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Original article

Effect of age of Awassi ewes crossed with Naimi rams on some growth characteristics and litter size

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ABSTRACT

The study focused on Awassi ewes crossed with Naimi rams. Ewes weight and age were closely related to their productivity, especially on female reproductive performance, therefore this research studied the effect of ewes age to their weight, as well as the effect of the ewes age on the weight of their lambs at birth, at one month, 4 month and to their sex and fertility. In the Awassi ewes used in this study, mature body size was attained at the age of 4 then it started to decline. At lambing, the lambs whose mothers were at the age of 5 years outperformed the rest of the age groups of their mothers, and at one month, the lambs whose mothers were at the age of 3 years outperformed ($p \leq 0.05$) the rest of the age groups of their mothers. The weight of the lambs at weaning (4 months of age) showed the highest in the lambs whose mothers were 3 to 4 years old. The largest number of male lambs were obtained from ewes aged 2.5 and 3 years (75 and 88.9% respectively). Singleton births were 100% for all ewe ages, except for the ewes aged 2.5 and 3 years (40 and 20%, respectively). The highest number of twin births (80%) ($p \leq 0.05$) was obtained in lambs whose mothers were 3 years old, while the highest litter size was 1.8.

Keywords: Awassi ewes, lamb sex, litter size, Naimi rams, singleton birth, twin birth

INTRODUCTION

The Awassi sheep breed is one of the most important breeds in semi-arid lands (Lafi *et al*., 2009) and has several characteristics that are desirable to the consumer, the most important of which is the quality of meat and milk, as well as its adaptation to various environmental conditions and its tolerance of high temperatures and its ability to walk long distances for grazing purposes, as well as its resistance to diseases (Hermiz and Alkass, 2018). The Awassi breed of sheep is raised in the Near Eastern regions of the world using a semi-intensive system. The Awassi breed of sheep is an important economic resource for many countries in the world, and it is the best breed of sheep in the dairy industry due to its abundant milk production (Hailat 2005; Juma and Alkass 2006). There were many factors that led to the great variation in the flock, including the genetic composition of sex of the animal, nutrition, age of the animal, type of birth (singleton or twin), good management, disease incidence, and environmental conditions surrounding the sheep flock (Hailat 2005; Juma and Alkass 2006). Ewes selection in a flock was based on their ability to produce, the most important of which were their ability to lamb, the litter size, the weights of their newborns, and the production of large amounts of milk to feed the

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newborns, thus increasing the weights with age, and all this providing economic benefits and genetic improvement (Al-Dabbagh., 2011), Reproductive characteristics in sheep were important in improving their production. Determining the age of sexual maturity has a prominent role in determining the effectiveness of reproduction. Genetic improvement programs and crossbreeding played an important role in increasing the productive efficiency of sheep and raising their fertility value (Vasantha and Kona, 2016; Gebreselassie *et al.*, 2019; Hussein and Alajeli, 2021; Al-Janabi *et al*., 2023; Kostusiak *et al*., 2023; Alnajm *et al*., 2024). This research has the ultimate goal of crossbreeding between breeds with the aim of increasing sheep production and reproduction. The number of offspring and fecundity in sheep is one of the most important components in the reproductive performance of sheep in general and Iraqi sheep in particular, in addition to improving the growth characteristics of newborns. To achieve this, attention must be paid to protecting lambs and their mothers from infectious diseases, in addition to good nutrition (Bashir *et al*., 2024; Mohapatra *et al*., 2024).

MATERIALS AND METHODS

The study was conducted on sheep on a private farm with a continental climate, hot in the summer and cold and rainy in the winter. This farm is managed by agricultural engineers specialized in animal production, and veterinarians who care for and treat the animals from diseases. This study focused on Awassi ewes crossed by Naimi rams (Figure 1). A total of 35 ewes were selected from the flock and divided into 7 age groups (1.5 2 2.5 3 3.5 4 and 5 year) with 5 ewes for each group. Then the Awassi ewes were weighed.

Figure 1 Naimi ram (left), Awassi ewe with the lambs (middle), and Naimi ram-Awassi ewe cross (right).

Ewes in the flock were inseminated. Lambs weight was recorded at birth, 1 month and 4 months of age. To determine fertility rate, litter size was calculated based on the following equation (Notter *et al*., 2017), number of litters (number of offspring produced in one birth) = number of lambs born/number of ewes giving birth. Meanwhile, to determine the relationship of the ages of the ewes to their productive performance, the type of birth (singleton or twin), and the sex of the lambs (male or female) were also studied.

Statistical analysis

The data was analyzed statistically using the Statistical Analysis System (SAS, 2012) to study the effect of age of Awassi ewes crossed by Naimi rams on growth characteristics and some of their reproductive characteristics, and the significant differences between the averages were compared by using the Duncan test (Duncan, 1955). It is a polynomial that applies the least squares method according to the following mathematical model:

$$Yijk = \mu + Gi + Aj + eijk$$

So, it is represented by:

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Yijk observation value
μ: general mean
Gi: genetic structure (Awassi ewes crossed with Naimi rams)
Aj: effect of age
eijk: random error that is normally distributed with a mean of zero and two bits σ2e

RESULTS

Table 1 shows that the age of ewes ranged from 1.5 to 5 years. At the age of 4 years the weight of ewes tended to outperform other age groups, with an average weight reaching 44.65 kg, and at the age of 5 years the weight of ewe decreased ($p \leq 0.05$). At lambing, the highest body weight ($p \leq 0.05$) was obtained in lambs whose mothers were 5 years old. At the age of one month, lambs whose mothers were 3 years old had the highest body weight ($p \leq 0.05$). Weaning weight of lambs were averagely the same and in lambs whose mother were 5 years old weight of the lambs declined ($p \leq 0.05$).

Table 1 The effect of the age of Awassi ewes crossed with Naimi rams on some growth characteristics

	no.	age year	Average (kg) ± standard error			
			MWT	BWT	WT1	WT2
	5	1.5	41.76 ± 1.16 [a]	1.50 ± 0.17 [g]	4.49 ± 0.40 [b]	12.10 ± 0.23 [a]
	5	2	41.00 ± 1.05 [a]	2.00 ± 0.19 [f]	4.43 ± 0.19 [b]	11.75 ± 0.30 [a]
	5	2.5	43.04 ± 0.99 [a]	2.50 ± 0.12 [e]	4.30 ± 0.76 [b]	11.70 ± 0.67 [a]
	5	3	44.00 ± 1.70 [a]	3.00 ± 0.29 [d]	5.00 ± 0.75 [a]	12.85 ± 1.56 [a]
	5	3.5	44.05 ± 1.80 [a]	3.50 ± 0.26 [c]	4.60 ± 0.58 [b]	12.70 ± 0.87 [a]
	5	4	44.65 ± 2.60 [a]	4.00 ± 0.06 [b]	4.85 ± 0.30 [b]	12.85 ± 0.50 [a]
	5	5	36.35 ± 0.19 [b]	5.00 ± 0.18 [a]	4.70 ± 0.09 [b]	9.80 ± 0.17 [b]
Total	35	-				
p value	-	*	*	*	*	*

* : ($p \leq 0.05$); MWT: mother's weight; BWT: birth weight; WT1: weight at the age of one month, WT2: weight at weaning (4 month)

Table 2 Effect of age of Awassi ewes crossed with Naimi rams on several reproductive characteristics

	no.	age (year)	type of birth		sex of newborn		litter size (lambs/ litter)
			singleton (%)	twin (%)	male (%)	female (%)	
	5	1.5	100	0	60	40	1
	5	2	100	0	40	60	1
	5	2.5	40	60	75	25	1.6
	5	3	20	80	88.9	11.1	1.8
	5	3.5	100	0	80	20	1
	5	4	100	0	20	80	1
	5	5	100	0	60	40	1
Total	35	-					-
Average ± SE			80	20	60.6	39.4	1.2 ± 0.13
Chi-square (χ^2)			78.75		10.32		-
significance			**		*		ns

SE: standard error; **: $p \leq 0.01$; *: $p \leq 0.05$; ns: non-significant.

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Table 2 shows that for maternal age ranging from 1.5 to 5 years, the highest percentage for the type of birth is the singleton birth, namely 100% for maternal age 1.5, 2, 3.5, 4, 5 years, while for twin birth the highest percentage was obtained at the age of 3 years (80%), with the chi-square value reached 78.75 and a very significant level of difference ($p \leq 0.01$). Based on the sex of the lambs born, the highest percentage of lambs was male at 88.89% for mothers aged 3 years, while the highest percentage of females was 80% for mothers aged 4 years, and the chi-square value reached 10.321, with a significant difference ($p \leq 0.05$).

DISCUSSION

This study used ewes aged 1.5 to 5 years, and the weight of the ewes that were 4 years old tended to outperform the rest of the age groups, with an average weight reached 44.65 kg. From this study it could be seen that the Awassi ewes in this study attained mature body size as early as at 1.5 years of age and maximum live weight was attained at 4 years old then it started declining. A recent study showed that the weight of Awassi ewes increased with age (Al-Najjar *et al*., 2024) because the weight often rises with the age of the animal with the presence of veterinary care and the provision of new environmental conditions, foremost of which is good nutrition (Kelman *et al*., 2022).

The effect of the age of Awassi ewes crossed with Naimi rams on some growth characteristics

At birth, the highest body weight ($p \leq 0.05$) was obtained in lambs whose mothers were 5 years old, as seen from the average body weight of the lambs which reached 5 kg. This confirmed that the birth weight of lambs increased with increasing maternal age. Research on Hamdani ewes (Barzanji 2006), and Iraqi sheep (Awassi and Hamdani breeds) (Al-Dabbagh 2019) also found differences in lambs body weight due to the influence of maternal age. In contrast to these results, several other studies on Awassi ewes aged 2-5 years (Saleh *et al*., 2020; El Fiky *et al*., 2017) found no difference in lamb birth weight. The lamb's birth weight was important because it influenced the health of the lamb after birth until adulthood (Gardner *et al*., 2007). In addition, there was an optimum body weight for natural delivery with maximum fetal safety. Low birth weight was associated with neonatal preweaning mortality (Dwyer, 2008), while high birth weight was a risk factor for difficult lambing, lamb and maternal deaths (Jacobson *et al*., 2020). Birth weight was mainly influenced by litter size, breed, genetics, maternal birth weight, maternal nutrition, maternal parity, fetal sex and fetal genotype. Maternal nutrition is important to fulfill the needs for fetal development (Gardner *et al*., 2007).

At the age of one month, the weight of the lambs whose mothers were 3 years old outperformed ($p \leq 0.05$) the other maternal age group, where the highest body weight reached 5 kg. Given the scarcity of studies on the weight of lambs at one month old, we did not compare this study with previous studies. At weaning age, the weight of the lambs in this study were almost the same, except for the lambs whose mothers were 5 years old, whose body weight was lower than those in the other maternal age group. These results are consistent with several studies on Egyptian sheep (El Fiky *et al*., 2017) and on Awassi sheep (Al-Najjar *et al*., 2024) which found no difference in lamb weight at weaning age between maternal age group, while another study on Awassi sheep found the effect of maternal age on the weaning weight of the lambs (Mohammed *et al*., 2021). This discrepancy is most likely due to study-to-study differences between breed of sheep, sample size, method of nutrition, geographic conditions and weaning age.

In this study, 5 year old ewes weighing 36 kg gave birth to 5 kg lambs with a weaning weight of 9.86 kg; with a higher weaning weight of 12.85 kg, a 3 kg lamb was born to a 3 year old ewe weighing 44 kg (Table 1). This shows the relationship between the age and body weight of the ewes and the weaning weight of the lamb. The ewes in this study attained mature body size as early as at 1.5 years of age and maximum live weight was attained at 4 years old. The rate at which this size was achieved was controlled by

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genetic, environmental and nutritional factors (Kelman *et al*., 2022). In most ewe breeding flocks began before reaching maturity in body size (Pettigrew *et al*., 2021), and even under good conditions, only a few lambs reached their potential size (Kenyon and Corner-Thomas, 2022). The relationship between age and body weight in achieving adult body size is important because body size and body weight had quite a big influence on animal productivity, especially on female reproductive performance (Aliyari *et al*., 2012). From these studies, it is possible to find out how long a female sheep remains maximally productive and when that productivity decreases (Gardner *et al*., 2007).

Effect of the age of the Awassi ewes crossed with Naimi rams on some reproductive traits, the most important of which is litter size

Litter size, defined as the number of lambs born per ewe, is of economic importance given its impact on flock productivity (Assan, 2020; Tao *et al*., 2021). Some studies on Turkish Awassi sheep (Al-Samarrai *et al*., 2015), Iraqi sheep (Awassi and Hamdani breed) (Al-Dabbagh, 2019) found that the rate of single breed exceeded twin births, as well as an increase in the number of male births over the female birth. A study on Egyptian ewes found the impact of maternal age or parity in litter size (El Fiky *et al*., 2017). Another study in Egypt on six breeds of sheep found the same thing, except for the Awassi breed (Saleh *et al*., 2020). As for the litter size, the results recorded that the highest litter size rate was 1.8 for the dam aged 3 years, and the average litter size in this study is 1.2, the same as those of the Awassi sheep in Ramadi (Taha, 2016) and higher than those of the Awassi ewes study in Egypt (1.0) (Saleh *et al*., 2020). Litter size is influenced by genetic and non-genetic factors (Assan, 2020) including age or parity of the ewes. However, study on productive live showed that ewes born in smaller litter sizes had longer productive lives and larger litter sizes had the shortest productive lives (Hanna *et al*., 2023).

CONCLUSIONS

From this research it could be concluded that the age of Awassi ewes bred with Naimi rams had an effect on the weights of their offspring at birth, at the age of one month, and at the age of 4 month, and also on the sex of the offspring (male or female) and type of birth (singleton or twin).

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AUTHOR'S CONTRIBUTIONS

The writing and processing of this article was carried out by one author.

CONFLICTS OF INTEREST

The author declare that there is no conflict of interest with any other party.

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