two years (mating every eight months) was followed in the experimental farm. The corresponding lambing seasons took place in October, June and February.

Ewes and rams were mated for the 1st time at about 18 months of age. At mating, ewes were randomly divided to groups of 30-35 ewes each. Ewes of each group were exposed to a fertile ram for 35-45 days as a mating period in separate mating pens. Ewes were weighed before mating season and at lambing. Rams were tested for libido and semen quality before mating season. Ram was substituted by another ram if the ram was unable to serve the ewes.

During the period from December-May, the flocks were fed Egyptian clover (Berseem) *Trifolium alexandrinum*. In summer and autumn seasons, the ewes were fed on hay, by feeding stubble or green fodder if available, in addition to the pelleted concentrate feed mixture. Allowances feed were offered twice daily at 7 am and 4 pm. Drinking water was available twice daily during winter and 3 times during summer. Mineralized salt blocks were available to all ewes. The animals were housed in semi-open sheds and freely allowed to exercise. Animals were subjected to the routine vaccination program against infection diseases. Animals were sheared twice a year in March and September. Two weeks before the beginning of mating season, 0.25 kg concentrate supplement were fed for each ewe per day and also during the last 2-4 weeks of pregnancy. At lambing, new born lambs were identified and their type of birth, sex and pedigree were recorded. Lambs were weaned at approximately 8 weeks of age. Weights were recorded within 24 h of birth and at 30 days intervals.

The studied traits were number of lambs born per ewe lambing (NLB), number of lambs weaned per ewe lambing (NLW), weight of Lamb at birth (WLB) and weight of lamb at weaned (WLW).

Statistical analysis was performed by the least squares method using the general linear model procedure of the statistical analysis system computational program SAS[8].The significant differences among means were assigned using Duncan multiple range test method[9].

RESULTS

The results in Table 1 showed that the ewes came from a single-born produced significantly ($p<0.05$) heavier lambs at birth than those from multiple-born. The same trend observed for the lambs weaning weight. However, the total number of lambs born and weaned per ewe was not affected by the ewe own born type. This could clarify that the type of ewe born could affect the lamb birth-weight but not the total number of lambs born.

Additionally, Table 2 shows that the increase of ewes growth rate as a lamb (>100 g day^{-1}) during their rearing period from weaning to a year of age resulted a significantly increasing in the total number and weights of lambs born and weaned. Similar trend was detected at the highest ewes growth rate (>100 g day^{-1}) during the whole rearing period from birth upto a year of age. However, there was

Table 1: Least squares Mean±SE of total number lambs born (NLB), weaned (NLW) per ewe, the weight of lambs at birth (WLB) and at weaning (WLW) as affected by ewe own born type

Type of born	No.	NLB	NLW	WLB	WLW
Single	1119	1.238±0.452[a]	1.224±0.439[a]	3.749±1.461[a]	17.48±5.723[a]
Multiple	609	1.213±0.437[a]	1.195±0.419[a]	3.540±1.177[b]	16.95±5.141[b]

[ab]Means in the same column with different superscripts are significantly different at p<0.05

Table 2: Least squares Mean±SE of total number lambs born (NLB), weaned (NLW) per ewe, the weight of lambs at birth (WLB) and at weaning (WLW) as affected by ewe's growth rate as a lamb before and after weaning until year of age and for the whole period

Growth rate	No.	NLB	NLW	WLB	WLW
Birth- weaning					
<80 g day^{-1}	445	1.225±0.434[a]	1.208±0.424[a]	3.666±1.185[a]	17.21±5.113[a]
80-100 g day^{-1}	621	1.222±0.439[a]	1.211±0.421[a]	3.649±1.625[a]	17.01±5.440[a]
>100 g day^{-1}	662	1.239±0.464[a]	1.220±0.449[a]	3.705±1.220[a]	17.62±5.872[a]
Weaning-year					
<80 g day^{-1}	620	1.218±0.443[b]	1.207±0.435[b]	3.703±1.249[ab]	17.12±5.505[b]
80-100 g day^{-1}	755	1.212±0.422[b]	1.196±0.408[b]	3.584±1.161[b]	16.98±5.085[b]
>100 g day^{-1}	353	1.286±0.500[a]	1.263±0.474[a]	3.822±1.883[a]	18.26±6.331[a]
Birth-year					
<80 g day^{-1}	478	1.232±0.447[b]	1.222±0.443[ab]	3.747±1.224[b]	17.23±5.374[b]
80-100 g day^{-1}	951	1.206±0.425[b]	1.191±0.410[b]	3.565±1.169[c]	16.97±5.222[b]
>100 g day^{-1}	299	1.298±0.507[a]	1.273±0.478[a]	3.911±2.008[a]	18.44±6.519[a]

[a-c]Means in the same column with different superscripts are significantly different at p<0.05

Table 3: Least squares Mean±SE of total number lambs born (NLB), weaned (NLW) per ewe, the weight of lambs at birth (WLB) and at weaning (WLW) as affected by ewe's growth rate trend as a lamb before and after weaning until year of age

Growth rate	No.	NLB	NLW	WLB	WLW
Birth-weaning (<80 g day^{-1})					
<80 g day^{-1}	128	1.195±0.417[b]	1.207±0.428[b]	3.687±1.277[abc]	16.91±5.016[b]
80-100 g day^{-1}	204	1.240±0.451[b]	1.200±0.427[b]	3.667±1.196[abc]	17.05±4.963[b]
>100 g day^{-1}	113	1.230±0.423[b]	1.224±0.419[b]	3.642±1.062[abc]	17.80±5.469[b]
Birth-weaning (80-100 g day^{-1})					
<80 g day^{-1}	223	1.206±0.438[b]	1.208±0.431[b]	3.607±1.287[bc]	16.87±5.814[b]
80-100 g day^{-1}	275	1.207±0.415[b]	1.200±0.401[b]	3.553±1.153[c]	16.97±5.161[b]
>100 g day^{-1}	123	1.285±0.488[ab]	1.241±0.450[ab]	3.939±2.698[a]	17.35±5.428[b]
Birth-weaning (>100 g day^{-1})					
<80 g day^{-1}	269	1.238±0.460[b]	1.206±0.444[b]	3.789±1.201[abc]	17.41±5.480[b]
80-100 g day^{-1}	276	1.196±0.406[b]	1.188±0.402[b]	3.553±1.143[c]	16.94±5.117[b]
>100 g day^{-1}	117	1.342±0.575[a]	1.324±0.544[a]	3.875±1.399[ab]	19.69±7.690[a]

[a-c]Means in the same column with different superscripts are significantly different at p<0.05

Table 4: Least squares Mean±SE of total number lambs born (NLB), weaned (NLW) per ewe, the weight of lambs at birth (WLB) and at weaning (WLW) as affected by ewe's weight at conception

Ewe's weight at conception	No.	NLB	NLW	WLB	WLW
<40 kg	333	1.081±0.273[c]	1.083±0.277[c]	3.086±0.842[c]	14.98±3.646[c]
40-50 kg	883	1.187±0.401[b]	1.168±0.384[b]	3.619±1.144[b]	16.89±4.864[b]
>50 kg	512	1.398±0.550[a]	1.369±0.532[a]	4.154±1.779[a]	19.37±6.712[a]

[a-c]Means in the same column with different superscripts are significantly different at p<0.05

non-significant difference among the values of ewe's growth rate during their own rearing period from birth to weaning for all the tested traits.

As for the different trends of ewe's growth rate as a lamb before and after their weaning, the results in Table 3 cleared that the ewes which gave from 80 g day^{-1} growth rate before their weaning and continued with >100 g day^{-1} from weaning upto a year of age had the profitable values of all tested parameters for produced lambs. These results indicated that the ewe's growth rate and trend before conception has detrimental effect on lambs produced.

Heavier ewes at conception (>50 kg) have produced heavier lambs (Table 4). Since, the birth-weight of lambs was increased significantly (p<0.05) with advancing weight of their dams. Similar results have been found for the total number of lamb's birth and weaned. That means number of lambs and lamb birth-weights are positive sensitive to ewe weight at conception.

DISCUSSION

The present study detected that the single ewe's born type and the high ewe's growth rate as a lamb from birth or weaning until one year old (>100 g day^{-1}) affected positively the productivity traits tested herein. Such results could be explained as in all mammals, the maternal uterine space has a finite capacity to gestate offspring and as litter size increases individual birth weights decline[10]. This means that the ewes from a single born had better opportunities in the mother's wombs than the twin or triplets and hence were heavy at birth. Since, there is a positive significant effect of the birth type on the lamb birth weight[11,12]. On the other hand, the energy intake during gestation and rearing of mothers that having multiple lambs is not sufficient to enable their lambs to reach their growth potential[13] compared with single lambs. Then naturally, the ewes came from single born were receiving more milk from their mothers and then have higher growth rate compared with twin or triplet lambs. Heavier lambs have higher daily gain, particularly prominent in the third month of development[14]. Continuously, heavier lambs at weaning reported to had faster growth rates post-weaning than lighter lambs[15]. Latterly, such single born and higher growth rate ewes as a lamb expected to be the heavier ewes at conception that affected positively as in the present study, the number of lambs per ewe and the lambs weights of birth and weaning. This effect reflects in part (1) The ewes physiological capacity to adequately supply the products of conception with metabolic substrate, (2) The ewe physical capacity to bear multiple litters, (3) Mechanical forces in differing areas of the uterus and (4) Fetal genotypic effects. It is likely that all the above effects are interrelated and an umbrella term has been suggested, "maternal constraint of fetal growth"[16].

However, this study shown as along with other studies[10,5,7], the highest ewe live weight produced lambs with the highest body weight. Similarly, the increase in the weaning weight of the lambs was related to increasing dam weights reported by Aliyari *et al.*[5], Aktas and Dogan[6] and Aktas *et al.*[7]. Most likely, the reason for this phenomenon is the body fat degradation serving as a source for more milk production in the heavy ewes[7]. In addition, body weight of the ewe at mating has been shown to influence subsequent litter size and the ewe's productivity[10,17,18]. Otherwise, a moderate significant positive correlation was observed between BCS and live weight of ewes[12]. Accordingly, Sezenler *et al.*[19] and Sari *et al.*[11] found that ewes with a higher BCS at lambing had lambs with higher birth weights. However, there is wide variation between studies which examined the relationship between ewe BCS at different physiological periods and lamb birth weight. Some studies found a significant effect[20-22] while others reported no effect[5,23,24]. Moreover, a positive effect of ewe BCS on lamb growth was reported by Mathias-Davis *et al.*[13], Sari *et al.*[11] and Karakus and Atmaca[12]. Condition scoring of ewes at lambing time and feeding according to their conditions during lamb rearing period is beneficial for lamb growth to weaning[13]. On the other hand, ewe BCS at lambing has been reported to have positive effect on lambs weaning weight[19,25,26].

CONCLUSION

From the foregoing results, the ewe from a single born increased the lamb birth and weaning weights but not the total number of lambs born or weaned. Furthermore, the higher ewe's growth rate as a lamb upto 1 year of age has detrimental effect on lamb's number and weight at birth and weaning. The ewes productivity traits studied are positively sensitive to the ewe weight at conception.

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