

Exogenous melatonin extends the ram breeding season and increases testicular function in seasonal and non-seasonal sheep breeds

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Regulated by the neurohormone melatonin, ovine reproductive seasonality limits production outcomes due to annual periods of decreased reproductive efficiency (Karsh *et al.* 1986, Bittman *et al.*, 1985). In the ewe, slow-release melatonin implants are a commercial strategy to improve out of season reproductive performance, and act to extend the duration of the breeding season. Despite this, in Australia there is no equivalent method to promote ram fertility in the non-breeding season, and as such this period is characterized by a reduction in ram libido, testicular size, sperm quality and quantity.

Accordingly, we predicted that exogenous melatonin could be used to modify ram reproductive endocrinology, testicular size, sperm quality and production during the non-breeding season without compromising the following breeding season in Merino and Poll Dorset rams. Mature rams were treated with (n=14) or without (n=17) slow release melatonin implants (3 x18mg implants/ram; Regulon, CEVA Animal Health, NSW Australia) during the early non-breeding season and reproductive parameters measured weekly. Data analysis was undertaken using linear mixed model regression (REML) in R 3.4.1.

Melatonin treatment resulted in a significant elevation of melatonin concentration in seminal plasma from 1-8 weeks post-implantation and in blood plasma at 6 weeks post implantation (P<0.001). The blood plasma testosterone of implanted rams was greater than controls at both 6 weeks post-implantation and during the following breeding season (P<0.05). Implanted rams exhibited increased scrotal circumference (P<0.001) and number of sperm per ejaculate (P<0.05) from 3 weeks post-implantation but did not demonstrate any significant change in sperm motility or morphology in response to treatment. Though melatonin did not alter seminal plasma levels of Anti-Mullerian hormone, for the first time in the ram, we have found this hormone to be positively correlated with sperm production ($r = 0.464$, P<0.001) and motility ($r = 0.3424$, P<0.001).

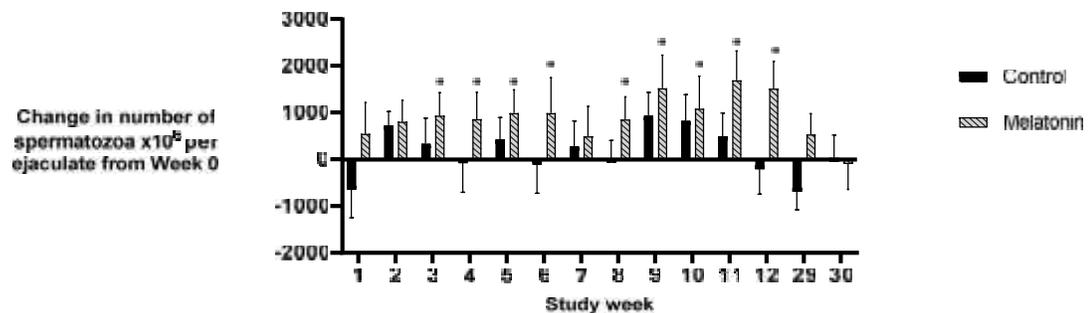


Figure 1. The difference in the number of spermatozoa x 10⁶ per ejaculate compared to week 0 measures for implanted and control rams from study week 1 (1 week post-implantation) to study week 30 (following breeding season). Weekly values are presented as means ± S.E.M. Data is based off the 18 rams that collected from week 0 (n= 9 per treatment). * Indicates significant difference from week 0 within treatment group (P<0.05).

This study confirms that exogenous melatonin advances the onset of ram reproductive seasonality and is able to increase testicular function during the non-breeding season. Melatonin was able to improve sperm production in both Merino and Poll Dorset rams with no deleterious impact in the subsequent breeding season. These results indicate melatonin has considerable potential for application in industry to improve out-of-season ram reproductive performance.

References

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