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THE EFFECTS OF ELECTROEJACULATION ON SOME PHYSIOLOGICAL PARAMETERS (RECTAL TEMPERATURE, RESPIRATORY AND CARDIAC RATES) IN *OULED DJELLAL* BREED

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ABSTRACT

In Algeria, the need to improve reproductive performance in sheep breed *Ouled Djellal* requires better knowledge of their semen characteristics. Electroejaculation is a procedure used to collect semen from rams. The aim of this paper is to characterize the physiological response of these animals during conventional electroejaculation. To asses the effect of this technique on some physiological parameters (rectal temperature, respiratory and cardiac rates) in *Ouled Djellal* breeds, 10 rams were subjected to semen collection by electroejaculation. The technique was applied every two weeks, for 4 consecutive months. The studied physiological parameters were monitored at different stages: before, during and after electrical stimulation.
The use of electro-ejaculation technique significantly induces changes in rectal temperature, heart rate and to a lesser degree respiratory rate ($P<0.05$), with different individual responses to electrical stimulation ($P<0.05$).
Recent introduction of this method of semen collection in the Technical Institute of Animal Husbandry (ITELV Ain M'lila, Algeria) makes our study important to evaluate its effects on animal comfort and sperm quality thereby making it easy to select the most adapted rams which gives the best semen quality, compared to other techniques for semen collection.

Key words: *Ouled Djellal*; rams; semen; electroejaculation; physiological parameters; comfort

INTRODUCTION

The study of reproductive performance in *Ouled Djellal* sheep breed requires a quantitative and qualitative evaluation of the male semen. Ram semen is collected mainly for two reasons; firstly for breeding soundness evaluation (fertility) and secondly to be used for artificial insemination (Matthews *et al*., 2003). Several techniques have been used for semen collection in mammals and birds, such as massage or manual stimulation of the accessory sex glands (Palmer *et al*., 2004), artificial vagina and electroejaculation (Terrill, 1940; Wulster-Radcliffe *et al*., 2001). The latter technique is now commonly used for the collection of semen from domesticated species (Austin *et al*., 1961; Healey and Sadleir, 1966; Sundararaman *et al.*, 2007; Damián and Ungerfeld, 2011) or wild animals (Wildt *et al*., 1984; Wildt *et al.*, 1986). The electro-ejaculator has been used in an effort to facilitate semen collection (Hulet *et al*., 1964). Electroejaculation is described as painful by some authors (Mosure *et al*., 1998; Etson *et al*., 2004; Palmer *et al*., 2004; Palmer, 2005) and induces severe stress (Voisinet *et al*., 1997; Orihuela *et al*., 2009a). Stafford (1995) noted that the electroejaculation was not more aversive than part-shearing.

Unfortunately, few studies have been devoted to assess the physiological response of animals after repeated stimulation. To assess the effect of this technique on rectal temperature, respiratory and cardiac rates in *Ouled Djellal* breed, we conducted a four months study on 10 rams.

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MATERIAL AND METHODS

A total of 10 intact rams of an average age of 14 months and an average weight of 70.75 ± 7.31 kg (weighing between 57 and 80 kg), were used in this study. The animals belonged to the Institute of Animal Husbandry Techniques (Ain M'lila, Algeria) and were kept in stall with an exercise area. These animals received a ration of 2 kg of good quality oat hay, and 800 g of concentrate per animal per day. Water was distributed twice a day.

The rams had been previously vaccinated against enterotoxaemia and sheep pox, they were dewormed twice a year (against internal and external parasites).

The collection of semen sample was performed once in every fifteen days with an electroejaculator of 9 volts working on battery (Medata Ram Ejaculator, Medata Systems Limited, England) with a dimension of 16.5 cm in length, 1.7 cm in diameter and 0.2 kg in weight. The device had a ring to the rectal tube to minimize any trauma.

During semen collection temperature, heart and respiratory rates were recorded once in every fortnight using a thermometer and a stethoscope. During stimulation, the animal was kept lying on its right side, placed on two bales of hay, to facilitate the collection of semen sample and record heart and respiratory rates.

Prior to practice of electroejaculation, animals were restrained, with a rope, by tightening the two front legs with the right hind one.

The procedure was followed as given below:

After being lubricated to minimize trauma, the rectal probe was inserted into the rectum forward and slightly downward with a rotation movement, to be in contact with the male accessory glands.

After exteriorization of the penis from the sheath, electrical pulses were applied that last for 2-5 seconds, alternating with rest periods of 5 seconds and so on, until obtaining suitable ejaculation and not seminal plasma only. Practically, rams ejaculate after the 3rd electrical stimulation.

Rectal temperature of the animals was measured before, during and after each collection, using an electronic thermometer. During the procedure, cardiac rate was also determined on the left side in the heart's projection area, using a stethoscope; this was achieved before, 20 minutes after the cessation and even during electrical stimulation. Respiratory rate is measured relative to the movements of the left flank that reveals the number of respiratory cycles (inspiration, expiration). This frequency was taken in the same manner as for the cardiac rate.

The experiment was carried out according to the animal welfare regulations of the Department of Veterinary Science, University Mentouri of Constantine Algeria. Statistical analysis involved the calculation of descriptive statistics: mean, standard deviation, standard error, minimum and maximum. The calculation of correlation matrix and significance test was done using the Pearson correlation coefficient (Statistica, 1999; Graph Pad, 2007).

RESULTS AND DISCUSSION

Overall mean values of rectal temperature, respiratory and heart rates at different stages of stimulation are presented in table 1.

Rectal temperature differed significantly ($P<0.001$) over the three stages: before, during and after stimulation (Table 1). We also found that it decreases during the stimulation and then increases slowly afterwards as shown in Figure 1.

Table 1: Effect of electro-ejaculation on rectal temperature, heart and respiratory rates (Mean ±SEM) at different stages of stimulation

Parameter (mean ±SEM)	Before stimulation	During stimulation	After stimulation
Temperature (°C)	39.57±0.075^{a}	39.32±0.092^{b}	39.45±0.094^{c}
Respiratory rate	49.83±1.24^{a}	46.45±1.01^{ab}	53.5±1.62^{b}
Heart rate	101.01±1.93^{a}	98.11±2.98^{b}	102.75±2.53^{c}

$^{a, b, c}$ Means within rows, not followed by the same superscript are significantly different

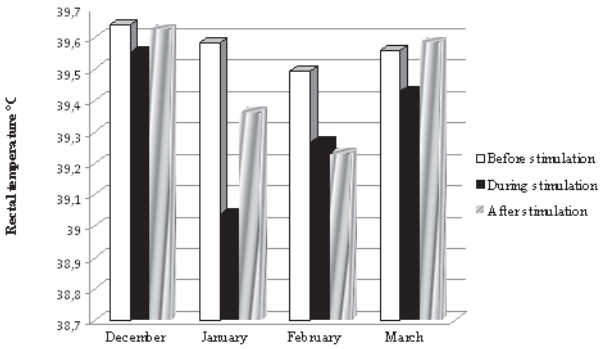

Fig. 1: Monthly variations in rectal temperature

Recording temperature allowed us to calculate the individual mean rectal temperature during the study period (Figure 2).

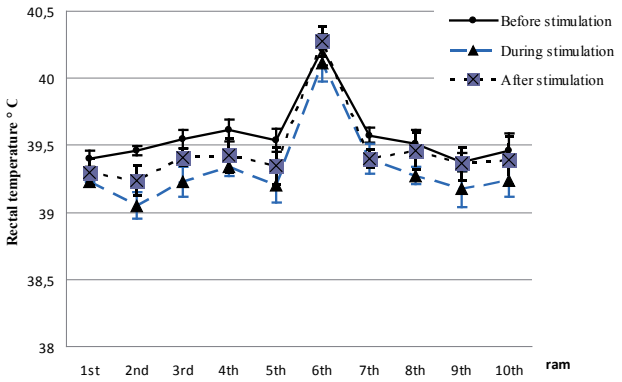

Fig. 2: Individual variations in rectal temperature (mean ± SEM)

Analysis of variance showed a significant difference ($P<0.01$, $r = 0.81$) between respiratory frequency before and after stimulation. So, we found a change of this parameter in rams when the animal was in lateral recumbency and did not undergo stimulation or stimulation was ceased (Table 1). In the four months study, respiratory rate differed depending on the stage of the stimulation. During that time, it seemed to be higher after stimulation and lower during its application. The respiration of animals through the seasons was always higher in the month of March as compared to winter season, during all stages of stimulation (before, during and after) (Figure 3).

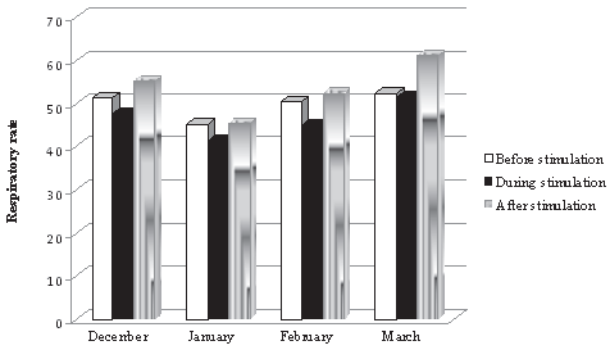

Fig. 3: Monthly variations in respiratory rate

During the three stages, the respiratory rate was higher after stimulation in almost all subjects. The same finding was reported throughout the different months of the study (Figure 3 and 4).

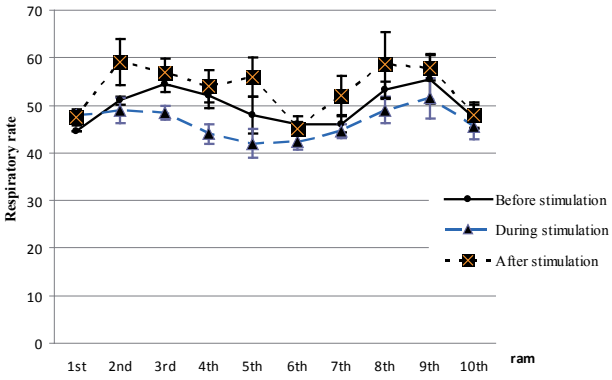

Fig. 4: Individual variations in respiratory rate (mean ± SEM)

As for temperature, significant differences were found between heart rate before and during electrical stimulation ($r = 0.75$, $P<0.05$), before and after stimulation ($r = 0.85$, $P<0.01$) and during and after the stimulation ($r = 0.77$, $P<0.05$).

The ANOVA test showed a significance decrease at the statistical level $P < 0.05$, suggesting that heart rate is strongly affected by electrical stimulation of 9 volts used to collect the semen. Throughout the study period, heart rate generally declined during the stimulation to reach its initial value before stimulation (Figure 5).

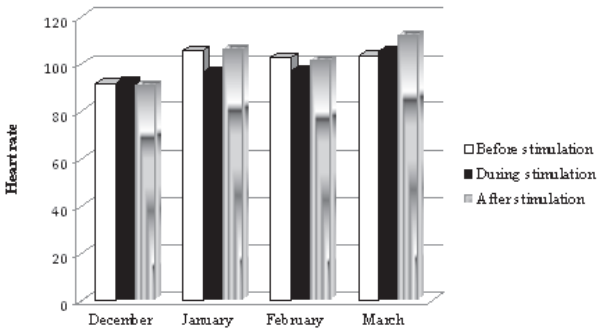

Fig. 5: Monthly variations in heart rate

The study of monthly variations in heart rate showed that during winter, the recovery of this parameter is obtained few minutes after cessation of stimulation (Figure 5). Individual differences (Figure 6) were observed in the three stages of the application of electroejaculation (P<0.05).

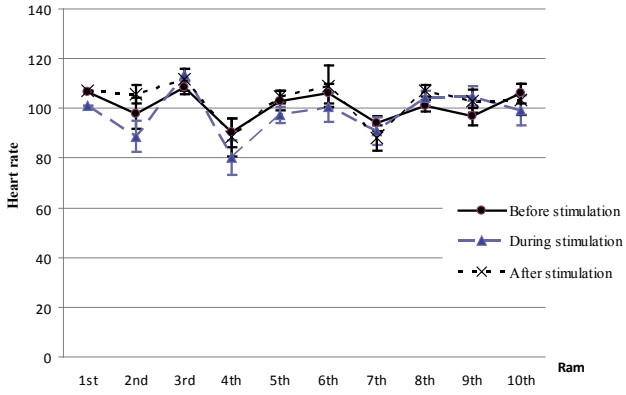

Fig. 6: Individual variations in heart rate (mean ± SEM)

To our knowledge, few studies have been devoted to the influence of electroejaculation on rectal temperature in sheep. Lindsay (1969) reported that electroejaculation resulted in virtually no rise in rectal temperature. But our results are consistent with those described recently by Fumagalli *et al.* (2011) in deer.

The explanation of these results appears to be related to the introduction of the electroejaculator probe which brought to room temperature. Knowing that the study period was characterized by low ambient temperatures (December - March), thus, the rectal temperature was lowered only *in situ*, but in reality, it does not mean that the core temperature has changed.

The temperature at the time of stimulation is generally lower than those recorded before or after the same stimulation. That appears to be due to the poor contact between the anal mucosa and the thermometer, following the introduction of the probe. At the individual level, rectal temperature presents significant differences prior to stimulation which continues to exist until the end of electrical stimulation, but it is still within the physiological norms. Thus, we can say that the temperature is not really affected by this technique.

Contrary to Orihuela *et al*. (2009a) who found that respiratory frequency does not differ significantly (P>0.05) following stimulation. Significant changes before and after stimulation was recorded in our study. Monthly variations in respiratory rate are higher after stimulation and lower during its application. This seems logical; the frequency is reduced during electrical stimulation (Matthews, 1993) because the animal is retracted in order to reduce the pain caused by the stimulation, then once it stops, it tries to compensate by accelerating its respiration, not to mention the increase in respiratory rate due to fear. Significant differences existed between some of the rams (P<0.05).

In accordance with our study, a significant change in heart rate during electroejaculation has been cited by Mosure *et al.* (1998) and Orihuela *et al*. (2009 a, b). This change associated with electroejaculation is due to the combination of muscle contraction and pain caused by stimulation (Mosure *et al*., 1998). Forced muscle contractions can also cause pain (Carter *et al*., 1990). Thus, we may conclude that heart rate can be used as a representative indicator of animal welfare and so did Manteca in his study (1998).

Monthly variations in heart rate showed that after stimulation, this parameter is recovered very rapidly but only in winter. Palmer (2005) reported that it recovers 2 minutes after stopping stimulation. However, in March, it continues to rise even few minutes after cessation of stimulation.

Some subjects showed small changes in their heart rate. This can be explained by individual differences in the same farm or even between farms, found by Rushen (1990), concerning the ability of animals to memorize or learn in response to a given treatment. So, the rams of *Ouled Djellal* breed do not have the same tolerance to this technique. It would be better to rely on this criterion, if we want to use this technique to collect semen in the insemination centres in Algeria.

Some authors advocated the use of anaesthesia to reduce the resulting pain (Mosure *et al*., 1998; Falk *et al.*, 2001; Etson *et al*., 2004; Orihuela *et al*., 2009b). At the end, it should be noted that due to lack of resources,

an important parameter could not be studied; it is the blood level of cortisol during electroejaculation. Several authors have identified a significant change in blood levels of cortisol during electroejaculation (Etson *et al.*, 2004; Ortiz-de-Montellano *et al.*, 2007; Orihuela *et al.*, 2009a,b; Damián and Ungerfeld, 2011). On the contrary, Stafford (1995) and Stafford *et al*. (1996) proved in their experiments that the increase in plasma cortisol response to electroejaculation did not differ significantly from that caused by certain practices, such as mowing or restraining the animal in lateral recumbency.

CONCLUSION

The results of this study showed that the technique of electroejaculation used to collect semen in *Ouled Djellal* sheep has led to changes of the studied physiological parameters, especially the rectal temperature, heart rate and at a lesser degree respiratory rate. However, with the progress of time, the rams seem to start to adapt to this technique. Individual variations exist. In addition, some animals show a marked tolerance to this technique. So, it would be interesting to select them for reproduction, if we wish to use this technique for semen collection in *Ouled Djellal* sheep in Algeria.

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