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ORIGINAL ARTICLE

Influence of lamb presence on daily rhythm in lactating ewes

M. MORGANTE[1], C. STELLETTA[1], M. GIANESELLA[1], C. CANNIZZO[1], A. SFEFANI[2], C. GIANNETTO[3] & G. PICCIONE[3]

[1]*Dipartimento di Scienze Cliniche Veterinarie, Facoltà di Medicina Veterinaria, Università degli Studi di Padova, Agripolis, Legnaro, Italy, and* [2]*Istituto Zooprofilattico delle Venezie, Padova, Italy, and* [3]*Dipartimento di Scienze Sperimentali e Biotecnologie Applicate, Laboratorio di Cronofisiologia Veterinaria, Facoltà di Medicina Veterinaria, Università di Messina Polo Universitario dell'Annunziata, Messina, Italy*

Abstract
To determine the influence of lamb presence on the dairy ewes circadian system we monitored simultaneously 16 different parameters (insulin, glucose, total protein, urea, cholesterol, triglycerides, total bilirubine, calcium, phosphorus, magnesium, sodium, potassium, chloride, rectal temperature, respiratory rate and heart rate). Sixteen clinically healthy Sarda breed dairy ewes, divided into two groups, group A with their lambs and group B without their lambs, were used. Data collection was done at 3 hourly intervals over a 24-h period. Our results indicate that lamb presence influences ewes metabolism, inducing modifications of the acrophase and robustness of the rhythm of some physiological variables. Most variables lost the rhythmicity that they show in not pregnant and not lactating ewes. Lamb presence also influenced urea circadian rhythm: the time of urea peak was shifted from 16:00 to 12:24 $\pm$ 00:35 when ewes were housed with lambs, and on triglycerides circadian rhythm.

Keywords: *Body temperature, daily rhythm, ewes, physiological parameters.*

Introduction

A range of endocrine and neuronal pathways are likely to relay timing information from the brain to the periphery. At higher levels of biological organization, circadian pacemaker has been discovered in the suprachiasmatic nuclei (SCN). Each SCN cell is capable of generating a circadian rhythm of its own by the molecular interplay of clock gene products that control the circadian output from the SCN by driving the expression of so-called clock-controlled genes (Stehle et al., 2003). This master circadian clock generates and coordinates circadian rhythmicity, i.e. internal organization of physiological and behavioural rhythms that cycle with a near 24 h period (Castillo et al., 2004). The circadian timing system generates daily rhythms of behaviour that permit organisms to anticipate predictable events in their environment, thus increasing the probability of locating essential resources (e.g. food and mates), avoiding predators, and ultimately increasing the likelihood of survival (Holmes & Mistlberger, 2000). Naked mole-rats were considered a model for the study of circadian rhythms in subterranean species as well as a highly social animal (Riccio, 1999); however for sheep the issue is different. In fact, the data suggests that circadian regulation of peripheral physiology is weaker in ruminates than in rodents; in sheep the timing of clock gene rhythms on peripheral organs is different from that of the central pacemaker (Reppert & Weaver, 2001). Sheep would show less robust clock gene rhythms in peripheral tissues. This is because sheep have a ruminant physiology that releases nutrients gradually due to microbial degradation in the rumen, unlike the situation in monogastric mammals, and they spend much of the 24 h grazing or ruminating (Anderson et al., 2005).

Free-running circadian rhythmicity in sheep has been demonstrated for melatonin secretion locomotor activity and some physiological variables (Ebling

Correspondence: Prof. Giuseppe Piccione, Dipartimento di Scienze sperimentali e Biotecnologie applicate, Laboratorio di Cronofisiologia Veterinaria, Facoltà di Medicina Veterinaria, Università di Messina Polo Universitario dell'Annunziata, 98168 Messina, Italy. E-mail: giuseppe.piccione@unime.it

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