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Effects of Dam Age, Litter Size and Gender on Birth Weight of D'man lamb
-Consequence on Lamb Mortality-

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Abstract: Knowledge of factors affecting variation in birth weight is especially important given the relationship of birth weight with neonatal and adult health. This study examines the effects of age of dam, litter size and gender on birth weight in D'man lamb breed under accelerate lambing system (3 lambings/2 years) in the oases of Gabès. Data recorded between February 25th and May 15th 2008, concerned 91 lambs born at the "Office d'Elevage et des Pâturages" station in Chenchou located in southern Tunisia. Two- to 8-year-old ewes had a higher performance and dropped heavier lambs ($P<0.05$) that the old dams (more than 8 years old). The mean birth weight of single-born lambs (4.0 ± 1.0 kg) were significantly higher ($P < 0.05$) than those for twins (3.3 ± 0.5 kg), triplets (2.5 ± 0.4 kg) and quadruplets (2.3 ± 0.4 kg). Male lambs were heavier ($P < 0.05$) than female lambs (3.0 ± 0.6 kg vs. 2.7 ± 0.7 kg, respectively). Mortality in lambs occurs continually from birth to weaning (60 days of age) and it averaged 19.7% ($n = 91$). The third of this rate (33%) was observed in lambs issued from young dams (2 years of age), while 67% of mortality was equally distributed between lambs born from dams, 3-, 7- and 9-year-old. Lambs born in triplet litter had a significant ($P < 0.05$) higher mortality (12%) than those born in twin (2.2%) and quadruple litter (5.5%). A higher mortality rate was observed in females (13.17%) than in male lambs (6.58%). Dead lambs had less ($P < 0.05$) birth weight and daily body gain until 30 days of age than the survived ones (2.4 ± 0.4 kg vs. 3.0 ± 0.6 kg; 53 ± 34 g vs. 160 ± 52 g respectively). In conclusion, age of dam, litter size and gender significantly affect the birth weight which could be an important risk factor for D'man lamb mortality.

Keywords: Birth weight, D'man sheep, Lamb mortality

1. Introduction

In several countries, prolific breeds of sheep are commonly used to improve flock productivity (Aboul-Naga, 1996; Gootwine *et al.*, 1995; Lassoued and Rekik, 2001). In Tunisia, the Moroccan D'man breed is selected because of its adaptation to local climatic conditions (Mahouachi *et al.*, 2005). Superior prolificacy, earlier sexual maturity and longer breeding season of D'man sheep have been reported by Lahlou-Kassi *et al.* (1989). However, increased litter size at birth usually leads to increased lamb mortality. Lamb birth has long been considered a major risk factor for lamb viability and survival (Gama *et al.*, 1991; Christley *et al.*, 2003), extreme birth weights being highly related to substantial increases in lamb mortality (Christley *et al.*, 2003; Casellas *et al.*, 2007). Most death of lambs is typically associated with birth weight by a curvilinear relationship (Nowak and Poindron, 2006).

The purpose of the present study was to investigate the influence of dam's age, litter size and gender on the birth weight of lamb under an accelerated lambing system of D'man sheep in the oases of Gabès.

2. Materials and Methods

The experiments were carried out in the breeding station of Chenchou for D'man sheep, arid Tunisia (latitude: 33˚N 29'57.8'', longitude: 10˚38'37.3''), and where sheep have been raised since 1994. This breeding center has been the base for the scientific research, breed improvement and productivity since the first year of its foundation. Ewes were naturally mated and mating took place in each group of 15 to 20 ewes separately by introducing one ram and ewes were exposed to rams in single-sire groups for a period of

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approximately 45 days. The flock follows an accelerated lambing system with approximately three lambings every 2 years.

The ewes were kept under intensive conditions and the same animal husbandry practices were used for all pregnant groups. Young ewes lambing for the first time were not included in the experiment, so the age of the ewes ranged from 2 to 9 years. All ewes were in good health and condition, were flushed with 300 g of concentrate mixture consisting of barley grains, soya and supplement of vitamins minerals with 1 kg of hay (Lucerne) per ewe per day were divided into two equal parts offered in the morning and evening and fresh water was available at all times. Over late pregnancy, the amount of concentrate was elevated to 500 g. Mating was scheduled from October 1st to November 15th 2007.

At birth, new-born lambs and their mothers were housed in pens for at least 72 h of life. Data concerning identification number, birth date, type of birth and sex were collected on 91 lambs born to 37 ewes between February 25th and May 15th 2008. Lamb mortality was recorded as number of lambs either still born or born alive but which died within the first 48 hours after birth (perinatal mortality). All lambs were weighted within 12 h after birth using suspended scales weighing from 0 to 20 kg in minimal 200 g increments.

SAS software (version 9) was used for statistical analysis of data. Birth weight and weight gains data of lambs were analyzed by ANOVA using General Linear Model (GLM) for determination the dam age, litter size and gender effect. The means values were compared using SNK test.

3. Results and Discussion

Birth data from 90 lambs born in spring are shown in **Table 1**. The mean birth weight of all live-born was medium (2.84 ± 0.64 kg). Average daily gain (ADG) of lambs between birth and 10 days of age was slightly lower (149.04 ± 62 g) compared to that during period of the 10-30 days of age (156.46 ± 55 g). Lamb mortality was high and average death rate was 19.75%.

Table 1. Mean birth weight, ADG and mortality of lambs.

Lamb traits	Number	Mean ± SD
Birth weight (kg)	90	2.84 ± 0.64
ADG0-10	81	149.04 ± 62
ADG10-30	75	156.46 ± 55
Lamb mortality	19.75 %	

Table 2 indicates that 3- to 7-year-old ewes had a higher-performance and dropped heavier lambs ($P < 0.05$) than the old dams (over 8 years of age). Age of dam was a significant source of variation influencing Birth weight (Table 2). Mean birth weight by age of dam revealed that lambs from 9-year-old ewes were lighter than lambs from all other age of dam classes. In contrast, differences were small among birth weights of lambs produced by dams that were 2 to 8 years of age.

Average daily gain performance of lambs between birth and 10 days of age was significantly ($P < 0.05$) affected by age of dam (Table 2). Average daily gain by age of dam revealed that lambs from 3-year-old ewes showed more rapid growth for the first 10 days compared to lambs from 8-year-old ewes. During the period of 10-30 days of age, average daily gain performance of lambs was not significantly ($P > 0.05$) affected by dam age.

The frequency of dead lamb was analyzed in five different ages of dam classes. The mortality of

Table 2. The effect of dam age on birth weight, ADG and mortaliy of lambs.

Lamb traits	Age (year) of dam classes				
	2 (n = 11)	3 (n = 16)	7 (n = 3)	8 (n = 2)	9 (n = 5)
Birth weight (Kg)	2.7^{ab} ± 0.7 (n = 22)	3.0^{a} ± 0.6 (n = 41)	3.1^{a} ± 0.4 (n = 7)	2.7^{ab} ± 0.8 (n = 5)	2.5^{b} ± 0.6 (n = 15)
ADG0-10	144^{ab} ± 68 (n = 20)	169^{a} ± 52 (n = 39)	139^{ab} ± 58 (n = 5)	86^{b} ± 45 (n = 5)	119^{ab} ± 67 (n = 11)
ADG10-30	160^{a} ± 69 (n = 19)	164^{a} ± 44 (n = 37)	172^{a} ± 59 (n = 4)	132^{a} ± 46 (n = 5)	128^{a} ± 61 (n = 10)
Mortality	6.65 %	4.4 %	4.4 %	0 %	4.4 %

Means within line with different superscripts differ ($P < 0.05$)

lambs from 2-year-old ewes was by 2.2% higher than that of lambs from 3, 7 and 9-year-old ewes. No mortality was observed in 8-year-old ewes.

Litter size effect on the average daily gain lamb performance was significant ($P < 0.05$) between birth and 10-30 days of age. Single-born lambs showed a more rapid growth for the first 10-30 days compared to twin, triplets and quadruplets (**Table 3**). Single-born lambs were 0.7, 1.5 and 1.7 kg heavier ($P < 0.05$) than twin, triple and quadruple-born lambs respectively. Lambs born as twin were also heavier ($P < 0.05$) than those born as triplets and quadruplets. Litter size had a significant influence on perinatal lamb mortality (Table 3). Less relative values (2.2%; 5.5%) were observed for lambs born as twins and quadruplets, while mortality was higher (12.1%) for triplets.

In order to analyse the causes of death more precisely, all lamb were grouped according to the birth weight at an interval of 0.5 kg. The analysis indicated that lambs of 1.5 to 2.5 kg birth weight had the highest mortality (15.36%). Broadly, the mortality of female lambs was by 6.59% higher than that of male lambs (**Table 4**).

Table 3. The effect of litter size on birth weight, ADG and mortality of lambs.

Lamb traits	Litter size			
	Singles	Twins	Triples	Quadruples
Birth Weight (kg)	$4.0^{a} \pm 1$ (n = 4)	$3.3^{b} \pm 0.5$ (n = 34)	$2.5^{c} \pm 0.4$ (n = 33)	$2.3^{c} \pm 0.4$ (n = 19)
ADGQ0-10	$216^{a} \pm 70$ (n = 4)	$169^{b} \pm 47$ (n = 34)	$147^{b} \pm 54$ (n = 26)	$94^{c} \pm 66$ (n = 16)
ADG10-30	$232^{a} \pm 57$ (n = 4)	$168^{b} \pm 42$ (n = 33)	$144^{b} \pm 53$ (n = 24)	$128^{b} \pm 63$ (n = 14)
Mortality	0 %	2.2 %	12.1 %	5.5 %

Means within line with different superscripts differ ($P < 0.05$)

4. Discussion

Table 4. Mortality of lambs according to gender and birth weight

Lamb traits		Mortality (%)	
		Male	Female
Birth Weight (Kg)	1.5 - 2	3.29 (n = 3)	6.59 (n = 6)
	2.0 - 2.5	2.19 (n = 2)	3.29 (n = 3)
	2.5 - 3.0	1.1 (n = 1)	2.19 (n = 2)
	> 3.0	0.0 (n = 0)	1.1 (n = 1)

In our study, the average birth weight of the live lambs was around 2.85 kg and similar to that reported previously for D'man lambs (Boujenane 1996; Mahouachi *et al.*, 2004). The age of dam effect was significant on birth weight ($P < 0.05$) with heavier lambs obtained from ewes being 3 to 7 years old. Male lambs were generally heavier than females ($P < 0.05$).

Birth weight is one of the most important factors influencing pre-weaning growth in young animals, since lambs heavier at birth grow faster than lightweight lambs. Birth weight is influenced by breed, sex of lamb, birth type, age of dam, feeding conditions and production system (Notter *et al.*, 1991). Lambs which are heavier at birth are usually males, singles, produced by ewes with larger body sizes and good feeding conditions.

The results indicate that the mortality between the classes of dam age was different. A higher neonatal mortality of 6.6 % was registered for the lambs from 2-year-old ewes compared to 4.4 % for the lambs from 3, 7 and 9-old ewes respectively. Sex of the lamb affects significantly the mortality but conflicting results have been obtained (Patil *et al.*, 1992; Ebangi *et al.*, 1996).

Overall lamb mortality was higher (19.75%) and increased with litter size. Lamb mortality was higher in quadruples litters than triples or in twins. In general, this finding agrees with results reported in the literature (Valls, 1983; Sierra, 1985; Fahmy, 1989, Ricordeau *et al.*, 1990). Perinatal lamb mortality, which occur around parturition time, result in significant lamb losses. Mendel *et al.* (1989) reported that Merinolandschaf ewes suffered lamb losses of 18.4%. While the corresponding value for the Bergschaf breed was 26.0%. The extent of perinatal mortality depends mostly on the management system, but the major factors affecting lamb survival include age of lamb, litter size, birth weight, nutrition, parity of the

ewe and season of birth (Gatenby *et al.*, 1997; Ambruster *et al.*, 1991; Notter *et al.*, 1991). In our study, litter size had significant ($P < 0.05$) influence on birth weight which influenced perinatal mortality. The rates of mortality tend to increase at extremely low or high birth weights (Mendel *et al*., 1989; Notter and Copenhaver, 1980).

5. Conclusion

As sheep production is directly influenced by the number of lambs born and reared from a flock at any given time, it is highly important to identify the cause of lamb mortality and to take appropriate measures to reduce it. A part from low birth weight, causes of early mortality could be stress, injuries, organ malfunction, starvation or mis-mothering. Some of the causes are closely related to the season, since during different times of year, sheep and new-borns are exposed to different environmental circumstances with regard to humidity and temperature. Therefore, for proper lambing management the season should be taken into consideration since it has great impact on birth weight and perinatal lamb mortality.

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