

Administration of royal jelly in estrus synchronization protocols for wool and hair sheep

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ABSTRACT

Objective: To assess the most relevant results on the usage of royal jelly in reproductive protocols of wool and hair sheep.

Design/methodology/approach: A review of studies referenced and published in scientific databases regard the livestock sector.

Results: In ewes, administration of “royal jelly” in addition to reproductive management protocols improves the response to estrus synchronization, time of onset and duration of estrus, number of large follicles, ovulatory rate and gestation rate.

Study limitations/implications: Royal jelly is a substance with beneficial effects on reproductive variables in ewes; however, the cost may be a limitation for its incorporation in synchronization protocols. Additionally, it is necessary to clarify the active metabolites that exert the action and the most effective route of administration.

Findings/conclusions: Royal jelly can be an alternative incorporated to estrus synchronization programs in ewes to substitute some hormones without decreasing reproductive variables.

Key words: *Apis mellifera*, reproduction, reproductive management, sheep.

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INTRODUCTION

In small ruminant reproductive management, it is possible to reduce the use of exogenous hormones by optimizing the animal's response to the environment and nutrition. These management strategies propose using knowledge and available resources (Delgadillo and Martin, 2015). In the reproductive management of sheep, it is possible to use targeted

or strategic nutrition (Martin, 2009), with supplements containing bioactive compounds (Delgadillo and Martin, 2015) or modifying metabolic hormone concentrations (Scaramuzzi *et al.*, 2006) to improve reproductive performance (Gutiérrez *et al.*, 2011). In this regard, royal jelly (RJ), produced by the cephalic glands of worker bees (*Apis mellifera*), can improve reproductive response in different species (Pavel *et al.*, 2011).

With the use of RJ in the reproductive management of wool ewes, positive effects are reported for reproductive variables such as estrus incidence, time of estrus onset, as well as an improvement in the percentage of gestation (Kridli *et al.*, 2003; Husein and Haddad, 2006). Royal jelly administration in hair sheep at different physiological stages shows similar results. The objective of this review is to present some of the results obtained with the application of RJ in the reproductive management of wool and hair sheep.

Royal jelly in estrus synchronization protocols in wool ewes

Administration of RJ (250 mg d⁻¹) orally or intramuscularly to Awassi ewes for 12 d (during the estrus synchronization protocol), shortened the time of estrus onset (31 ± 2.6 h), compared to ewes in the control group (45 ± 5.4 h), and increased the number of ewes responding to synchronization to 80%, to 40% in the control group (Husein and Kridli, 2002). Kridli *et al.* (2003) report that administration of 250 g RJ d⁻¹, orally for 12 d, increased the percentage of ewes with signs of estrus compared to the control group (80 *vs.* 40%), in addition, the percentage of pregnant ewes also improved with RJ administration (60 *vs.* 20%).

The application of three different doses of RJ (250, 500, 750 mg d⁻¹) orally, during an estrus synchronization protocol (12 d), showed that there were no differences among the three different doses for the variable estrus onset. The 500 and 750 mg RJ doses improved the estrus onset (49.6 ± 7 and 49.0 ± 8 h), compared to ewes that did not receive RJ (59.6 ± 7 h). The results obtained with the 500 and 750 mg RJ doses compared to the administration of a 600 IU dose of eCG showed no differences for the onset of estrus, percentage of gestation and prolificacy variables (Kridli and Al-Khetib, 2006).

When comparing the response of an estrus synchronization protocol in Awassi ewes, with the application of 12 doses of RJ of 400 mg d⁻¹ (orally), or the application of 500 IU of eCG, similar results were reported between both treatments for the response to synchronization, fertility or prolificacy variables, so it is proposed that RJ is an alternative for the use of eCG in wool ewes (Husein and Haddad, 2006).

Mostafa *et al.* (2008) found that RJ application for 21 d (RJ treatment initiated at 15 days postpartum) reduced days between lambing and first estrus (33.30 ± 0.57 *vs.* 44.80 ± 0.4 d) in Ossimi ewes. Estrus duration increased by 10 h on average in the RJ-treated ewes (41 ± 0.42 *vs.* 31 ± 0.31 h), possibly because RJ increases the number of growing follicles, as well as plasma estradiol levels, necessary for the ewe to show signs of estrus.

Royal jelly in estrus synchronization protocols in hair ewes

On a reproductive management protocol in which eCG or RJ was used in hair ewes, a shorter time to the onset of estrus was found in the eCG treated group (21.10 ± 2.34 h), compared to the group treated with RJ (30.95 ± 1.29 h). Ewes only synchronized with

progesterone showed signs of estrus at a longer time (36.78 ± 2.88 h). The RJ or eCG administration did not modify the ovulation rate and percentage of gestation variables (Pérez *et al.*, 2014).

When researching whether RJ has any direct effect on follicular development, it is reported that the administration of three applications of 500 mg RJ d^{-1} , intramuscularly, does not modify the number of small, medium and large follicles (similar between control and RJ-treated ewes) (Figure 1). Estrus duration was longer in RJ-treated ewes (54.7 ± 2.32 vs. 47.5 ± 3.47 h) compared to those in the control group (Pérez-Ruiz *et al.*, 2015). The effect on estrus duration coincides with that reported by Mostafa *et al.* (2008) in Ossimi ewes. However, when RJ treatment is increased to seven days (500 mg d^{-1}) and administered intravenously, it is possible to increase the number of large follicles ($>4 \text{ mm}$), shorten the time to estrus onset (49.08 ± 2.09 vs. 54.08 ± 1.35 h) and increase the ovulation rate (2.83 ± 0.16 vs. 1.83 ± 0.16), in Pelibuey ewes (Sosa-Pérez *et al.*, 2017).

In a reproductive management protocol excluding hormones, the administration of 1.0 g RJ on 30, 37, 44 and 51 postpartum days did not shorten the resumption of ovarian activity (evaluated by ultrasonography with the presence of corpora lutea in the ovaries) in Pelibuey ewes (Pérez-Ruiz *et al.*, 2018). In this research, in addition to the application of RJ, the suckling control strategy (30 min twice per day) was evaluated. Upon weaning, socio-sexual stimulation was initiated with the male every 12 h, and the response to estrus was evaluated, which was similar among all ewes. For the variable estrus onset, the RJ did not modify the response, but the suckling control did have a significant effect; in the continuous suckling group, estrus started in less time (3.5 ± 0.9 vs. $7.5 \pm 1.3 \text{ d}^{-1}$) than in the controlled suckling group. Estrus duration was significantly longer in RJ-treated ewes for both suckling modalities. The presentation of silent estrus may be a common problem in postpartum ewes, so the effect of RJ on increasing estrus duration could improve reproductive efficiency by promoting the expression of estrous behavior.

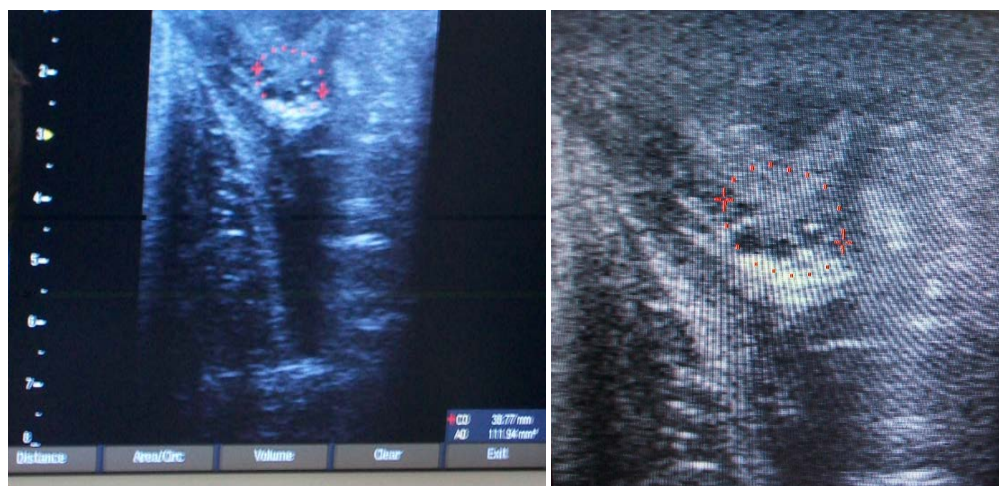


Figure 1. Large follicles ($<5 \text{ mm}$) in hair sheep synchronized with CIDR[®] and royal jelly application.

CONCLUSIONS

The results obtained by the administration of royal jelly in wool and hair sheep suggest a positive effect of this substance on reproductive variables such as follicular growth, estrus onset, estrus duration, ovulation rate and gestation, so it can be a natural alternative to the use of exogenous hormones, yet more research is needed to identify the metabolites that exert the action, as well as the most effective route of administration.

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