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Factors affecting scrotal measurements and weight of Ouled Djellal rams in eastern and south-eastern Algeria

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Abstract. Improving the reproductive capacity of rams spawning through selecting those with the best performance. The aim of our study was to evaluate some of these performances in rams bred Ouled Djellal. Twenty one Ouled Djellal rams divided equally into three age groups (group I: 2-3 years; group II: 4 years; group III: 5-6 years) were followed at Bouchebaa's pilot farm in Constantine, and 07 lambs, at the Artificial Insemination Centre at Biskra. For all these males we have monthly determined: the antero-posterior diameter of the testis, right and left ; the perimeter of the scrotum, scrotal volume, and body weight. In young rams, it was observed: (i) increased values of weight and scrotal measurements significant ($p < 0.01$ to $p < 0.001$) for periods "spring vs summer" and "spring vs autumn and a slight decrease (not significant, $p > 0.05$) in winter; and (ii) a highly significant positive correlation between the different weight and scrotal measurements, and no significant difference between measures of left and right testicles. In adult rams a highly and significant positive correlation appears between body weight and scrotal measurements for age groups 2-3 years and 4 years. But this correlation is insignificant for the third group (5-6 years). Regarding the age effect on the evolution of weight and scrotal measurements, we find a variation ranging from very ($p < 0.01$) at highly ($p < 0.001$) significant between the age groups 2-3 vs 4 years, and 2-3 vs 5-6 years against any change significant of these parameters appears between ages 4 vs 5-6 years. This study shows that there is a positive correlation between the measurements of the gonads and body weight that is in decline with age, and that these measurements in adults reach their peak around the age of 4 years, then stabilized relatively thereafter.

Keywords. Rams – Breed Ouled Djellal – Scrotal measurements – Body weight.

Facteurs affectant les mensurations scrotales et le poids des béliers de race Ouled Djellal dans l'est et le sud-est algérien

Résumé. L'amélioration de la capacité reproductive des béliers géniteurs passe par la sélection de ceux possédant les meilleures performances. L'objectif de notre travail est d'évaluer certaines de ces performances chez les béliers de race Ouled Djellal. Vingt et un (21) béliers répartis équitablement en trois groupes d'âge (groupe I: 2-3 ans; groupe II: 4 ans; groupe III: 5-6 ans) ont été suivis à la ferme Bouchabaa à Constantine, et 07 agneaux au niveau du Centre d'insémination artificielle à Biskra. Pour tous ces mâles on a procédé mensuellement à la mesure du diamètre antéro-postérieur des testicules, droit et gauche, du périmètre du scrotum; du volume scrotal; et la pesée. Chez les jeunes béliers l'analyse statistique (ANOVA) a révélé : (i) une augmentation des valeurs de ces mensurations allant de très ($p < 0,01$) à hautement ($p < 0,001$) significative pour les périodes «printemps vs été» et «printemps vs automne» ; et (ii) une corrélation positive et hautement significative apparaît entre ces différentes mensurations scrotales et pondérales pour les jeunes béliers ainsi que pour les géniteurs des deux premières tranches d'âge. Mais cette corrélation est insignifiante pour la 3ème tranche (5-6 ans). Concernant l'effet âge, l'analyse de variance a permis de révéler une variation allant de très à hautement significative entre les tranches d'âge 2-3 vs 4 ans et 2-3 vs 5-6 ans par contre aucune variation significative de ces paramètres n'apparaît entre les tranches d'âge 4 vs 5-6 ans. Cette étude montre qu'il existe une corrélation positive entre les mensurations scrotales et le poids corporel qui tend à diminuer fortement avec l'âge, et que chez les adultes ces mensurations atteignent leur pic vers l'âge de 4 ans, pour se stabiliser relativement par la suite.

Mots-clés. Béliers – Race Ouled Djellal – Mensurations scrotales – État d'embonpoint.

I – Introduction

In Algeria, Increasing the productivity of sheep farms by increasing the reproductive efficiency is a goal easily achieved by improving the reproductive capacity of rams. These are directly or indirectly involved in the reproductive process, either during natural reproduction or by the production of semen used for artificial insemination.

Several authors (Hahn *et al.*, 1969; Folch, 1984; Foster *et al.*, 1989; Salhab *et al.*, 2003) affirm that the measurement of scrotal circumference reflects the weight of the gonad and therefore the ability of sperm production. Colas *et al.* (1988 and 1990) and Folch (1984) state that in the young animals this measure is useful to make an early preliminary selection based on more or less gonad development, because the testicular size of the young lamb and the same animal at the adult age are highly correlated, so this measurement can be utilized to sort out the best producers of semen from the age of 8 months. The same approach can be seen in our sheep farms.

II – Material and methods

1. Animals

For 12 months, 21 breeding rams of the breed Ouled Djellal type Hodna divided equally into three age groups (group I: 2-3 years; group II: 4 years; group III: 5-6 years) were followed at Bouchebaa's pilot farm in Constantine (eastern Algeria with a Mediterranean climate type continental semi-arid), and 07 lambs of 7 months, at the Artificial Insemination Centre at Biskra (South Eastern Algeria with an arid climate).

2. Measurements performed

To have a good knowledge of the aptitudes of reproduction of those rams of the Ouled Djellal race, which is widely used in ovine breeding in Algeria, we have made some types of measures:

- the antero-posterior diameter of the right (DTa-p right) and the left testis (DTa-p left) using a caliper,
- the scrotum perimeter (SP), with a metrical ribbon,
- the scrotal volume (SV) using a measuring bucket (graduated 125 ml), with a capacity of two liters, of plastic material transparent,
- weighing, using a beast scales.

Such measures have been validated in sheep or in other species (cattle, goats, rabbits...) for the determination of variations in sperm production (Hahn *et al.*, 1969; Knight, 1977; Colas, 1986; Matos *et al.*, 1992; Rege *et al.*, 2000; Salhab *et al.*, 2003; Boucif *et al.*, 2007). All these measurements were realized at the end of each month throughout the study period.

3. Statistical analysis

We used the one-way ANOVA and non-parametric Tukey: compare all pairs of columns (Graph Pad Prism®5 Software Version 5.03) to determine: seasonal variations in different weight and scrotal measurements in adult rams of Bouchebaa farm and lambs of Ouled Djellal Centre. And to determine also the age effect on these measurements for rams of Bouchebaa farm. To determine the relationships that may exist between the different parameters measured (scrotal circumference, antero-posterior testicular diameter, scrotal volume and body weight), we calculated the coefficient of correlation (Pearson (r)), and the degree of significance (p) (Software Graph Pad Prism®5. Version 5.03). The latter is also used to calculate the mean, the standard deviation and the standard error of the mean (SEM). Statistical signification was set at $P < 0.05$.

III – Results and discussion

Table 1 show an increase of the majority of the studied characteristics in yearling, with differences ranging from very to highly significant for the periods spring vs summer and spring vs autumn. A slight decrease, non-significant ($p>0.05$) was recorded in winter. Whereas for adults, the seasonal average of scrotal measurements and weight, shows variations according to age group. Thus, they accuse variations with very significant differences ($p<0.001$) between the age groups (2-3 years vs 4 years) (2-3 vs 6).

Table 1. Seasonal averages of scrotal measurements and weight of yearlings from the center of Ouled Djellal (n = 7) (mean \pm SEM)

Season	Spring	Summer	Autumn	Winter
Weight (kg)	56.24 \pm 1.34 ^{a***b***c***}	68.38 \pm 1.55 ^{c***}	74.05 \pm 2.10 ^{b***}	72.76 \pm 2.7 ^{a***}
SP (cm)	27.40 \pm 0.45 ^{a**b***c***}	31.63 \pm 0.43 ^{c***}	31.86 \pm 0.67 ^{b***}	30.19 \pm 0.52 ^{a**}
SV (ml)	352 \pm 27 ^{b**c***}	584 \pm 35 ^{c***}	535 \pm 42 ^{b**}	477 \pm 29
DTa-p left (cm)	4.87 \pm 0.11 ^{a***b***c**}	5.69 \pm 0.14 ^{c**}	6.14 \pm 0.18 ^{b***}	5.87 \pm 0.15 ^{a***}
DTa-p right (cm)	4.84 \pm 0.09 ^{a***b***c***}	5.63 \pm 0.12 ^{c*** d*}	6.18 \pm 0.13 ^{b*** d*}	5.80 \pm 0.13 ^{a***}

*: $p<0.05$ (significant difference). **: $p<0.01$ (very significant difference). ***: $p<0.001$ (highly significant difference).

(a) variation spring vs winter, (b) variation spring vs autumn, (c) variation spring vs summer, (d) variation summer vs autumn.

For all age groups the difference between the right DTa-p and left DTa-p is insignificant ($p>0.05$). Whereas for the correlation analysis, we found a positive correlation between different measurements of the gonad: SP, right DTa-p, left DTa-p and SV with a coefficient of correlation ranging from 0.51 to 0.95 (Tables 2 and 4). The same is observed between body weight and different scrotal measurements for groups of age: yearlings, 2-3 and 4 years, while for the age group (5-6 years) this correlation is not significant (Table 3).

Table 2. Correlations (r) of body weight and scrotal measurements of the yearling from the center

	Weight (kg)	SP (cm)	SV (ml)	DTa-p left (cm)
SP (cm)	0.55***			
SV (ml)	0.57***	0.86***		
DTa-p left (cm)	0.51***	0.82***	0.71***	
DTa-p right (cm)	0.58***	0.84***	0.74***	0.89***

(r)***: highly significant correlation ($p<0.001$).

In young rams, in accordance to a normal state, due to the fact that these rams are in a full growing situation, the effect of the season is strongly modulated by this factor. Salhab *et al.* (2001), having studied the effect of different factors on the development of testicular parameters (length, diameter, scrotal circumference and volume) in Awassi lambs from weaning age (2-3 months) up to 17 months, note that the largest increase in testicular parameters is recorded between 7 and 10 months of age. This confirms our results that reveal a highly significant increase in testicular measurements during the spring period (7th-8th-9th month) vs. summer (10th-11th-12th month).

Table 3. Seasonal averages of scrotal measurements and weight of adult rams from Bouchebaa's pilot farm (Mean \pm SEM)

Groups	Season parameter	Spring	Summer	Autumn	Winter	Coef. (r)
Group I (n = 7) 2-3 years	Weight (kg) d**, e**	83.19 \pm 2.02	80.95 \pm 1.51	82.52 \pm 1.87	88.48 \pm 2.23	0.36
	SP (cm) d*, e**	34.31 \pm 0.56	32.29 \pm 0.36	32.22 \pm 0.49	32.73 \pm 0.33	
Group II (n = 7) 4 years	Weight (kg) d**	97.86 \pm 2.36	95.10 \pm 2.45	96.33 \pm 2.84	101.50 \pm 2.39	0.63
	SP (cm) d*	35.57 \pm 0.65	33.10 \pm 0.52	33.70 \pm 0.70	34.62 \pm 0.51	
Group III (n = 7) 5-6 years	Weight (kg) e**	97.71 \pm 1.59	96.62 \pm 0.95	96.43 \pm 1.62	98.38 \pm 2.03	0.19
	SP (cm) e**	36.76 \pm 0.63	34.84 \pm 0.58	35.52 \pm 0.69	33.12 \pm 0.75	

*: $p < 0.05$ (significant difference); **: $p < 0.01$ (very significant difference); d: (2-3 years vs 4 years); e: (2-3 years vs 6 years).

Table 4. Correlations (r) of scrotal measurements of adult rams from Bouchebaa's pilot farm

Tranche d'âge		DTa-p right (cm)	DTa-p left (cm)	SP (cm)
Group I (n = 7) 2-3 years	DTa-p left (cm)	0.93***		
	SP (cm)	0.69***	0.66***	
	SV (ml)	0.56***	0.56***	0.87***
Group II (n = 7) 4 years	DTa-p left (cm)	0.93***		
	SP (cm)	0.79***	0.83***	
	SV (ml)	0.69***	0.73***	0.88***
Group III (n = 7) 5-6 years	DTa-p left (cm)	0.95***		
	SP (cm)	0.82***	0.86***	
	SV (ml)	0.64***	0.64***	0.79***

(r)***: highly significant correlation ($p < 0.001$).

Concerning the results obtained for adult rams we notice that testicular size reaches its peak around the age of 5 to 6 years to stabilize relatively later and this is consistent with the results obtained by Hahn *et al.* (1969) in cattle, where they noted the existence of a linear correlation between testicular size and age of bulls. In our study, measurements of scrotal perimeter have a highly significant difference between the groups aged 2-3 years and 4 years, whereas no significant difference was found between groups of 4 and 5-6 years, which leads us to the conclusion that the peak of these measures is reached at the age of 4 years. Contrary to the results obtained by Hassan *et al.* (2009) which showed no significant difference for age 1-4 years. This difference can be probably related to the race factor. As for body weight, they obtained a highly significant effect of age which increases with the age of 1 to 3 years, to be stabilized between 3 and 4 years, so that in our level this increase occurs between groups aged 2-3 and 4. And that the weight remains relatively stable for groups 4 and 5-6 years.

IV – Conclusions

This study shows that there is a positive correlation between scrotal measurements and body weight; correlation which tends to decrease significantly with age. Thus, in adults these measurements reach their peak around the age of 4 years to stabilize relatively thereafter. The season exerts its effect in a more remarkable manner on yearling rams than in the rams aged more than two years. Finally we can conclude that the testicular morphobiometry, closely related to body weight is important to the evaluation of the reproductive ability of males to be selected as spawners.

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