Original Research Paper

Reproduction and Growth Performance of the Algerian Tazegzawt Sheep Breed

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Abstract

Three zootechnical criteria: fertility, prolificacy and fecundity were used to evaluate reproductive performance of 23 and 27 multiparous Tazegzawt ewes in experimental station INRAA of Bejaia during autumn mating in 2013 and 2014. A total of 52 lambs were subject to measure the average daily gain at different ages (0, 10, 30, 70, 90 and 180 days) in spring of 2013 and 2014. Some non-genetic factors (sex and type of birth of lambs) were used to study their influencing in dairy production. The results indicated that, the fertility rate was 84.22% and the prolificacy rate was higher than 150%. Fecundity rate seemed interesting in Tazegzawt breed (an average more than 126%). The mean bodyweight (W) at birth was 4.72 ± 0.92kg; 7.22 ± 1.27kg at 10 days, 12.17 ± 2.18kgat 30 days, 21.63 ± 3.02kg at 70 days and 25.80 ± 3.69kg at 90 days of age, the Average Daily Gain (ADGs) estimates for weight at 10 days (ADGs0-10) was 247.48 ± 72.45g/d and decreases with age to reach 208.64 ± 86.20g/d in ADGs70-90. In addition, the highest positive significant correlation ($r=0.92$, $p<0.01$) was observed between W30 and ADGs0-30.The growth rate was not affected by sex. However; the influence of birth type on growth performances of lambs during the 30 days showed a superiority of singles over twins ($p<0.05$). It seems that Tazegzawt sheep is one of the most prolific local breed, it shows a good growth potential. This breed has very promising potentialities that can be exploited to improve mutton meat production in Algeria.
Keywords: Lambs, Ewes, Breed, Live weight, Zootechnical aptitude

Introduction

The Algerian sheep farming is primarily intended for the production of red meat, it is the main supplier of red meat in Algeria. Culinary and religious habits mean that consumption of sheep meat per year and per capita precedes that of cattle (2614092 vs 1321433 Qx) (MADR 2012). The importance of sheep farming in Algeria (26 880 000 heads (MADR 2013)), lies in the wealth of its genetic resources. Currently, this herd consists of at least 9 breeds (OuledDjellal, Rembi, Hamra, Berber, Barbarine, D'man, Sidaou, Taadmit and Tazegzawt) with various characteristics of resistance, prolificacy, meat productivity, milk and wool and good adaptability to arid, steppe and Saharan conditions (Djaout et al., 2017).

The Tazegzawt breed is a local Algerian sheep breed, it has a very small population (currently 300 heads) with a very limited herd size, its geographical distribution is concentrated on a small territory between Akbou (Bejaia) and Bouzeguene (TiziOuzou). Flock size has decreased to such an extent that this breed could officially be considered among the endangered breeds in Algeria (El Bouyahiaoui et al., 2015), because of the anarchic crossings, especially with the white breed and the threat of in-breeding.

The Tazegzawt breed is a typical sheep of the mountain and the valley of the "Soumam", well adapted to the natural conditions of the region. It has excellent morphological characteristics and remarkable hardiness that clearly distinguish it from other sheep breeds in Algeria. This breed is also characterized by an acceptable annual level of wool productivity, but it provides relatively thick and more or less long wool compared to the specialized breeds (El Bouyahiaoui et al., 2018). Moreover, the predominant production system at the level of the breeding of this breed is the mixed crop-livestock farming systems (El Bouyahiaoui, 2017).

In order to deepen the characterization work, the objective of this study is to take stock of the breeding and growth performance of the Tazegzawt breed.

Materials and Methods

The study area

The study was carried out at the National *Agronomic Research Institute* of *Algeria* (INRAA), experimental station "OuedGhir", located in the southwest of the wilaya of Bejaia in Algeria (Fig 1) at 36° 42' 37" latitude North and 4° 58' 38" longitude East and elevation 66m.The region is characterized by a Mediterranean climate with average annual temperatures ranging from 12.9° C to 22.1° C and an average annual rainfall of 767 mm.
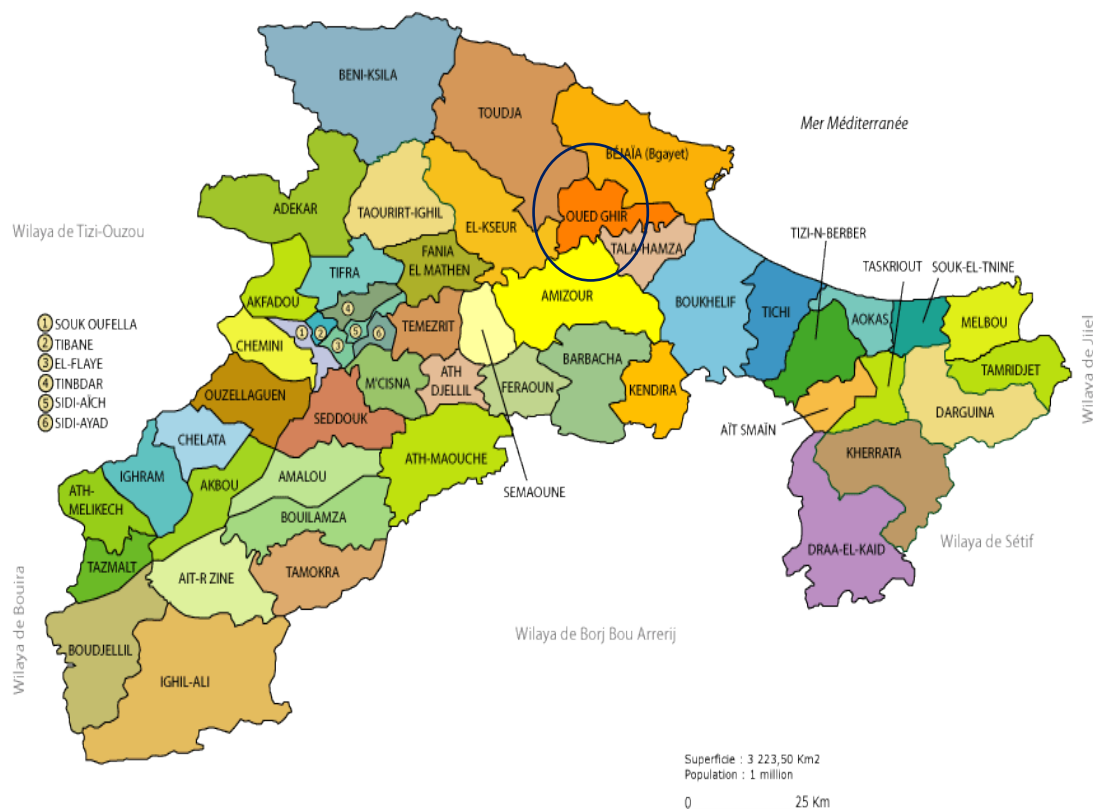

Figure 1. Oued Ghir geography map Aniref (2013)

Morphological and genetic description of Tazegzawt breed

Tazegzawt breed is made up of slender animals, of exceptional size (the height at withers is about 80 cm in ewes and 88 cm in ram), they present some very specific phenotypic characters (presence of black pigmentations with bluish reflections around the eyes, at the muzzle and at the level of the lower lobe of the ears, blue spots at the level of the anterior part of the tongue and pendants in the region of the neck), the profile and the chamfer are beaked in the males (Fig 2) (El Bouyahiaoui, 2017).

Figure 2. Profile photo of the Tazegzawt ram

The Tazegzawt breed is genetically distinct from other local sheep breeds. A recent study has confirmed the isolation and genetic specificity of this breed compared to other Algerian sheep breeds (Gaouar et al., 2017).

Breeding performance of ewes

Animals

The study included 23 ewes and 27 multiparous ewes for the years 2013 and 2014, respectively. On average at 3 to 4 years of age and the average body weight and body condition score for the two years were 55.24±7.81 kg and 3.23±0.39 kg.

Mating of ewes

Autumn being the breeding season in this study, natural batch coition was achieved without the use of any hormonal treatment. This consisted of putting a single term over a period between 8 and 10 weeks.

Evaluation of reproduction parameters

The reproductive parameters evaluated after each period of calving or following are:

- Fertility (percentage of ewes lambed from ewes mated)
- Prolificacy (number of lambs born per ewe lambed)
- Fecundity (number of lambs born per ewe mated)

eight and growth performance of lambs

Animals

A total of 52 individual lambs (25 males and 27 females) born in the spring of 2013 and 2014 were subjected to body growth control. All lambs are weighed and identified at birth. Their date of birth, sex and type of birth were recorded.

The animals were driven in permanent stabling. The feeding of lambs during the first month of their life is exclusively based on milk. From the second month, the lambs receive at will a commercial concentrate (ONAB or CAA). After weaning, lambs are fed under a semi-intensive diet with good quality forage, supplemented with a concentrated feed and pasture when possible. Knitting stones (KNZ) were made available to the animals to compensate for mineral needs and the water is distributed at will. The animals receive vaccines against contagious diseases and internal and external antiparasitic treatments (Distomatosis, strongylosis, scabies).

Growth parameters

In this study, the measured parameters are the weight at typical ages (WTA) weight at 10 (W10), 30 (W30), 70 (W70), 90 (W90) and 180 (W180) days of age to characterize the various phases of young growth. Using weights at different typical ages, we calculated the Average Daily Gains (ADGs) of birth -10days (ADGs birth-10), 10-30 days (ADGs 10-30), 30-70 days (ADGs 30-70), 70-90 days (ADGs 70-90) and 90-180 days (ADGs 90-180). The criterion (ADGs10-30) is an indicator of the mother's milk value while growth between 30-70 days is used as a criterion characterizing the lamb's earliness and its own growth abilities. The different weights at the typical ages were obtained by linear interpolation between the different weightings carried out.

- The typical age weights and growth rates of lambs are presented by sex and birth type.

- A correlation test between the different weights at typical age was carried out.

The live weight was measured using a load cell with a span of 50 kg and a scaling accuracy of 100g.

The live weight (LW) and the Average Daily Gains (ADGs) are expressed in kg and g/day, respectively.

Statistical analysis

Reproductive parameters, arithmetic averages, standard deviations and variance of lamb growth traits, and correlation between study parameters weights were developed using Statistical Packages for Social Sciences (SPSS) Version 19.

The following parameters (Birthweight (BW), ADGs0-10, ADGs 10-30) were subjected to a two-way analysis of variance (sex and birth type of lambs).

Results and discussion

Reproductive performance

Table 1 summarizes the different reproductive parameters recorded during the study of two consecutive years:

-Tazegzawt breed appears to have good reproductive performance, the fertility rate of Tazegzawt ewes following natural reproduction averages 84.22%, with a rate of 86.96% recorded in 2013,

-a relatively remarkable prolificacy of more than 150%, it results from the high proportion of multiple litters, with an average of 1.60 lambs per ewe and per litter recorded in 2013. Indeed, the high values of prolificacy (essential component of livestock productivity), without hormonal stimulation, could classify the Tazegzawt breed among the most prolific breeds of sheep in Algeria.

The good fertility obtained during the autumn wrestling, considered as a favorable breeding season for small ruminants, should also be evaluated during the spring wrestling to determine if this breed is influenced by photoperiodicity and therefore if seasoned or not.

-In addition, average fertility, which depends on the capacity of the ewes to be pregnant (fertility) and the number of lambs per litter (prolificacy), seems interesting for the Tazegzawt breed (an average of about 127%).

Table 1. Mean reproductive parameters of the herd

Parameters	Autumn mating 2013 (n = 23)	Autumn mating 2014 (n = 27)	Average
Fertility (%)	86.96	81.48	84.22
Prolificacy (%)	160.00	140.91	150.45
Fecundity (%)	139.13	114.81	126.97

Number of females put in mating (N).

The results obtained are near to the rates calculated from the results of surveys by Hambli and Tazarat, (2003) in the Tazegzawt breed: 72% and 154%, for fertility and prolificacy, respectively. Under the same breeding conditions, the ewe's fertility recorded in this study is comparable to that of the standards of local sheep breeds : 89% for OuledDjellal (IANOR, 2007a), 90% for Rembi, (IANOR, 2013), 86% for the Hamra breed (IANOR, 2007b), of the Black Tunisian race of Thibar : 90.5% (Hammami et al., 2014), of the Boujaâd breed : 89%, (El Fadili, 2008) and of the BeniGuil breed : 91% (El Fadili, 2009).Nevertheless, the Tazegzawt ewe is less fertile than the Sardi breed : 98% (Chikhi and Boujenane, 2003), while the prolificacy is much higher compared to the OuledDjellal breed : 110% (IANOR, 2007a), Rembi: 115% (IANOR, 2013), Hamra : 115% (IANOR, 2007b), Sardi : 129% (Chikhi and Boujenane, 2003), Boujaâd : 109% (El Fadili, 2009), Black Tunisian Thibar: 120% (Hammami et al., 2014), the Merino breed of Rambouillet : 123% (Anonymous, 2010) and Timahdite: 105% (Boujenane and Kansari, 2005) but comparable to that of Lacaune : 175% (Babo, 2000).

Weight and growth ability of lambs

The arithmetic means, standard deviations and variance of growth traits of Tazegzawt lambs are reported in Table 2.

Table 2. Mean weights at typical ages (kg) and ADGs (g) of lambs regardless of gender

Parameters	N	Mean±S.D	Min.	Max.	Variance
BW	52	4.72±0.92	2.3	6.3	0.85
W10	49	7.22±1.27	4.5	9.8	1.62
W30	49	12.17±2.18	8	16	4.74
W70	46	21.63±3.02	16.5	29	9.09
W90	46	25.80±3.69	19.5	35.5	13.62
W180	36	37.08±5.16	27	47	26.65
ADGs (0-10)	49	247.45±72.22	140	450	5215.75
ADGs (10-30)	49	247.50±66.04	80	390	4361.72
ADGs (0-30)	49	247.48±53.68	120	353.33	2881.63
ADGs (30-70)	46	233.72±50.50	117.5	325	2549.76
ADGs (70-90)	46	208.64±86.20	75	525	7429.92
ADGs (90-180)	36	116.90±40.64	5.56	208.33	1651.82

ADGs: Average Daily Gains; BW: Birth Weight; N: Number of individuals; W: Weight

The mean live birth weight of lambs collected over a two-years period is 4.72 ± 0.92 kg, ranging from 2.3 to 6.3 kg depending on litter size regardless of sex. The average weights of the lambs are 7.22 ± 1.27 kg, 12.17 ± 2.18 kg, 21.63 ± 3.02 kg and 25.80 ± 3.69 kg, respectively at 10, 30, at 70 and 90 days. We notice that the weight shows a significant increase from the second month, reaching the highest value at 180 days (Fig 3). Under favorable breeding conditions, this breed reaches a mean post-weaning weight (age at 180 days) of 37.08 ± 5.16 kg (37.71 ± 5.65 kg in the male and 36.38 ± 4.62 kg in the female).
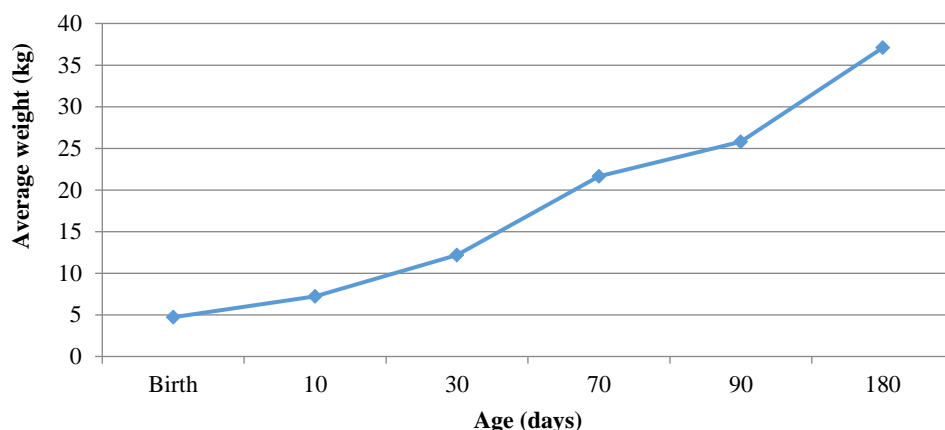
Figure 3. Evolution of average weight at typical ages independently of sex

It appears that Tazegzawt sheep's good weight performance is due mainly to the high growth potential of lambs. The average growth performance of this breed is 247.48 ± 72.45 g / day in ADGs birth - 10d and then decreases with age to reach 208.64 ± 86.20 g / day in ADGs 70-90. The relatively high value of the ADGs 0-10 is probably due to the high milk yield of the ewe of this breed.

The Mean of ADGs has an inverse curve to body weights at various types of ages (growth rate slow progressively with age) in Tazegzawt lambs (Fig 4).
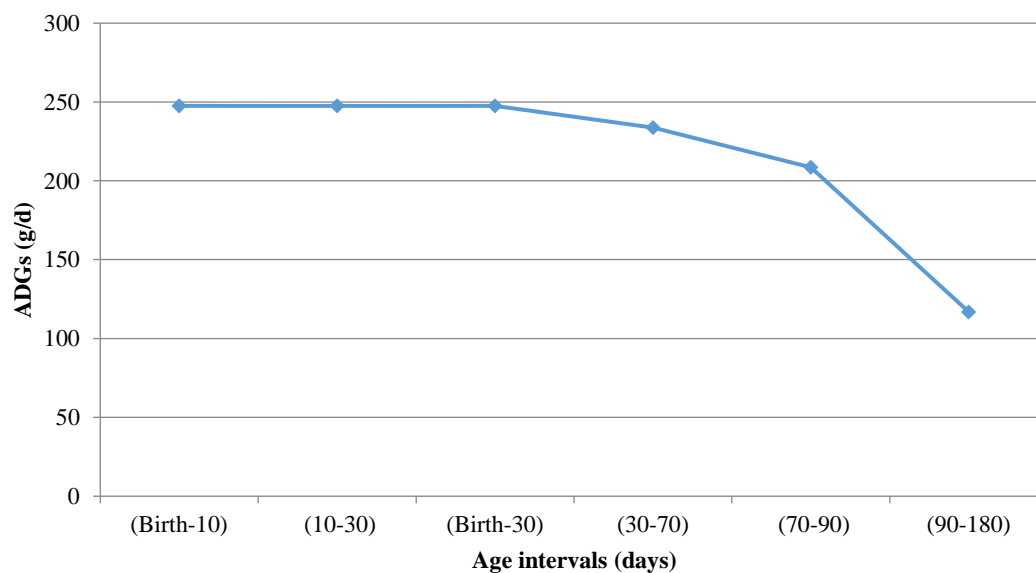

Figure 4. Evolution of average daily gains independently of sex

The weight at birth of lambs in this breed is largely important compared to other breeds : 3.5 kg in OuledDjellal (IANOR, 2007), 4 kg in Rembi (IANOR, 2013), 3.1 kg in Hamra (IANOR, 2007), 2.60 kg in the D'man breed (Mahouachi et al.,2004), 3.7 kg in the Sardi breed (Boujenane et al.,2001), 3, 72 kg in the Timahdite breed (Boujenane and Kansari, 2005), 2.8 kg in Ile-de-France (Boujenane, 2005) and comparable to that of the Moroccan breed Boujaâd : 4.95 kg (El Amiri et al., 2010), of the Awassi breed from the Middle East : 4.3 kg (Kridli et al.,2006), the Mexican Blackbelly breed : 4.5 kg (Herrera-Alarcón et al.,2007).

The growth performance achieved by lambs of the Tazegzawt breed is comparable to that of other local breeds in Algeria. Average weights of 12 kg and 29 kg are recorded at 30 days and 120 days, respectively, in the OuledDjellal breed (IANOR, 2007a), 9.92 kg, 15.44 kg and 22.06 to 30 days at 60 days and 90 days, respectively, in the Rembi breed (IANOR, 2013).

However, the results of this study are well above the mean values reported by Kerfal et al(2005) in the D'man breed : 7.69 kg and 19.8 kg at 30 and 90 days, respectively, by Rekik et al (2008) in the same breed : 3.4 Kg, 5.9 Kg, 11.4 Kg, 13.1 Kg, at 10, 30, 70 and 90 days, respectively, with a ADGs of 100 g/d between the age of 10 and 30 days, by Chikhi and Boujenane (2003) in the Sardi breed, the most important Moroccan breed : 10.9 kg, 22.5 kg and 35.7 kg at 30, 90 and 180 days, respectively with a ADGs of 224 g/d between 0-30 days and 194 g/d between 30 and 90 days and by Boujenane and Kansari (2005) in the Timahditebreed : 9.56 kg and 17.9 kg at 30 days and 70 days respectively.

Male lambs were slightly heavier than females at birth (4.84 ± 1.02 kg vs 4.62 ± 0.83 kg); males weighed 0.22 kg more than females. Some individuals born from single litters are born with a birth weight of over 6 kg.

Generally, males are always heavier than females at birth, in the Tazegzawt race this difference is not marked since the weights of both sexes from birth to 30 days are very close, it is from at the age of 70 days the difference in weight is remarkable in favor of males (Table 3). So the sex effect is all the more important as the lambs are older. These results are in agreement with those of many authors (Huidobro and Jurado, 1989, Boujenane and Kerfal, 1990, Theriez et al., 1997, Chikhi and Boujenane, 2004). The difference in weight between the two sexes at 70 days is 1.61 and 2.37 kg at 90 days, corresponding to a difference in ADGs of 16.06 g/day between 30 and 70 days and 38 g/day between 70 and 90 days. These results are comparable with those of Jurado and al., (1986) for the Spanish Merina breed; Boujenane and Kerfal (1990) for the D'man breed.

Table 3. Average weights at typical ages (kg) and ADGs (g) of lambs by sex

Parameters	N	Lambs	N	Ewe lambs	Total	p
BW	25	4.84±1.02	27	4.62±0.83	4.72±0.92	ns
W10	24	7.45±1.23	25	7.00±1.30	7.22±1.27	ns
W30	24	12.43±2.28	25	11.92±2.09	12.17±2.18	ns
W70	22	22.47±2.99	24	20.86±2.89	21.63±3.02	ns
W90	22	27.04±3.90	24	24.67±3.16	25.80±3.69	*
W180	19	37.71±5.65	17	36.38±4.62	37.08±5.16	ns
ADGs (0-10)	24	255.83±71.12	25	239.40±73.80	247.45±72.22	ns
ADGs (10-30)	24	248.85±73.01	25	246.20±60.10	247.50±66.04	ns
ADGs (0-30)	24	251.18±53.99	25	243.93±54.25	247.48±53.68	ns
ADGs (30-70)	22	242.10±54.51	24	226.04±46.34	233.72±50.50	ns
ADGs (70-90)	22	228.52±102.29	24	190.42±65.26	208.64±86.20	ns
ADGs(90-180)	19	113.30±48.28	17	120.92±30.97	116.90±40.64	ns

ADGs: Average Daily Gains; BW: Birth Weight; N: Number of individuals; W: Weight; (*): Significant at p<0.05; ns: Non Significant

However, the birth type an important source of weight variability at typical ages and growth rate. This study revealed differences in weight and growth between single and twin lambs (Table 4). These results confirm those of Kerfal et al(2005) who reported that birth weight decreased significantly with increasing litter size and those of Madani (1987), Heriez (1991), and Boussena et al (2013).

Table 4. Mean weights at typical ages (kg) and ADGs (g) of lambs by birth type

| Parameters	N	Single	N	Twin	Total	p
BW	42	4.90±0.80	10	3.96±1.04	4.72±0.92	**
W10	39	7.53±1.14	10	6.00±1.03	7.22±1.27	***
W30	39	12.71±2.00	10	10.08±1.51	12.17±2.18	***
W70	38	21.94±2.97	8	20.13±2.94	21.63±3.02	ns
W90	38	26.18±3.67	8	24.00±3.46	25.80±3.69	ns
W180	30	37.47±5.30	6	35.17±4.29	37.08±5.16	ns
ADGs (0-10)	39	258.59±74.97	10	204.00±38.06	247.45±72.22	*
ADGs (10-30)	39	258.72±67.76	10	203.75±34.75	247.50±66.04	*
ADGs (0-30)	39	258.68±53.36	10	203.83±26.20	247.48±53.68	**
ADGs (30-70)	38	232.11±51.39	8	241.41±48.46	233.72±50.50	ns
ADGs (70-90)	38	211.78±87.77	8	193.75±82.10	208.64±86.20	ns
ADGs(90-180)	30	118.24±42.00	6	110.19±35.56	116.90±40.64	ns

*ADGs: Average Daily Gains; BW: Birth Weight; N: Number of individuals; W: Weight; *: Significant at p<0.05; **: Significant at p<0.01; ***: Significant at p<0.001; ns: Not Significant*

The average difference in weight between single and double births of lambs ranges from 0.94 to 1 kg at birth, 2.63 kg at 30 days and 2.18 kg at 90 days, with a difference in growth of 54.85 g / d between birth and 30 days and 18.63 g / d between 70 and 90 days of age.

Many authors agree that the type of birth is the factor that most clearly affects the birth weight and growth of lambs (Des vignes et al., 1966, Boujenane and Kerfal, 1990, Boujenane and Mharchi, 1992, Rekik et al., 2008). For their part, Theriez et al. (1976) find that two- and three-litter lambs weigh 86% and 73%, respectively, of the weight of single lambs. This difference is due to the phenomenon of multiple competitions during the fetal life and the breastfeeding period (Fraysse and Guitard, 1992).

On the other hand, the growth rate of lambs, regardless of their sex and birth type, tends to decrease from 70 days (Figs 7 and 8), in contrast to live weight which continuously changes to adulthood (Figs 5 and 6).

We also note, as the lamb progresses in age, its weight gain expressed by the average daily gain has slowed down. This result is consistent with the study conducted by Bedhiaf et al (2000).
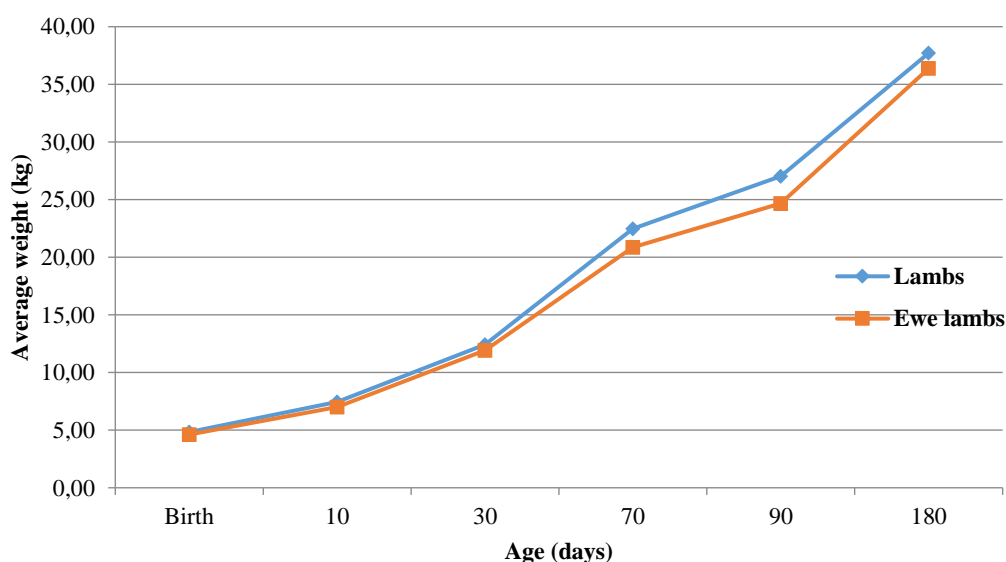
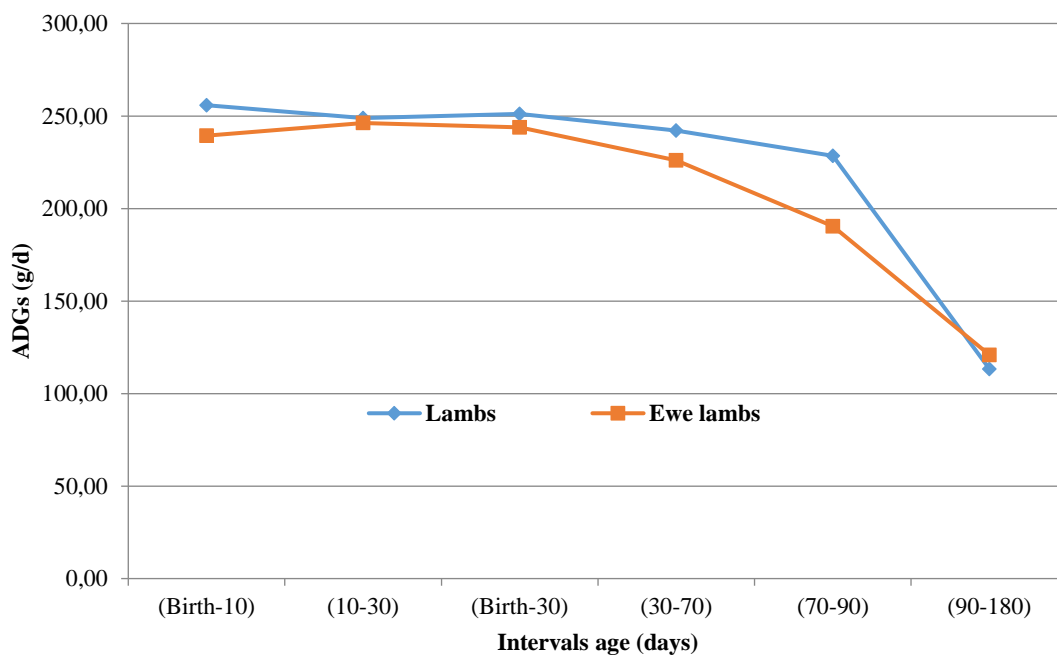**Figure 5.** Evolution of average weight at typical ages by sex
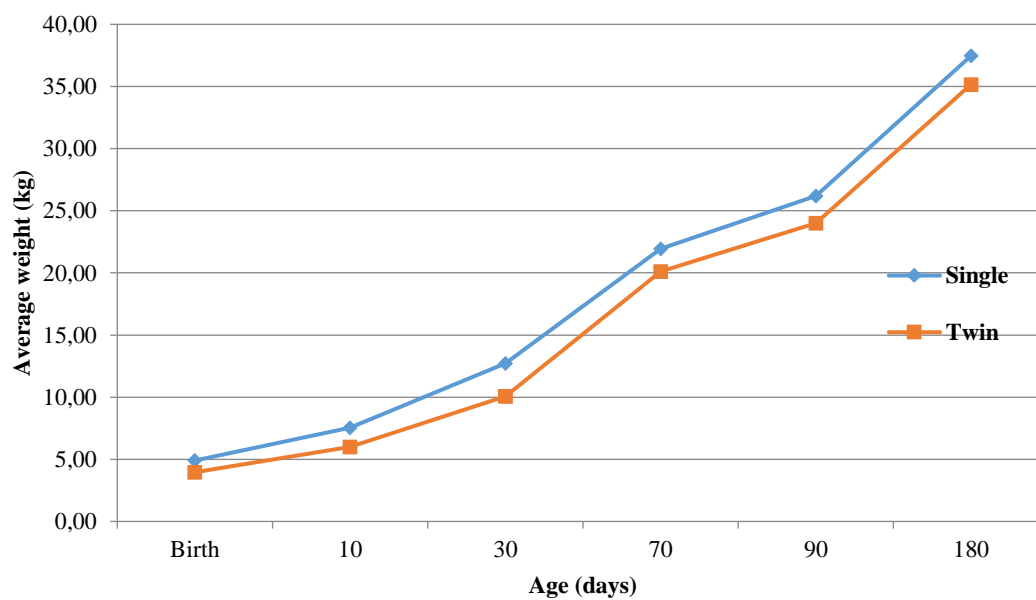
Figure 6. Evolution of average daily gains by sex

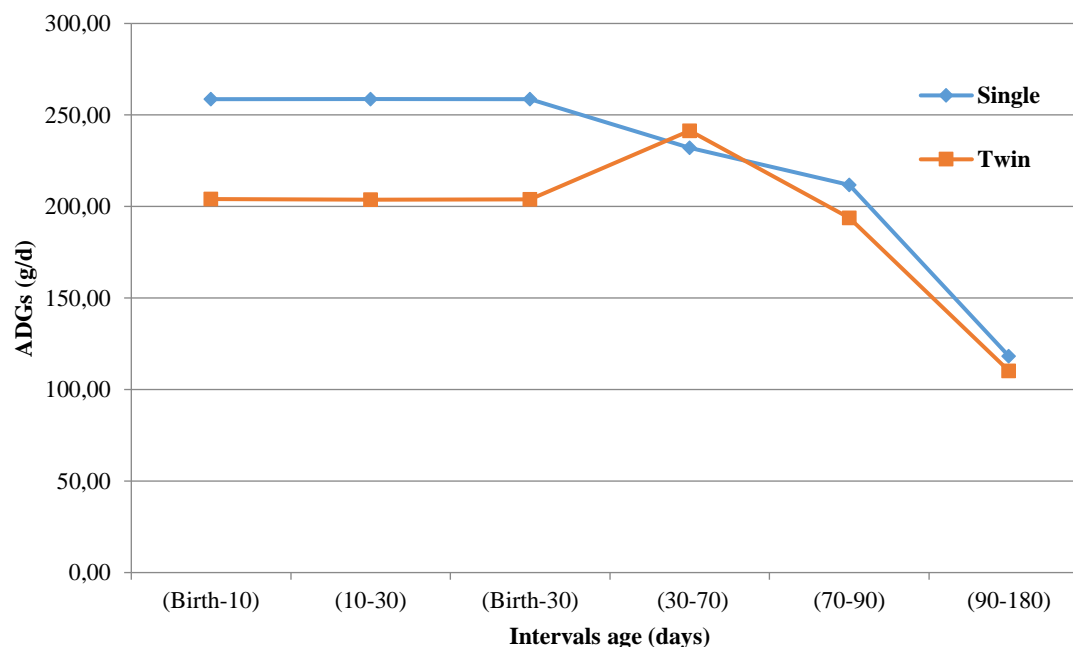**Figure 7.** Evolution of average weight at typical ages by birth type

Figure 8. Evolution of average daily gains by birth type

Table 5 presents the correlation matrix used to evaluate the dependence between the different growth traits studied. Strong associations were observed between mean weights at 10 days and birth weight (r = 0.85, p <0.01), between weight at 30 days and weight at 10 days (r = 0, 83, p <0.01) and between the 90 day weight and the 70 day weight (r = 0.88, p <0.01). The highest positive and significant correlation (r= 0.92, p <0.01) was recorded between W30 and ADGs birth-30 while the lowest (0.004) was found between W70 and ADGs 90-180. For the rest, however, the intensity of the linear relationship between them is relatively low. These results are consistent with those obtained by Boujenane and Mharchi (1992) in lambs of the BeniGuil and Boussena et al (2013) breed in lambs of the OuledDjellal breed. Significant and positive correlations observed between growth traits mean that selection for any performance will result in genetic improvement of other performances. During the milk feeding,the ADGs was positively related to birth weight regardless of birthtype (single or twin under the mother). Villette et al (1981) obtained a similar result.

However, some parameters are negatively correlated, they vary in two opposite directions and with a similar intensity, notably:

 -between the weight at 90 days and ADG 90-180

 -and between ADG 90-180 and ADG 70-90.

Table 5. Correlation between the studied parameters

	B W	W10	W30	W70	W90	W180	ADGs (0-10)	ADGs (10-30)	ADGs (0-30)	ADGs (30-70)	ADGs (70-90)	ADGs (90-180)
BW	1	**0.857**[**]	0.762[**]	0.594[**]	0.594[**]	0.493[**]	0.266	0.430[**]	0.472[**]	0.149	0.233	0.074
W10		1	**0.833**[**]	0.677[**]	0.698[**]	0.603[**]	0.715[**]	0.409[**]	0.656[**]	0.183	0.311[*]	0.179
W30			1	0.745[**]	0.769[**]	0.629[**]	0.522[**]	0.846[**]	**0.928**[**]	0.083	0.344[*]	0.081
W70				1	**0.887**[**]	0.634[**]	0.460[**]	0.571[**]	0.670[**]	0.727[**]	0.149	0.004
W90					1	0.706[**]	0.496[**]	0.591[**]	0.701[**]	0.533[**]	0.589[**]	-0.014
W180						1	0.490[**]	0.455[**]	0.589[**]	0.333[*]	0.340[*]	0.699[**]
ADGs (0-10)							1	0.171	0.589[**]	0.138	0.257	0.231
ADGs (10-30)								1	**0.897**[**]	-0.03	0.265	-0.029
ADGs (0-30)									1	0.034	0.329[*]	0.071
ADGs (30-70)										1	-0.131	-0.079
ADGs (70-90)											1	-0.037
ADGs (90-180)												1

** : The correlation is significant at the 0.01 level; *: Correlation is significant at the 0.05 level; ADGs: Average Daily Gains; BW: Birth Weight; W: Weight

Conclusion

The Tazegzawt breed is one of the most prolific local breeds. A detailed study is possible to determine the factors influencing the relatively high prolificacy rate in this breed (follicular dynamics, ovulation rate, embryonic survival, etc.). Also, with the molecular biology techniques currently being developed, we will be able to identify the responsible gene. However, evaluation of reproductive parameters with a reduced herd remains the limiting factor in this study. The Tazegzawt breed shows good growth potential, which places it among the high-weight productivity breeds. The good growth rate recorded between birth and age of 30 days is an index reflecting the dairy value of the Tazegzawt ewe. This breed therefore has very promising potentials that can be exploited to improve meat production in Algeria. It is necessary to recall that the performances studied in this study relate to the data collected under controlled breeding conditions.

Acknowledgement

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