

Effects of Lambing on Behaviour and Cortisol Levels in Postparturient Ewes

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Abstract

The aim of the current research was to evaluate the effects that lambing process has on major behavioural patterns and cortisol levels in multiparous Turcana ewes during the first 21 days after parturition. At 14 hours following lambing, cortisol level was 7.78 ± 0.47 $\mu\text{g/dl}$, and decreased to 5.08 ± 0.72 $\mu\text{g/dl}$ on the 7th day of the experiment ($p \leq 0.05$), then to 2.75 ± 0.50 $\mu\text{g/dl}$ on the day 14 ($p \leq 0.05$) and to 1.61 ± 0.43 $\mu\text{g/dl}$ in the last day of experiments ($p > 0.05$). Differences in cortisol levels between single and twin lambing ewes were not significant ($p > 0.05$), suggesting that either cortisol sampling could not be used as an indicator for assessing stress caused by the additional lamb(s) in postparturient ewes, either in multiparous Turcana ewes rearing two lambs does not impose a great stress to the mothers' organism. Both the major behavioural patterns and milk cortisol levels are influenced significantly by the lambing process in multiparous ewes during first 14 days following parturition. After two weeks, time devoted to feeding, rumination and resting behaviours tend to be less influenced by the lambing process.

Keywords: behaviour, post-parturient ewes, sheep welfare, stress indicators

1. Introduction

Low input systems are now becoming increasing attractive to sheep farmers in the EU. These systems rely on optimizing the ability of the animals to take care of themselves, through appropriate behavioral responses and resistance, when faced with common health and welfare challenges [1].

Lambing has been identified as an important factor which influences post-parturient sheep welfare [2].

Behaviour in postparturient ewes is being mainly influenced by factors such as breed, production system, lambing type and previous experience of

animals. Previous studies have shown that Blackface ewes express a better distance recognition of their lambs, and are more attracted to their own lambs, when compared with Suffolk ewes [3].

Ewes from unimproved breeds (e.g. mountain Zackel group) show superior maternal instincts, compared to high-performing intensively selected genotypes (e.g. Merino), being subject to less human intervention. Furthermore, extensively reared breeds are prone to far more adverse conditions (e.g. outside winter lambing), which translate into higher mortality rates of lambs, however individuals that do survive, will have a higher organic resistance throughout their productive life and will imprint this on their offspring.

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Ewes lambing multiples experience far higher stress in rearing the offspring, and individually, the lambs receive significantly less maternal care. This becomes an issue when triplets and quadruplets are involved, with mortality rates in these cases of over 30-40%.

Primiparous ewes, in case of dystocia face higher stress and performance, when compared to more experienced multiparous animals due to lack of experience and other factors such as smaller body size, lower milk production and higher incidence.

Up today the welfare and behaviour of sheep is commonly envisaged by the general public as providing better standards compared to dairy cattle or the poultry and pig sectors. As a result, significantly fewer researches were focused on welfare and behaviour of this species [4].

The aim of the current research was to evaluate the effects that lambing process has on major behavioural patterns and cortisol levels in multiparous Turcana ewes during the first 21 days after parturition.

2. Materials and methods

Researches were carried out at the Didactical Research Station of the Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara (45.46° N/ 21.15° E; 91 m altitude; 620 mm average annual rain fall; average temperatures of 21.1/-1.2 °C during summer/winter) during February 2012.

Secundiparous Turcana ewes (n=6) and their lambs (n=9) were monitored for behaviour for the first 21 days, starting the first day after lambing. Out of the six secundiparous Turcana ewes monitored, three ewes lambed singletons and three gave birth to twins.

Ewes were housed on deep straw bedding, in two collective pens of 3.5 m x 2 m each, with a space allowance of 1.7 m²/ewe. Moreover, ewes had *ad libitum* access to water and to pasture hay and also supplements of 300 g/head barley for single lambing ewes and 500 g/head for twining ewes.

The average temperature inside the barn was -1.2 °C, with limits ranging between -3.3 and +1.6 °C. Video-recordings were made for 24 hours, at intervals of 7 days, using a surveillance system CC 9922 BIR with four video-cameras of 125 fps. Measurements have been made for the following behavioural patterns: (i) feeding and rumination

time /24 hours; (ii) lying down and sleeping /24 hours; (iii) contact with lamb(s) of ewes.

Cortisol levels were determined from milk samples, which were collected at 14 hours after lambing, and at 7, 14 and 21 days. Milk collecting was done on each sampling day at 7:00 in order to avoid daily fluctuations of the hormone [5]. Cortisol concentration was determined in a private laboratory, using the Roche Electro-chemoluminescence method.

Data were statistically analyzed by non-parametrical Mann-Whitney test using MiniTab14 software. All decisions about the acceptance or rejection of statistical hypotheses have been made at the 0.05 level of significance.

The study was performed in accordance with the EU Directive 2010/63/EU for animal experimentation [6].

3. Results and discussion

Results concerning milk cortisol levels during the first 21 days after lambing, as well as feeding and rumination behaviours of postparturient ewes are presented in Table 1 (mean±SE).

At 14 hours following lambing, cortisol level was 7.78±0.47 µg/dl, and decreased to 5.08±0.72 µg/dl on the 7th day of the experiment ($p \leq 0.05$), then to 2.75±0.50 µg/dl on the day 14 ($p \leq 0.05$) and to 1.61±0.43 µg/dl in the last day of experiments ($p > 0.05$).

Differences in cortisol levels between single and twin lambing ewes were not significant ($p > 0.05$), suggesting that either cortisol sampling could not be used as an indicator for assessing stress caused by the additional lamb(s) in postparturient ewes, either in multiparous Turcana ewes rearing two lambs does not impose a great stress to the mothers organism.

Authors have different opinions on the feasibility/reliability of using cortisol from milk as a stress indicator, with recent work presenting divergent opinions.

For instance, in lactating dairy goats it was showed that the intra-mammary infections had no effect on milk cortisol concentration, and somatic cell count did not correlate with cortisol concentration [7]. While in lactating dairy cows and ewes, cortisol level was reported as being a suitable indicator of stress [8, 9].

Feeding behaviour was less affected by the parturition. Only one significant ($p \leq 0.05$) difference for the feeding time was observed between the first 24 hours after lambing and day 7 of the experiments.

Results are in accordance with limits for the feeding behaviour published by Acatincai (2003) [10], feeding representing between 28.9% and 34.5% in 24 hours interval.

A similar pattern was observed for the rumination behaviour, being influenced ($p \leq 0.05$) by parturition moment only between the first two intervals (24h vs. 7d). Rumination process represented between 23.0% and 33.9% of the day, during first 24 hours and day 14 following lambing, respectively.

Ewes spent lying on average 513.8 ± 25.40 , 637.5 ± 21.00 , 627.2 ± 16.80 and 602.7 ± 13.10 minutes during the first 24 hours after lambing and at 7, 14 & 21 days, respectively. Post-parturient Turcana ewes devoted significantly ($p \leq 0.005$) less time to resting behaviour during the first 24 hours after lambing, compared to days 7, 14 & 21 of the experiments.

Similar results were reported for the Karagouniko breed postparturient ewes, with the animals lying for 33.6% of the time during the first 24 h after lambing and 50.5% on day 12 following parturition [11].

Time devoted to sleeping (REM) was less influenced by the parturition moment, differences being significant ($p \leq 0.05$) between days 1 and 2 of the experiments.

Given the difficulty in registering sleep behaviour, the data presented in Table 2 has just an orientation value.

Following the pattern of the resting behaviour, the maternal-care behaviour was influenced by parturition moment during first 14 days following lambing, with no significant ($p > 0.05$) differences between days 14 and 21 of experiments. Results of the current study are in accordance with those reported for the Blackface mountain breed, which spent on average 51.4 minutes with lamb, compared to 27.4 minutes in Suffolk breed ewes [12].

Table 1. Milk cortisol levels, feeding and rumination behaviours of postparturient ewes (mean±SE)

Interval	Cortisol levels (µg/dl)	Feeding (min)	Rumination time (min)
24 h after lambing [A]	7.78±0.478	416.4±22.2	331.7±12.9
Day 7 after lambing [B]	5.08±0.725	495.0±16.1	474.7±17.3
Day 14 after lambing [C]	2.75±0.500	497.8±7.8	488.5±16.6
Day 21 after lambing [D]	1.61±0.438	495.7±12.6	466.5±18.2
A vs B	*	*	*
B vs C	*	ns	ns
C vs D	ns	ns	ns

Table 2. Lying, sleeping and maternal care behaviours of postparturient ewes (mean±SE)

Interval	Lying (min)	Sleeping (min)	Contact with lamb (min)
24 h after lambing [A]	513.8±25.4	58.15±2.81	40.90±3.15
Day 7 after lambing [B]	637.5±21.0	65.17±3.33	20.67±3.17
Day 14 after lambing [C]	627.2±16.8	61.55±3.54	16.80±2.15
Day 21 after lambing [D]	602.7±13.1	62.55±3.07	14.52±1.26
A vs B	**	*	**
B vs C	*	ns	*
C vs D	ns	ns	ns

4. Conclusions

It has been concluded that cortisol from milk could prove a suitable indicator of sheep adrenal-cortex activity that may be applied to measure stress in lactating ewes. However, further researches are needed to better understand how cortisol from milk correlates with other widely accepted indicators, and how alleviation of the cortisol from milk affects the major physiological and productive traits in lactating ewes.

Both the major behavioural patterns and milk cortisol levels are significantly influenced by the lambing process in multiparous ewes during the first 14 days following parturition. After two weeks, time devoted to feeding, rumination and resting behaviours tend to be less influenced by the lambing process.

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