Influence of Region on Some Reproductive Parameters in Ouled Djellal Sheep

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ABSTRAK

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Penelitian ini bertujuan untuk menilai kinerja reproduksi domba betina Ouled Djellal di empat lokasi Biskra yang berbeda: El Hadjeb, Sidi Okba, Ouled Djellal, dan Chaiba. Semua kelompok dipelihara secara ekstensif. Penelitia ini menggunakan 357 ekor domba betina Ouled Djellal yang sehat secara klinis dan tidak bunting. Perkawinan semua kelompok dilakukan secara bebas selama dua bulan: Mei dan Juni 2015 (61 hari). Selama periode beranak, jumlah total domba betina dan jumlah total domba di semua kelompok ditentukan. Dilakukan perbandingan tingkat kesuburan, fekunditas, dan proliferasi menggunakan uji $\chi 2$ untuk memverifikasi hubungan antara tingkat yang diukur dan empat lokasi, serta beberapa perbandingan yang menunjukkan perbedaan signifikan antarlokasi. Parameter yang dinilai dalam penelitian ini meliputi fekunditas, proliferasi, dan fertilitas. Nilai rata-rata keseluruhan yang diperoleh adalah 78% untuk kesuburan, 117% untuk produktivitas, dan 92% untuk kesuburan. Rata-rata ini ditemukan jauh lebih rendah dibandingkan dengan rata-rata yang diamati pada ternak yang dikelola secara intensif. Namun, angka terendah tercatat di lokasi 4 (Chaiba), dengan nilai 65% untuk kesuburan, 109% untuk produktivitas, dan 71% untuk fekunditas. Hasil penelitian ini jelas menunjukkan bahwa wilayah mempunyai pengaruh yang signifikan terhadap kesuburan (P= 0,001) dan fekunditas (P= 0,0001), namun tidak berpengaruh signifikan terhadap tingkat produktivitas (P= 0,074).

Kata Kunci: Domba Betina, Fekunditas, Fertilitas, Profikasi

ABSTRACT

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The present study aims to assess the reproductive performance of Ouled Djellal ewes at four different Biskra locations: El Hadjeb, SidiOkba, Ouled Djellal, and Chaiba. All flocks were kept under extensive management. For this study, 357 clinically healthy and non-pregnant Ouled Djellal ewes have been used. Mating was practiced in an accessible mode, conducted over two months: May and June 2015 (61 days) for all herds. The total number of lambing ewes and lambs in all flocks was determined during the lambing period. We compared fertility, fecundity, and prolificacy rates using the $\chi 2$ test to verify the relationshipbetween the measured rates and the four sites and multiple comparisons that revealed significant differences. The variables assessed in this study encompassed fecundity, prolificacy, and fertility. The overall mean values obtained were 78% for fecundity, 117% for prolificacy, and 92% for fertility. These averages were significantly lower than those observed in intensively managed herds. However, the lowest rates were recorded at site 4 (Chaiba), with65% for fertility, 109% for prolificacy, and 71% for fecundity. The results of this study clearly show that the region has a significant effect on fertility (P= 0.001) and fecundity (P= 0.0001) but no significant effect on the prolificacy rate (P= 0.074).

Key Words: Ewes, Fecundity, Fertility, Prolificacy

INTRODUCTION

In Algeria, the sheep herd represents the most significant animal resource, estimated at more than 27 million heads, 80% of which are breeding sheep (Titaouine and Meziane 2015). Despite its economic and social importance, sheep farming needs better management concerning technical planning , production systems (Benyounes et al. 2013a), environmental conditions, and reproductive management,which cause low productivity. Improving productivity in sheep production must go hand in hand with controlling reproduction and increasing performance. It allows the choice of breeding period and the reduction of

unproductive periods (Castonguay 2018). According to Benyounes et al. (2013b), the alignment of genetic baggage and ensuring good nutritional level before, during, and shortly after mating, as well as at the end of gestation, ensures the survival rate of ovulation and embryos, which consequently contributes to increasing fertility and fecundity.

In the Biskra department, sheep breeding is one of the most essential activities. Since the Ouled Djellal breed represents the majority of the flocks in the region, the Ouled Djellal breed has been the subject of several studies on production and reproduction performances. The latter is perfectly adapted to the extreme conditions of an arid environment. Therefore, this study aims to update and evaluate some reproductive performances of the Ouled Djellal breed in different regions of Biskra, , namely El Hadjeb, Sidi Okba, Ouled Djellal, and Chaiba. The goal is to calculate fertility, reproduction rate, and fecundity rate to determine the impact of the region on these parameters.

MATERIALS AND METHODS

Study area

The present study was conducted in the department of Biskra, located in central-eastern Algeria, at the gateway to the Algerian Sahara. It is a real buffer zone between north and south, about 400 km from the southeast of the capital, Algiers (Aissaoui et al. 2019). Biskra comprises four different geomorphological elements: the mountains, the plains, the plateaus, and the depressions (Makhlouf et al., 2020). The selection of the sites is based on the geographical distribution and characteristics of the areas (landforms and altitude). We selected four locations (Figure 1): El Hadjeb, SidiOkba, Ouled Djellal, and Chaïba, respectively referred to as Site 1, Site 2, Site 3, and 4. The first two sites have a flat landform, the third is a plateau, and the fourth site is a mountainous region.

Climate data

According to the National Meteorological Office, the study area is characterized by significant diurnal heat amplitudes. Thus, the temperature, which reaches very high values in the shade in summer, drops to as much as 50% at night. The variation of daily thermal amplitude is significant in all months of the year. The maximum temperature is reached in July: 49°C, but in January, it varies by 5°C, especially at night. The amount of precipitation is low and varies from month to month; depending on the season, the amount of precipitation increases, especially in autumn and winter. Relative humidity varies considerably depending on the season. It drops to 25% in summer due to high evaporation, especially in July. In winter, however, it rises to as high as 60%. Winds blow throughout the year, and in general, northwest winds dominate. The southerly winds are generally cold and dry in winter. In summer, they are hot and dehydrated: Sirocco. It increases the evaporation and, therefore, the dryness.

Studied flocks of sheep

The selected Ouled Djellal ewes are clinically healthy and non-pregnant, belonging to four flocks. The animals are extensively bred, kept outdoors most of the year during the day, and only wholly indoors for a limited period, depending on the weather. , All experimental animals are kept exclusively on steppe-type pastures, including Halfa (Stipa tenacissima), Diss (Ampelodesmos tenax), and white sagebrush (Artemisia herba alba), and on annual meadows, consisting of various grasses (mainly Cynodon dactylon), and legumes (especially Melilotus sulcata and Vicia monantha). Nutritional supplements are provided only for the breeding rams and the antennas in the breeding program, which are kept in pens. Males are entirely isolated from the females and are added to the flock only during the mating season (1 male for 30 to 40 ewes (1 ram in site 1, 2 rams for sites 2 and 3, and 5 rams for Site 4). The mating mode is accessible, and it was conducted for two months: May to June 2015 (61 days) for all herds. Reproduction parameters were determined five months later (October - November).

Studied parameters

During the lambing period from October to November 2015, we recorded the total number of lambing ewes and the total number of born lambs in each flock. The following reproduction performances (fertility, prolificacy, and fecundity) were evaluated in each flock:Fertility rate= (number of ewes lambing/number of ewes mated) x 100, Prolificacy rate= (number of lambs born/number of ewes lambing) x 100, Fecundity rate= (number of lambs born / number of ewes mated) x 100,All these parameters were calculated according (Dursun 2019).

Analysis method

Statistical analysis of the reproductive variables was conducted using SPSS Inc.'s "IBM SPSS Statistics 20" software, Chicago, Illinois, USA. We compared the means of fertility values, fecundity, and prolificacy rates of the four sites (El Hadjeb, Sidi Okba, Ouled Djellal, and Chaiba). We used the $\chi 2$ test to verify theassociation between the measured rates and the four sites. In addition to multiple comparisons, which revealed sites with significant differences.

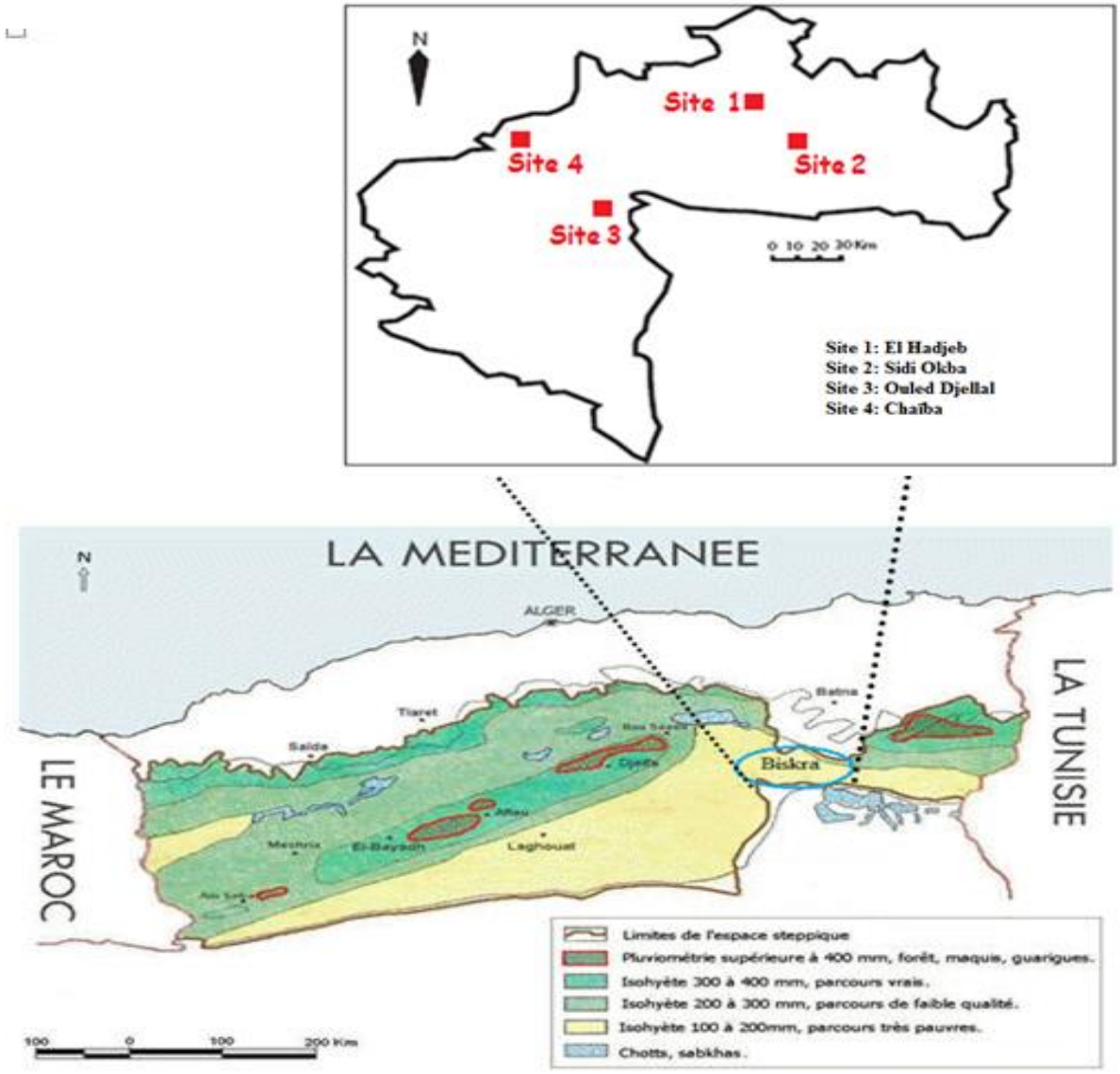

Figure 1. Geographical distribution of the studied sites in Biskra department (Senoussi et al. 2014)

RESULTS AND DISCUSSION

Fertility

Table 1 summarizes the distribution of ewes in each of the four sites, while Table 2 shows how the region and its components affect the various reproductive parameters. Table 2 shows the overall average values of reproductiveperformances of the studied flocks regardless of their location. Basedon these results, it can be stated that the average fertility of ewes is 78%, i.e., 78 lambings and 22 non-lambing (infertile), the average prolificacy of the studied ewes is 117%, i.e., 17 more lambs for 100 lambs, and the average fecundity is 92%. The average fertility scores for flocks at Sites 1 and 4 were lower than the average at 0.7 and 0.65, respectively. In contrast, the average fertility values for the flocks at Sites 2 and 3 were higher than the overall average at 0.9 and 0.87, respectively. For prolificacy, we found that ewes at sites 1, 2, and 3 averaged above the overall average of 1.17 and above the average for the flock at Site 4, which was 1.09. Fecundity was below the overall average. The flocks at sites 1 and 4 were 0.83 and 0.71, respectively. On the other hand, the averages of the flocks at sites 2 and 3 were above the overall average, which was 1.06 and 1.07, respectively.

The total fertility rate in this study was lower compared to that of (Chellig 1992) in a similar sheep breed (100%), with a difference of 22% compared to our results and the rates recorded in Ouled Djellal breed described by (Dekhili, 2004) in Setif region, where the

average was 92% and those of (Arbouche et al. 2013) which was 88% with a difference of 14% and 10% respectively.Our findings are consistent with the 75% fertility rate reported by (Zidane et al. 2021) in the Ouled Djellal sheep breed in the Chlef region of the semi-arid western Algerian Highlands. On the other hand, (Mefti Korteby et al. 2017) reported a fertility rate of 83% with a difference of 5%. In certain Moroccan breeds described by (Chikhi and Boujenane 2003) as the Boujaâd, Sardi, Timahdite and Beni Guil breeds, the fertility rates varied from 98%, 85% to 92%, 77% to 95%, and 82 to 87% respectively with differences of 20%, 7% to 14%, 1 % to17%, and 4 to 9%, respectively compared to our results. The lower values in the sheep flocks studied can be explained, on the one hand, by the breeding mode, especially the food supply during the mating season (No flushing technique), and, on the other hand, by the drought-induced nutritional conditions in the study area. Several authors, including(Ayele and Urge 2019) and (Desmarchais et al. 2022), reported that good feeding quality during the breeding period improves ewe fertility. Thus, fertility is influenced by the season and mating month (Catalano et al. 2015;Thompson et al. 2019).The best fertility results were obtained when mating occurred with abundant and high-quality forage. In this context (Nechifor et al. 2022) showed that a daily decrease in nutrient absorption decreased endometrial sensitivity to progesterone and affected embryo survival. From the results ($\chi2 = 22.829$, $p = 0.001$), it can be concluded that the region has a significant effect on fertility rate. Animals from sites 2 and 3 exhibited the best fertility rates: 90% and 87% ($p = 0.589$), compared to 70% and 65% ($p = 0.611$) for sites 1 and 4, respectively. Comparison of fecundity rates revealed a significant difference between sites 1 and 2 (P= 0.016), between sites 1 and 3 (P= 0.041), and a significant difference between sites 2 and 4 (P= 0.0001).

Prolificacy

The average prolificacy of Ouled Djellal ewes was 117%. Our results are lower than those obtained by Dekhili (2004) and Dekhili (2014) for Ouled Djellal sheep, which were 130% and 126%, respectively, with a difference of 13% and 9%. Moreover, the results obtained are lower than those of Chellig (1992) described in D'Man breed sheep, ranging from 185 to 200% with differences from 68% to 83%. Closer results were obtained by Dekhili (2002) in a similarly studied sheep breed (110% with a 7% difference) and in Rembi sheep (110% with a 7% difference) by Chellig (1992). Our results are similar to those of the Hamra and Moroccan Sardi breed, which ranged from 110 to 120% and 107 to 121%, with a difference of 3% and 4%, respectively (Chellig 1992). Finally, Dekhili & Aggoun (2007) found a slightly higher fertility rate in the Ouled Djellal breed in the Sétif region (109%, a difference of 8% from our results). Chikhi & Boujenane (2003) found higher average fertility in Beni Guil and Timahdite sheep breeds, which were 108% and 105%, with differences of 9% and 12%, respectively, compared tothe results in the Ouled Djellal sheep studied. The prolificacy rate is influenced by the feeding of ewes during estrus (Abd El-Hamid et al. 2016).Taherti and Rachid (2018) reported that the distribution of supplementary feed to ewes before and during the mating period improved the ovulation rate and, consequently, the prolificacy rate. Similarly, Sitaresmi et al. (2020) found that adequate and high-quality feeding during the mating season may favor twin births. Animals from site 3 had the best prolificacy rate (123% vs. 119%, 118%, and 109% for sites 1, 2, and 4, respectively). The results of the comparative test of prolificacy rates according to the region (site 1, site 2,site 3, and site 4) are presented in Table 3. Based on the obtained results ($\chi2= 6.933$, P= 0.074), we can say that the region has no significant effect on prolificacy.

Table 1. The numbers registered on different sites

Sites	Ewes number	Lambing ewes	Lambs number	Simple pregnancy number	Double pregnancy number
Site 1 (El Hadjeb)	30	21	25	17	4
Site 2 (SidiOkba)	60	54	64	44	10
Site 3 (Ouled Djellal)	70	61	75	47	14
Site 4 (Chaiba)	197	128	140	116	12
Total	357	264	304	224	40

Table 2. Effect of region on fertility, prolificacy, and fecundity in Ouled Djellal ewes reared under semi-arid conditions

Sites	Fertility rate, %	Prolificacy rate, %	Fecundity rate, %
Site1	70a	119	83a,b
Site2	90b	118	106a
Site3	87b,c	123	107a
Site 4	65a	109	71b
Mean±Standard Deviation	78±12	117±6	92±18
Pearson's Chi-square	22,829	6,933	29,963
P value (Site 1 vs 2 vs 3 vs 4)	0.001	0.074	0.0001
P value (Site1 vs Site 2)	0.016	/	0.056
P value (Site 1 vs Site 3)	0.041	/	0.116
P value (Site 1 vs Site 4)	0.589	/	0.341
P value (Site 2 vs Site 3)	0.611	/	0.741
P value (Site 2 vs Site 4)	0.0001	/	0.0001
P value (Site 3 vs Site 4)	0.0001	/	0.0001

Values with different letters within columns are significantly different (P<0.05)

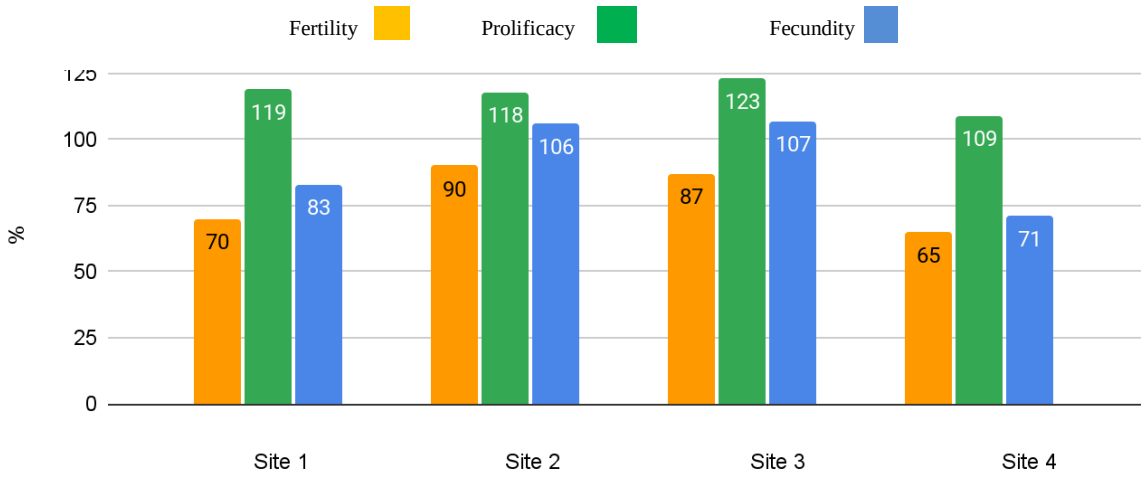

Figure 2: Results of the reproduction parameters refer to the 4 sites. Site 1 (El Hadjeb) and Site 2 (SidiOkba): flat landform regions; Site 3 (Ouled Djellal): plateau relief; Site 4 (Chaiba): mountainous region

Fecundity

The average fecundity rate of the studied Ouled Djallal ewes was 92%. This rate was comparable to that of other breeds of sheep, n, namely the Rembi and Barbarine breeds, which was 95%, with a difference of 3% (Chellig 1992). For the similar breed of ewes, our results were lower than those of Dekhili (2002) and Dekhili (2004), 110% and 128%, with differences of 18% and 36%, respectively. In addition,it was lower than those reported by Narimane et al. (2016), which ranged from 146% to 176%. However, our fecundity value was higher than that of Merghem (2009), which was 70% for the Ouled Djellal breed in the Setif region.The differences between the results obtained in the present study and those of several authors can be explained by racial factors, the rearing systems, and the type of feeding, especially during the control periods. In this study, the herds were reared extensively with inadequate feeding that only met maintenance needs. This malnutrition, especially during the control period, harmed the reproductive potential of the ewes studied. Sheep flocks at sites 2 and 3 had the best fecundity rates, 106% and 107%, versus 83%and 71% for sites 1and 4, respectively. The results of the comparative test of fecundity rate by region (site 1, site 2, site 3, and site 4) are reported in Table 3. We conclude that the region significantly affects fecundity based on the obtained results ($\chi 2$= 29.963, P= 0.0001). Pairwise comparisons of fecundity rates show a significant difference between site 2 and site 4 and between site 3 and site 4 (P= 0.0001), no significant difference of fecundity rates between site 1 and site 3 (P= 0.116), neither between site 1 and site 4 (P= 0.341) nor between the site 2 with site 3 (P= 0.741).

In conclusion, the results of this study indicate the presence of differences in reproductive performances among the four herds raised in different regions. We consider herd 2 of SidiOkba region as the most fertile and herd 3 in the Ouled Djellal region as the most prolific and fertile, while herd 4 in the Chaiba region is considered the least fertile (0.65), the least fecundable (0.71), and the least prolific (1.09). It is known that the expression of its genotype determines the performance of an animal, the influence of the environment in which it develops, and the interaction between these two factors(Dekhili and Aggoun 2006). Therefore, the difference in reproductive performance among the four flocks is the first explanatory element of this response of Ouled Djellal ewes from one site to another. The poorer fertility, prolificacy, and fecundity rates at site 4 (Chaiba) can be explained by the decrease in progesterone levels in ewes at high altitudes(Barnett et al. 1978).

Given that (Chaiba), the highest region compared to other studied sites, has an altitude of 450 m; this variation can be attributed to its specific environmental and geographical characteristics. In light of the results obtained and the analysis of our experimental data, it is apparent that Ouled Djellal ewes do not show their best reproduction performances in high altitudes. Hence, the low rate of the latter explains the presence of a characteristic site effect, where it is expressed by a biological reaction of the ewes depending on the site. Moreover, Sutama et al. (2012) report that in ruminants,high blood progesterone levels can improve ovulation rates, embryo survival, and implantation of fertilized eggs in the uterus, and thus reproductive rates. Controlling livestock and improving food supply and its availability, which is uncertain in arid areas, can significantly improve breeding parameters.

Furthermore, considering the potential impact of climate change on reproductive performance in arid regions is an essential avenue for future research. Investigating how changing environmental conditions, such as temperature and precipitation patterns, may affect the reproductive capabilities of Ouled Djellal sheep could help develop adaptive strategies to mitigate potential adverse effects.

CONCLUSION

Our study concluded that the region significantly influenced fertility and fecundity; on the other hand, it had no influence on prolificacy. Further work is needed to complete this study, including determining the effects of age, season, rearing, feeding, and other climatic data on the reproduction and development of the sheep flock in Algeria. Continued research in these areas holds the potential to inform targeted breeding programs and management practices, ultimately enhancing the reproductive performance of Ouled Djellal sheep and other related breeds facing similar environmental conditions. .

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