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Effect of melatonin implants on the dry period of dairy goats

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The dry period in a dairy animal appears to be essential for ensuring milk yield in the subsequent lactation. Subclinical udder infections may appear in this period (Contreras and Rodriguez 2011). Inflammations of the mammary gland are recognized as a situation of oxidation stress. Melatonin improves the activity of antioxidant enzymes and it might help to control free radical excess (Yawno *et al*. 2013). The aim of this work is to check the effect of the administration of melatonin in the antioxidant status of dairy goats in the dry period.

Verata does of same body condition, age (3 to 5 years), parity (2 to 5) were randomly assigned to control or treatment until forming 2 groups of 20 animals each. The goats in the treated group received one subcutaneous implant of 18 mg melatonin 45 days before mating. Both groups were submitted to same feeding and husbandry practices through the trial and monitored periodically to assess the incidence of mastitis.

Heparinized blood samples were taken 5 times, the first at the time of implant application and then 4 times more at intervals of 45 days. Melatonin was measured by enzyme immunoassay and spectrophotometry was used for erythrocyte glutathione peroxidase (GSHPx), superoxide dismutase (SOD) and glutathione reductase (GR) activities. Haemoglobin was determined with an automated cell counter.

Normally distributed data were analysed by repeated-measures ANOVA using a split-plot design with melatonin treatment as a between-subject factor and time as a within-subjects factor. The G-Stat statistical package was used (Letón and Marino 2002).

Melatonin concentration was significantly higher ($P<0.05$) in the implanted goats at the second and third samplings, 90 and 135 days after treatment (Table 1). These results followed a similar dynamics to previous work. Exogenously administered melatonin from continuous slow-release implants advanced the onset of breeding season in sheep and goats by mimicking the stimulatory effect of short days without suppressing the endogenous secretion (Zarazaga *et al*. 2013).

There were significant differences for GSHPx ($P<0.05$) between the control and the implanted groups in the third and the fourth samplings. These changes in the antioxidant activity after melatonin application resemble previous works in small ruminants (Jiménez *et al*. 2009), which reported significant changes in blood GSHPx activity 100, 120 and 150 days after melatonin was given.

GR and SOD activities were significantly higher in the implanted than in the control animals at the third sampling. Similar increases were previously reported in other species (Öztürk *et al*. 2012, Bharti *et al*. 2014).

Some studies indicated that a good antioxidant system

Table 1. Mean activities (mean ±SD) of melatonin (pg/ml), GSHPx (IU/g), GR (IU/l) and SOD (IU/l) in the control and the implanted goats in 5 blood samplings during the experiment

Groups		First sampling	Second sampling	Third sampling	Fourth sampling	Fifth sampling
Melatonin	Control	45.0±9.8	45.5±12	51.2±8.3	43.75±7.5	40.0±7.4
	Implanted	47.5±4.8	262.5±23.9	143.7±35.9	57.5±13.6	47.5±8.2
GSHPx	Control	215.20±10.47	221.40±12.30	230.25±20.10	220.10±14.25	217.68±17.54
	Implanted	223.14±9.80	240.99±13.10	289.40±16.41*	296.32±25.6*	216.20±12.36
GR	Control	55.20±2.0	64.00±4.75	62.20±7.40	53.41±6.3	65.45±3.50
	Implanted	52.40±1.97	59.10±2.00	85.70±5.60*	55.23±4.25	76.35±5.92
SOD	Control	345.52±10.68	352.62±11.01	326.40±25.50	320.24±15.2	330.87±14.62
	Implanted	366.15±9.50	360.20±12.30	393.10±29.37*	335.30±10.78	329.65±15.20

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could be related to the health of the udder. Jiménez *et al*. (2009) registered lower somatic cell counts in goats implanted with melatonin. These findings may be a consequence of the improvement of function of immune system in udder. The positive action of melatonin on the activity of antioxidant enzymes would render a more efficient antioxidant system, more capable to protect leucocytes against oxidative damage.

In conclusion, administration of melatonin to goats 45 days before mating affects positively the antioxidant enzymes, which may act favourably in the recovery of mammary epithelial cells in next lactation. Thus, in dairy goats, use of melatonin, in addition to reproductive purposes, could be a promising means to improve milk production due to a better recovery in the dry period.

SUMMARY

The melatonin administration to milking goats before mating increased significantly blood glutathione peroxidase, glutathione reductase and superoxide dismutase activities during 3–4 months. Therefore, the use of melatonin implants, in addition to reproductive benefits, could affect milk production through improving the health of the udder during the dry period in dairy goats.

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REFERENCES

Bharti V K, Srivastava R S, Kumar H, Bag S, Majumdar A C, Singh G, Pandi-Perumal S R and Brown G M. 2014. Effects of Melatonin and Epiphyseal Proteins on Fluoride-Induced Adverse Changes in Antioxidant Status of Heart, Liver, and Kidney of Rats. *Advances in Pharmacological Sciences*. Article ID 532969, 6 pages.

Contreras A G and Rodriguez J M. 2011. Mastitis: Comparative Etiology and Epidemiology. *Journal of Mammary Gland Biology and Neoplasia* **16**: 339–56.

Jiménez A, Andrés S and Sánchez J. 2009. Effect of melatonin implants on somatic cell counts in dairy goats. *Small Ruminant Research* **84**: 116–20.

Letón, M. and Marino, A. 2002. *G-Stat 2.0 User´s guide*. Department of Biometry Glaxo Smithkline, Madrid.

Öztürk G, Akbulut K G, Güney and Acuna-Castroviejo D. 2012. Age-related changes in the rat brain mitochondrial antioxidative enzyme ratios: modulation by melatonin. *Experimental Gerontology* **47**:706–11.

Yawno T, Castillo-Melendez M, Jenkin G, Wallace E G, Walker D W and Miller S W. 2012. Mechanisms of Melatonin-Induced Protection in the Brain of Late Gestation Fetal Sheep in Response to Hypoxia. *Developmental Neuroscience* **34**: 543–51.

Zarazaga G A, Gatica M C, Gallego-Calvo L, Celi I and Guzman J L. 2013. Melatonin improves the reproductive performance of seasonal anoestrus goats exposed to buck effect during early post-partum. *Spanish Journal of Agricultural Research* **11**: 997–1003