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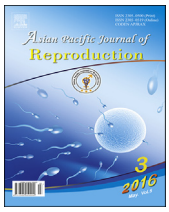

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Changes in sperm characteristics of the three main breeds of sheep in Algeria after dietary supplementation

Litim Miloud[1*], Bereksi Reguig Karima[2]

[1]*Department of Biology, University of Abdelhamid Ibn Badis of Mostaganem, Algeria*

[2]*Department of Biology, University of Djillali Liabes Sidi Bel Abbes, Algeria*

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ABSTRACT

Objective: To evaluate the effect of an important dietary supplement on sperm quantity and quality breeding rams of the three main breeds of sheep at the artificial insemination center, called Belhandjir, in the region of Naama in Algeria.

Methods: Twenty-four breeding rams of the three major breeds in Algeria, namely *Ouled Djellal*, *Hamra* and *Rumbi* breeds are divided into two groups CR and SR, and subjected to two different diets. The first group CR followed a regime R based on barley and fodder and the second SR group to follow a regime R + a vitamin and mineral dietary supplement for 15 weeks of collection. Analysis of sperm quality (motility) and quantity (volume, concentration and doses produced) were followed after collection.

Results: The quantitative effect was more significant in supplemented rams SR, volume and concentration were higher in rams SR. Therefore, the doses produced differ significantly compared to the group of control rams CR. Results of motility were more mixed, motility showed a significant difference in rams supplemented of *Ouled Djellal* breed only; however, the other two breeds *Hamra* and *Rumbi*, showed no significant differences.

Conclusions: Supplementation could significantly improve the characteristics of quantitative sperm in the breeding rams of the three main Algerian sheep breeds. Motility, only qualitative parameter studied, was not significantly improved.

1. Introduction

The bad results observed in some breeds of sheep farmers lead to a lack of interest for this technique and makes the organization of breeding schemes difficult. This can lead, in more or less long term, to the closure of some insemination centers. Different causes can be the origin of an alteration of semen quality of rams: food, xenobiotics, collection rate, stress, photoperiod, and pathology [1]. The objective of this study was to determine the effects of significant dietary supplements, consisting of fat-soluble vitamins, water-soluble and micro-nutrients on doses of semen produced in breeding rams of the three major breeds in Algeria, namely, *Ouled Djellal*, *Hamra* and *Rumbi* breed. For this study, we mobilized the data regularly collected at the center of artificial insemination (AI) Belhandjir.

*Corresponding author: Litim Miloud, Department of Biology, University of Abdelhamid Ibn Badis of Mostaganem, Algeria.
E-mail: litimiloud@gmail.com

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2. Materials and methods

During 2012, 24 healthy breeding rams, with no damage in their reproductive system, *Ouled Djellal* breed, previously trained for semen collection and regularly collected in artificial insemination center, were selected for experimentation.

Rams were followed at the NAICGI (National Artificial Insemination Centre and Genetic Improvement) Belhandjir in the region of Naama, which is located in the semi-arid area at an altitude of 1 147 m above sea level, latitude: 32°42′16 N, longitude: 0°42′07 W. Rams are aged from 24 to 40 months; they are medium weight, BCS: body condition scoring, between 2 and 3 (The results concerning the relationship between the BCS at the moment of AI and its success are variable across studies. For Grimard *et al.*, there is no significant relationship between these variables [2], and Roche, the relationship is positive [3]).

Breeding rams are divided into two groups, the CR group or control rams (*Ouled Djellal*: n = 5, *Hamra*: n = 4 and *Rumbi:*

n = 3), and a SR group or supplemented rams (*Ouled Djellal*: n = 5, *Hamra*: n = 4 and *Rumbi:* n = 3). Throughout the experiment, the group of control rams CR followed a regime R that is based on barley and fodder and the second group SR followed an R + vitamin and mineral regime (A mineral and vitamin complement or MVC, resulting from industry). This dietary supplement is made up of water-soluble vitamins (B vitamins and vitamin C), fat-soluble vitamins (A, D, E and K) and minerals such as iron, copper, zinc, manganese, phosphorus and calcium; it also contains betaines, and methionine. The dietary supplement was used in 15 days of 30, and at a dosage of 1.5% of the R (barley + fodder) regime.

To avoid biasing our results, given the strong positive correlation existing between scrotal circumference and spermatic production [4], the two lots of CR and SR, of the three breeds, have been selected such a way that the average perimeters of the scrotum are very close in all breeds of rams used.

Rams are stimulated by the presence of a sheep, and collections are made using an artificial vagina. A semen analysis was followed after the collection. Four variables are studied, namely, volume, concentration, number of doses produced (quantitative parameters) and motility of the semen (only qualitative parameter studied).

The least significant difference test (z-test), the Student test, and for correlations, the Fisher's Z-Transformation were used. The P value < 0.05 was considered as significant.

3. Results

The effect of supplementation was very marked in rams from the SR group after collection. A highly significant difference was found in the calculation of the average doses produced by SR group rams compared to rams CR group (Table 1), average 29.23 ± 13.47 respectively and 16.83 ± 6.92 in *Ouled Djellal* breed (P < 0.000 1), average 23.73 ± 9.55 vs 16.10 ± 4.93 in *Hamra* breed (P = 0.004 9) and about 28.31 ± 12.17 vs 18.22 ± 9.28 in the *Rumbi* breed (P = 0.000 5).

The use of dietary supplements increases the main of doses produced, an increase of about 73%, 47% and 55% of doses produced in SR group compared to CR group respectively in *Ouled Djellal*, *Hamra* and *Rumbi* breeds (Table 1).

The volume in the group SR differs significantly from that observed in the CR group, a difference of about 47% in *Ouled Djellal* breed: [(1.79 ± 0.63) vs. (1.21 ± 0.37) mL, P < 0.000 1], 24% in *Hamra* breed: [(1.16 ± 0.29) vs. (0.93 ± 0.18) mL, P = 0.007 7], and 50% in *Rumbi* breed: [(1.84 ± 0.79) vs. (1.22 ± 0.46) mL, P = 0.000 23] (Table 1), which has consistently increased the number of doses produced, given the correlation between the two parameters (Figure 1).

The supplementation improves significantly the quantitative characteristics studied (volume, concentration and doses produced) in rams of three breeds. Only the difference of the concentration at the *Rumbi* breed was not significant, although the mean concentration in supplemented rams is superior to controls (5.68 ± 1.31 vs 5.06 ± 1.18, P = 0.061, Table 1). The value of motility (qualitative characteristic) was very mixed, only the *Ouled Djellal* breed has a significant difference, other breeds studied show no significant differences.

All recorded values of diluents in the three breeds studied after supplementation were considered significant compared to values recorded in controls rams (CR). The diluent values are significantly higher in supplemented rams, which does not reduce the cost of doses produced.

A positive correlation was observed between doses produced and the volume of the semen in *Hamra* and *Rumbi* breeds (Figure 1). Differences are not significant for both *Rumbi* and *Hamra* breeds after Fisher transformation (P > 0.05, significances levels of P are respectively P = 0.43, P = 0.95), the same thing was observed in *Ouled Djellal* breed, the difference is not significant (P = 0.48).

4. Discussion

Similar studies have shown that massive supplements fat-soluble vitamins (A, D, E and K) and water-soluble (B-complex vitamins) which were administered to male pigs can increase the total amount of sperm and the products especially after daily intensive collections so called stress [5]. Many authors have reported the effect of diet on reproductive performance in rams [6]. Supplementation studies show a beneficial effect of folate on sperm quality in humans (infertile men) [7]. In animals, vitamin B12 deficiency in utero is associated with a reduced number of spermatogonia [8].

Vitamin E in the diet can improve the density of cells in spermatogenesis, Sertoli cells, tube diameter and the thickness of the germinal epithelium seminiferous (especially 200 IU) [9]. Ascorbic acid plays an important role in the sperm DNA of protection of the oxidative damage induced by ROS [10]. Another study reported that the ascorbic acid supplementation in the drinking water for 12 weeks increased concentration of male rabbit's sperm [11].

The use of dietary supplements (vitamin compounds and minerals) does not allow us to reduce the volume of diluent required for the production of semen doses. The diluent values are significantly higher in supplemented rams of different breeds studied, which don't reduce the cost of doses produced.

Table 1

Average changes in individual sperm characteristics and data supplemented rams of the three main breeds in Algeria.

Rams	Collection	Semen volume	Diluent volume	Doses	Concentration	Motility
OD SR	69	1.79 ± 0.63^a	5.57 ± 2.77^a	29.23 ± 3.47^a	5.64 ± 1.23^a	4.49 ± 0.08^a
OD CR	69	1.21 ± 0.37^b	3.04 ± 1.39^b	16.83 ± 6.92^b	4.94 ± 1.19^b	4.28 ± 0.37^b
Hr SR	15	1.16 ± 0.29^a	4.95 ± 1.83^a	23.73 ± 9.55^a	7.09 ± 1.32^a	4.43 ± 0.17^a
Hr CR	19	0.93 ± 0.18^b	3.17 ± 1.13^b	16.10 ± 4.93^b	6.09 ± 1.16^b	4.36 ± 0.36^a
Ru SR	22	1.84 ± 0.79^a	5.38 ± 2.46^a	28.31 ± 12.17^a	5.68 ± 1.31^a	4.27 ± 0.55^a
Ru CR	40	1.22 ± 0.46^b	3.30 ± 1.93^b	18.22 ± 09.28^b	5.06 ± 1.18^a	4.41 ± 0.19^a

Values with the same letters in the same column are not different significantly at P < 0.05. OD: *Ouled Djellal*; Hr: *Hamra*; Ru: *Rumbi*. Student's t test was used to compare means in Table 1. (n_1 and/or n_2 < 30).