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Age and Season Effects on Sexual Parameters in Mature Rams Used in Artificial Insemination Centre (Algeria)

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Abstract: The present study aims investigate the effect of age and season on body weight, testicular size, Gonadosomatic index (GSI), serum testosterone concentration and semen characteristics of rams used at Artificial Insemination Centre in arid region of Algeria. Semen samples were collected from 6 rams (2-4 years of age) via artificial vagina along the year. The results showed that seasonal variations of sperm characteristics were not significant ($p > 0.05$), except for color, consistency, pH and mass motility. A significant effect of season on testicular conformation, body weight and serum testosterone levels. Testicular conformation, body weight and serum testosterone levels increased significantly ($P < 0.05$) during winter and decreased during autumn ($P < 0.05$). Testicular circumference positively correlated with the testosterone concentration, body weight (BW), mass, individual motility and semen concentration. The BW, testicular size and testosterone concentration increased with age. Furthermore, semen quality was fairly independent of age except for some morphological abnormalities. Despite the seasonal variations affecting sperm quality and quantity, these parameters were within the range regarded as satisfactory for normal fertility.

Key words: Ram · Age · Season · Testicular dimentions · Semen Quality

INTRODUCTION

Sheep production in Algeria is mainly known in steppe areas where they show a particular productive performance [1, 2]. Algerian sheep population is estimated at approximately 21.4 million head [3]. The predominant breed is called Ouled Djellal (O.D.). It is also known as the great white Arabian breed which is usually raised in the arid and semi-arid regions. This breed is known for its high rusticity and capacity for adaptation to different environments [1, 4].

A very few short-term studies have been carried out on the reproduction of O.D. rams in spite of the considerable data available regarding their semen characteristics [5- 8]. In order to choose the best breeders in or out of breeding season, sufficient information is needed on body weight, testicular development and sperm characteristics.

The best selected reproductive rams are kept solely for the purpose of artificial insemination (AI). Even though the preservation of fresh semen is a major innovation in AI technology worldwide, it is not yet popularized in our country. This study aimed to determine the effect of age and season on sexual parameters of the O.D. rams.

MATERIALS AND METHODS

Animals and Location: The study was performed in arid area of Algeria, at an artificial insemination (AI) centre located on the Ouled Djellal plain (196 m of altitude, 34°25' N latitude and 5°40' E longitude) with hot and dry summers and cold and dry winter. Six fertile Ouled Djellal rams, 2-4 years of age and with a live weight of 77-104 kg were used in the study. The animals were maintained under natural photoperiod and during the trial, the rams

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Fig. 1: Scrotal circumference (SC).

Fig. 2: Width scrotal (WS).

Fig. 3: Width testis (lT)

Fig. 4: Length testis and epididymis (LT).

Fig. 5: Thickness testis (TT).

Fig. 6: Wight testis (WT).

were housed separately from the ewes. All rams received a daily diet of 1000 g barley distributed in the morning and hay in the evening. All rams had free access to mineral blocks and fresh water.

Physical Measurements and Blood Samples: Live weight, size testis and serum testosterone concentration were determined once per month over the time of the experiment. Body weight (BW) was measured using electronic weighing balance. The testis weight (TW) was measured volumetrically using the Archimedes principles of water displacement in a measuring cylinder and result recorded. Testicular and Epididymal length (TL), width (Tl), the testicle thickness (TT) of left and right testicles and scrotal width (SW) were measured using a caliper [9] (Figure 1, 2 3 and 2). The scrotal circumference (SC) was

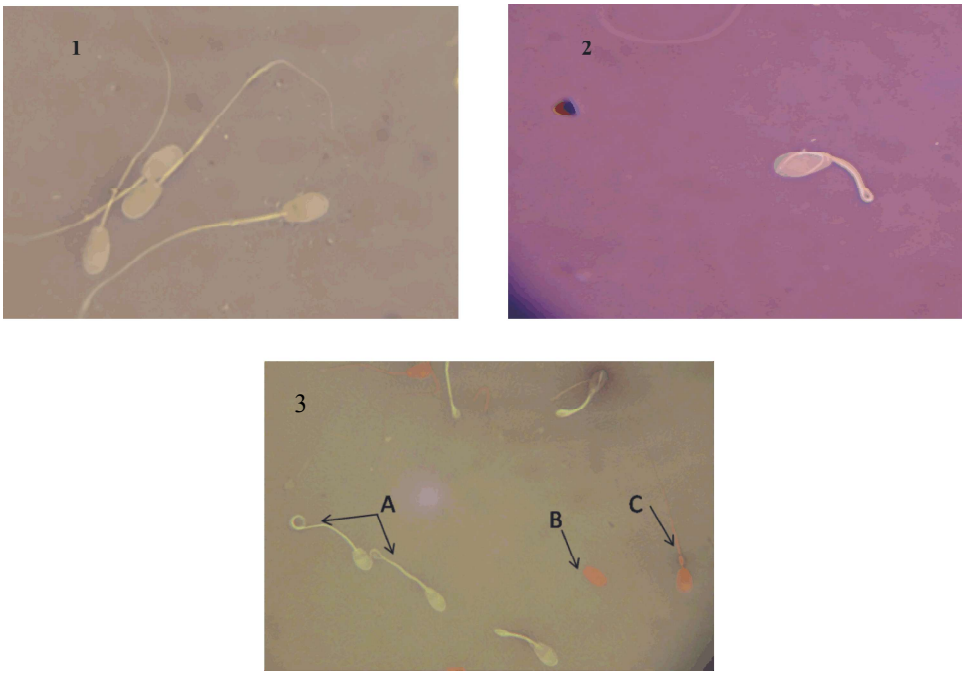

Fig. 7: Photomicrograph of the spermatozoa of the Ouled Djellal. 1: Live sperm cells (White); 2: Death sperm cells (Pink). 3: Some abnormal morphologies of ram spermatozoa (A: tail defects; B: Detached head; C: Proximal droplet) (Magnifiation: X1000), Eosin-Nigrosin.

measured at the widest point of paired testes. Gonadosomatic index (%) was calculated (GSI = [Testis weight/body weight] x 100) [10].

A jugular blood sample was collected (08.00 h) from each ram in dry tubes. The concentration of testosterone in serum (T) was measured in all samples by ICLIA (Electro-immunochimiluscence).

Semen Collection and Quality Evaluation: Semen was collected, from Jun 2013 (Summer) to July 2014 (Summer), at monthly intervals and it was constant throughout the study, from the 6 fertile rams trained to serve an artificial vagina (AV) (Temperature of 42-43°C). All the examinations were done by the same technician. Immediately after ejaculation, the fresh semen samples were transferred to the laboratory (Keeping out of direct sunlight) and evaluated.

The assessment of the color and consistency of semen collected was made directly after collection by directing the tube towards daylight. Semen samples with score 3 denoted creamy consistency, score 2 with milky consistency and score 1 cloudy. The color of ram semen ranged from a transparent (Score 1) to white-ivory (Score 2) [11].

Ejaculated semen volume (V) (ml) was recorded after collection using a glass graduated tube. The pH of the semen was sometimes measured at the time of semen collection. This determination was usually made by using litmus paper. Mass motility (MM) in undiluted semen was assessed by examining a drop of semen under a warm stage microscope (×100 magnification) on the basis of an arbitrary scale from 0 to 5 (0 = immotile, 5 = vigorous motility). Individual motility (IM) was subjectively estimated by diluting a drop of semen with normal saline, mounting it with a cover slip and examining under a warm stage microscope (×400 magnification), using an arbitrary scale of 0-5 [12].

Sperm concentration (C) ($x10^9$ sperm /mL) determined with the spectrophotometer, after dilution 50 µl of the semen sample with a 100 ml physiological serum. A total number of sperm per ejaculate (TNS) ($x10^9$ sperm /mL) was calculated by multiplying sperm concentration and ejaculate volume [13].

Furthermore, a semen smear was stained with eosin-nigrosin to determine the live spermatozoa (PLS) and percentage abnormal sperm (PAS) by counting at least 200 spermatozoa under an oil immersion objective (1000X) random fields. Morphological examination of the sperms was carried out and major and abnormalities of the sperm cells located in the head, midpiece and tail were observed under a microscope [14].

Statistical Methods: All statistical analyses were performed using the SPSS 21 (SPSS, 2013). In effect, three types of statistical analysis were performed. Because the sample size was small (6 ram) and the normality of the data was no longer assured for all variables. We opted for the analysis of the nonparametric Kruskal-Wallis variance with fixed factors like season and age of rams. The general linear model (GLM) was used to analyze the effects of interactions between variables. If a factor was significant, the Tukey's multiple comparisons test was used to determine differences between means and probabilities ($p < 0.05$) were considered to be statistically different. All mean values were expressed as the mean ± standard error of mean (SEM). Partial Pearson correlation coefficient was calculated to evaluate the relationship between the traits.

RESULTS

Body Weight and GSI: Rams BW was influenced by age ($P < 0.001$) and season of year ($P < 0.05$; Table 1). Rams aged four years were heavier than rams aged two years and three years throughout the experiment. Rams reached their heaviest weights during the winter (>95 kg) than any other season. The testicular growth in relation to body development in this study, the evolution pattern was recorded between two and four years of age, when the testicular growth followed the body growth and the GSI ranged from 0.10 to 0.11% ($p>0.05$).

Testicular Size: Our results showed a significant effect of age on TW, Tl, TT, SW and SC ($p<0.05$). The lowest average values of these variables were determined at 2 years of age, while the highest values were measured at 4 years of age.

Time of the year significantly affected testicular size of Ouled Djellal rams. were recorded exempt the TL. As indicated in Table 1, Tl, TT, SW and SC showed a uniform pattern with high scores during winter than any other season. Moreover, the interaction of Season × age had a significant ($p<0.01$) effect on testicular weight with values increasing over the month of winter and decreasing over the month of autumn.

Testosterone Concentration: The average values of testosterone levels in the blood serum increased significantly ($P < 0.01$) from 4.19±0.60 ng/ml at 2 years of age to 6.06±0.78 ng/mL at 4 years of age (Table 2). Similarly, serum testosterone concentrations were higher during winter ($P< 0.01$), compared to the other months of the year.

Seminal Characteristics: The chi-square test showed a better ($P=0.026$) color during winter and spring (white-ivory), while it was creamy in consistency in summer and winter ($P=0.028$).

The results showed a significant seasonal effect on pH and mass motility ($p<0.05$). The pH was higher during autumn and summer than during spring or winter, however, mass motility was higher during winter than any other season (Table 2).

Semen volume, individual motility, sperm concentration, the total number of spermatozoa in the ejaculate, percentage of abnormal sperm and percentage of live sperm were not influenced by the season and the age of the animals ($p>0.05$).

The percentage of major abnormalities doesn't follow a consistent trend as the percentage of minor abnormalities. Throughout the period of the experiment,

Table 1: Effect of season and age on body weight and testicular measurements (X ± SEM).

Factors	BW (kg)	TW (g)	GSI	LT (cm)	Tl (cm)	TT (cm)	SW (cm)	SC (cm)
Season	*	NS	NS	NS	**	***	***	***
Summer	91,50±1,46	934,44±52.11	1.0 ±0.00	13,65±0,39	6,05±0.14	6,58±0.18	11,76±0,31	35,46±0,81
Autumn	88,00±1,74	838,88±50.73	1.0 ±0.00	12,73±0,46	5,71±0.18	6,04±0.18	10,65±0,28	32,14±0,79
Winter	94,69±1,80	952,77±48,92	1.1 ±0.00	14,05±0,37	6,30±0.13	7,06±0.12	11,95±0,23	35,92±0,62
Spring	89,88±2.26	916,66±40,82	1.0 ±0.00	13,67±0,34	5,68±0.12	6,40±0.16	10,96±0,22	34,05±0,57
Age (year)	***	NS	NS	NS	NS	*	*	NS
2	85,60±1,63	864,58±35,67	0,010±0.00	13,02±0,36	5,81±0,11	6,32±0,13	11,25±0,21	34,27±0,50
3	88,66±1,10	898,75±47,10	0,010±0.00	13,59±0,36	5,95±0,11	6,40±0,19	11,25±0,33	34,04±0,90
4	98,79±1,57	968,75±41.13	0,010±0.00	13,96±0,31	6,05±0,17	6,84±0,12	11,48±0,18	34,86±0,56
Interaction (Season* age)	NS	*	NS	NS	*	NS	NS	*

BW (Live weight); TW (Testicular weight); TL (Testis length); Tl (Testicle width); TT (Testicle thickness); SW (Scrotal width), SC (Scrotal circumference).
NS: Not significant, *: Significant at P <0.05, ** Significant at P <0.01, *** Significant at P <0.001,

Table 2: Effect of season and age on testosterone concentration and sperm characteristics (X ± SEM)

Factors	T(ng/mL)	pH	V (ml)	MM	MI	C(x10^9 spz/mL)	NTS (x10^9 spz/eja)	PLS	PAS
Season	**	*	NS	*	NS	NS	NS	NS	NS
Summer	3,99±0,75	6,83±0.03	1,01±0,07	3,05±0,35	3,15±0,36	3,57±0,36	3,86±0.51	53,88±4,35	22.08±2.64
Autumn	2,96±0,52	6,87±0.05	0,96±0,08	2,90±0,33	2,75±0,35	2,67±0,31	2,58±0.42	50,22±4,75	22.50±5.91
Winter	6,46±0,84	6,58±0.10	0,86±0,07	3,55±0,16	3,41±0,18	3,79±0,28	3,47±0.54	63,44±5.30	17.44±3.70
Spring	5,05±0,97	6,72±0.09	0,92±0,07	2,13±0,38	2,38±0,42	2,81±0,42	2,77±0.54	50,97±4,74	26.19±4.29
Age (year)	*	NS	NS	NS	NS	NS	NS	NS	NS
2	4,19±0,60	6,75±0.06	0,98±0,05	3,29±0,27	3,18±0.29	3,39±0,29	3,51±0.43	61,54±4.38	17.96±3.35
3	3,59±0,69	6,70±0.06	1,02±0,06	2,52±0,36	2,49±0.37	3,03±0,41	3,42±0.57	49,16±4.75	21.87±4.13
4	6,06±0,78	6,80±0.06	0,81±0,06	2,91±0,20	3,10±0.20	3,22±0,21	2,58±0.26	53,18±3,33	26.33±3.53
Interaction (season* age)	NS	NS	NS	NS	NS	NS	NS	NS	NS

T (Testosterone concentration); V (Sperm volume); C (Sperm concentration); MM (Mass motility); IM (Individual motility); NTS: (Total number in sperm); PLS (Percentage of live sperm); PAS (Percentage of abnormal sperm); NS: Not significant, *: Significant at P <0.05, ** Significant at P <0.01.

Table 3: Effect of season and age on major and minor abnormalities (X ± SEM)

Factors	PSAM	PSAM1	PSAM2	PSAM3	PSAM4	PSAM5	PSAm	PSAm1	PSAm2	PSAm3	PSAm4	PSAm5	PSAm6
Season	NS	NS	NS	NS	NS	***	NS	NS	NS	NS	NS	NS	***
Summer	8.16±1.67	1.47±0.58	0.72±0.30	3.72±0.99	0.00±0.00	2.25±0.71	12.72±1.58	0.63±0.30	3.47±1.10	7.44±1.41	0.41±0.28	0.11±0.06	0.63±0.19
Autumn	6.88±2.40	1.80±0.80	0.22±0.19	4.83±2.09	0.00±0.00	0.02±0.02	15.81±3.94	0.67±0.29	8.88±3.26	4.91±1.05	0.16±0.12	0.94±0.83	0.22±0.12
Winter	4.13±1.15	0.69±0.23	0.44±0.19	3.00±1.39	0.00±0.00	0.00±0.00	12.92±2.43	2.33±1.10	3.90±1.25	6.61±1.28	0.00±0.00	0.08±0.08	0.00±0.00
Spring	11.38±3.49	6.52±3.45	0.63±0.48	3.88±1.09	0.27±0.19	0.05±0.05	14.73±2.53	0.52±0.23	8.55±0.27	5.66±1.43	0.00±0.00	0.00±0.00	0.00±0.00
Age (year)	NS	NS	NS	NS	NS	**	NS	NS	NS	NS	NS	NS	NS
2	4.97±1.77	1.41±0.71	0.25±0.17	3.16±1.48	0.00±0.00	0.14±0.06	13.12±2.12	0.83±0.30	4.69±1.67	6.53±1.23	0.08±0.08	0.70±0.62	0.27±0.15
3	9.60±2.79	4.75±2.58	0.77±0.38	3.52±1.10	0.20±0.14	0.35±0.25	12.39±2.62	0.37±0.12	6.41±2.47	5.00±1.05	0.31±0.21	0.06±0.06	0.22±0.10
4	8.35±1.50	1.70±0.60	0.50±0.21	4.89±1.14	0.00±0.00	1.25±0.55	16.62±2.29	1.91±0.84	7.50±1.43	6.93±1.08	0.04±0.04	0.08±0.04	0.14±0.06
Interaction (season* age)	*	*	NS	NS	*	***	NS	NS	NS	NS	*	NS	NS

PSAM (Major abnormalities); PSAM1 (Proximal cytoplasmic droplet); PSAM 2 (Periforme head); PSM 3 (Curly tail or tail wrapped around the head); PSAM 4 (Deformation of the intermediate piece); PSAM 5 (Poor development); PSAm (Minor abnormalities); PSm1 (Distal cytoplasmic droplet); PSm2 (Detached head); PSm 3 (Folded or curled tail to the end); PSAm 4 (Small or giant narrow head); PSAm5 (Abaxial implantation); PSAm6 (Abnormal acrosome, pleated, loose).

NS: Not significant, * Significant at P <0.05,** Significant at P <0.01, *** Significant at P <0.001

Table 4: Coefficients of partial correlations between size testicular, characteristics sperm and testosterone concentration in rams

r	WT (g)	TL (cm)	Tl (cm)	TT (cm)	SW (cm)	SC (cm)	BW (kg)	T (ng/ml)	V (mL)	MM	IM	C (x spz/ml)	TNS (x10^9 spz/ eja)	pH	PLS (%)	PAS (%)
WT (g)	1															
TL (cm)	0.81***	1														
Tl (cm)	0.72***	0.68***	1													
TT (cm)	0.73***	0.72***	0.75***	1												
SW (cm)	0.77***	0.79***	0.81***	0.81***	1											
SC (cm)	0.77***	0.81***	0.80***	0.86***	0.95***	1										
BW (kg)	0.43***	0.43***	0.30*	0.46***	0.40***	0.46***	1									
T(ng/ml)	0.30**	0.38***	0.34**	0.38***	0.33**	0.38***	0.20	1								
V (ml)	0.19	0.21	0.11	0.10	0.23*	0.24*	-0.10	-0.06	1							
MM	0.14	0.15	0.21	0.36**	0.22	0.26*	0.19	0.13	0.20	1						
MI	0.23*	0.22	0.22	0.37***	0.28*	0.32**	0.27*	0.06	0.20	0.90***	1					
C (x10^{9}spz/mL)	0.26*	0.24*	0.25*	0.43***	0.37***	0.44***	0.19	0.13	0.27*	0.66***	0.69***	1				
TNS (x10^{9}spz/eja)	0.27*	0.31**	0.23*	0.36**	0.40***	0.46***	0.10	0.03	0.69***	0.53***	0.56***	0.85***	1			
pH	0.16	0.01	0.13	-0.04	0.07	0.03	0.04	0.10	-0.01	-0.09	-0.12	-0.16	-0.16	1		
PLS (%)	0.13	0.16	0.04	0.18	0.10	0.12	0.23*	0.14	0.17	0.59***	0.47***	0.43***	0.34**	0.22	1	
PAS (%)	-0.09	-0.30*	-0.17	-0.25*	-0.16	-0.19	-0.17	-0.02	-0.16	-0.63***	-0.50***	-0.31**	-0.30**	-0.04	-0.50***	1

BW (Live weight); TW (Testicular weight); TL (Testis length); Tl (Testicle width); TT (Testicle thickness); SW (Scrotal width), SC (Scrotal circumference); T (Testosterone concentration); V (Sperm volume); C (Sperm concentration); MM (Mass motility); IM (Individual motility); TNS: (Total number in sperm); PLS (Percentage of live sperm); PAS (Percentage of abnormal sperm); *: Significant at P <0.05, ** Significant at P <0.01, *** Significant at P <0.001.

the percentage of minor abnormalities was still high (12.72 to 15.81%) compared to the percentage of major anomalies (4.13 to 11.83 %; Table 3).

Different classes of major abnormalities studied, PSAM1 (Proximal cytoplasmic droplet), PSAM5 (Poor development) and PSAM4 (Deformation of the intermediate piece) occupy respectively the second, third and fifth place in order of importance after PSAM3 (Spermatozoa with curly tails and coiled around the head), influenced by interaction age*season, characterized by a higher frequency in spring time (PSAM1 and PSAM4) for the rams of 3 years old and in dry periods (PSAM3) for

the rams of 4 years old. For minor abnormalities, PSAm4 (Small or giant narrow head) and PSm6 (Abnormal acrosome, pleated, loose) occupy respectively the last and fourth place in order of importance after PSAm2 (Detached head), influenced by season, characterized by a higher frequency during dry periods for the rams 2 years old (PSAm6) and for the rams 3 years old (PSAm4).

Correlation: Correlations between semen characteristics and testicular measurements are presented in Table 4. Body weight had the highest correlation coefficients with testicular size with correlation values ranging from 0.30 for TL and 0.46 for TT and SC. A significant ($p<0.001$) and positive correlations existed between the testes weight and all the morphometric characteristics. Scrotal circumference positively correlated with the V ($r= 0.24$, $p<0.05$), MM ($r= 0.26$, $p<0.05$) IM ($r= 0.32$, $p<0.01$), C ($r= 0.44$, $p<0.001$) and TNS ($r= 0.46$, $p<0.001$). Similarly, testis weight has shown to correlate ($p<0.05$) with IM, C and TNS. It has been noticed from Table 4, that testosterone correlated with testicular size especially TL, TT and SC.

DISCUSSION

The present study is the first to report the interaction between season and age in reproductive variables of Ouled djellal rams reared in the Algeria arid. As it was expected, live weight of Ouled Djellal rams varied seasonally. However, seasonal variations little marked or not ($p> 0.05$) were observed by different authors and in different breeds: Kridli *et al.* [15] in Awassi rams and Dorostghoal *et al.* [16] in Arabic rams. This difference in body weight of sensitivity to changes in photoperiod was explained by differences related to the environment and especially the food level and quality [17]. In the current study, the increase of body weight during winter could be more related to season since feeding resources were rationally balanced.

The testicular growth in relation to body development in this study, the evolution pattern was recorded between two and four years of age, when the testicular growth followed the body growth and the GSI ranged from 0.10 to 0.11%. However, Bonnes *et al.* [18] indicated that GSI in rams is equal to 0.5 % during the no-breeding season and 2 % during the breeding season. The gonadosomatic index of 0.10 % recorded in this study was low when compared to what had been reported in mammals. Lunstra *et al.* [19] reported 0.4% for goats, while 0.97% was reported for Najdi breeds [20] between ages 7 and 8 months. However, the development of testicular weight, as well as the body weight, were low in our breed in comparision to others breeds may be attributed to management and feeding of each rearing facility, environmental effects, as well as the procedures of selection and breeding, more intense in these animals [19].

A significant effect of season and age on testis measurements of Ouled Djellal rams was observed in the current study. A similar trend in the values of morphometric testicular was found by Foc°ăneanu *et al*. [21]. Other studies have suggested that the influence of age on testicular length and circumference gradually decreased with the advent of sexual maturity [21, 22]. The largest values recorded for the testicular sizes of the Ouled Djellal rams, was during winter, while the lowest values were recorded during autumn. This is in agreement with the results of Oláh *et al.* [23]. However, the highest values of a testicular circumference and scrotal width were recorded in autumn for the Moghani breed rams [12] and in spring for the Suffolk breed [24]. On the other hand, other studies such as that of Jackson *et al.* [25] showed that season is not a reliable predictor of scrotal circumference. Several factors influenced testes size in rams like temperate climates, day length, feed quality and average daily weight gain [12].

The variable character of testosterone levels in the blood of rams and the significant effect of age between 2 and 4 years. This is in agreement with the results of Maksimoviæ *et al.* [26]. Preston *et al.* [27] reported that the production of testosterone changed during the life of rams, with increasing levels of hormones from birth until they reach full sexual maturity and a decrease thereafter. In the present study, testosterone concentration followed approximately the same profile as testicular measurements. The lowest plasma concentration of testosterone was recorded in autumn and the highest level in winter ($P< 0.01$) (Table 2). Investigations with Suffolk, Finnish Landrace (Finn), have reported highest concentrations of testosterone during the fall months and lowest levels occurring during the spring [28].These variations among studies may be due to different locations among studies involved. Androgen in rams mainly testosterone hormone influenced by many factors such as hormonal regulation which once affected by photoperiod, different types of stressors especially hot-climate and transport [29].

In the present study, the best semen color winter and spring (White-ivory) and best consistency in summer and winter. However, other studies such as that of Juma and Al-Kassab [30] showed a better ($P<0.01$) color and consistency during summer and spring (Between milky to creamy). Visual evaluation of the ejaculate in respect of color can be a good index for concentration.

In the present study, seasonal fluctuations in some seminal characteristics were observed in the rams under investigation pH and mass motility. The highest pH was recorded in autumn and decreased to a minimum in winter. However, Juma and Al-Kassab [30] in a study with Hamdani breed found that pH was reduced during summer was due to increase of sperm concentration. However, study shows that the mass motility is better during winter than during the other seasons of the year. The present results however, contradicted the observation of Taha *et al.* [31] that found, mass motility was not depending on the season of the year in Egyptian breeds (At latitude 31° N) and Kafi *et al.* [32] in the Persian Karakul breed (At latitude 20° N). On the other hand, in other studies semen samples had a higher mass motility in autumn and differences among breeds were reported [33].

The findings of the present study showed that volume, individual motility, sperm concentration, sperm output, percentage of abnormal sperm and percentage of live sperm remained constants throughout of this study. However, Mandiki *et al.* [24] recorded higher quality semen (Percentage of abnormal sperm and percentage of live sperm) during the winter in both Suffolk and Ile-de-France rams. Karagiannidis *et al.* [34] was also observed that the percentage of abnormal spermatozoa was higher during spring and summer, while winter was a transitional period in Greek breeds. The overall mean of abnormal spermatozoa (22.05%) obtained in the present study falls within the normally reported range of good quality rams semen. This value was consistent with the findings of Adam [35] who claimed that good quality semen should not contain more than (20%) abnormal spermatozoa. If the accumulated total abnormal spermatozoa exceed 25% of the total in an ejaculate, reduced fertility can be anticipated [36].

A significant effect of age and season on the percentage of major and some minor abnormalities of Ouled Djellal rams was observed in the current study. This is in agreement with the results of Rege *et al.* [14] who found a strong association between age and the different classes studied of abnormalities (Head abnormalities, anomalies of the intermediate piece, tail anomalies, detached head, distal cytoplasmic droplet and proximal); in Menz and Horro breeds. Taha *et al.* [31] who reported that the acrosome alteration also varied significantly with the season in Barki and Awassi rams. Bearden *et al.* [36] demonstrated that the cytoplasmic droplets forms on the neck of spermatozoa during spermatogenesis. Cytoplasmic droplets are usually lost during maturation in the epididymis. If they still present, they are considered as abnormalities and, when they are associated with others abnormalities, results in reduction of semen fertility. According to Adam [35] deformed spermatozoa may result from cold or hot shocks, X-ray, exposure of semen to sunlight and nutritional or endocrine imbalances. Moreover, the presence of spermatozoa with cytoplasmic droplets has been related to a disturbance in sperm maturation or epididymal dysfunction.

In agreement with the results of the present study, the body weight and testis weight positively correlated with testicular size. [37, 38] The positive correlation between SC and V ($r = 0,24$, $p < 0,05$), MM ($r = 0.26$, $p<0.05$), IM ($r = 0.32$, $p<0.01$), C and TNS ($r = 0.46$, $p<0.001$) of the present study are in accord with the study of Elmaz *et al.* [37] who observed an increase in testicular size with increasing spermatogenesis. Overall, the correlation results indicated that the increase in one testicular trait leads to an increase in the other and vice versa. The good and positive correlations between testes weight, scrotal circumference and morphometric characteristics indicated the possibility of predicting organs weight, since testes weight correlated highly with testicular sperm reserves and males with larger testes tend to produce more sperm [39]. The results of this study showed that hormone testosterone correlated with testicular size especially TL, TT and SC. According to previous reports by Kishk, [40], the amplitude of seasonal changes in testicular size was closely related to that observed in gonadal functions for some breeds.

CONCLUSIONS

The findings from this study showed that measurement of scrotal circumference and size of testis give good indication of semen production. The reproductive of Ouled Djellal is characterized by distinct seasonal variations in testicular size and body weight and by fluctuations in plasma levels of testosterone with a different season. These data indicated that the level of testicular size, body weight and testosterone concentration was higher during the 4th year than during the 2nd and 3rd year of age.

On the basis of results of the present study, it may be concluded that seminal characteristics are rather more likely affected by the photoperiod, all were within the range considered appropriate for normal fertility.

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