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IMPACT OF THE SEVERITY OF LABOR AND BIRTHPLACE ON HORMONAL CHANGES IN THE SHEEP

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The onset and evolution of parturition are affected by environmental stressors, number of lambs, and dystocia. The regulation of parturition follows a chronological sequence, whose complete understanding is still rather complex. Progesterone (P_4) is essential for ovine pregnancy maintenance. The placenta is the major source of P_4, but also the fetus plays a critical role in the endocrine mechanisms that regulate the parturition timing. In the last 15 days before term, fetal adrenal gland increases cortisol (F) production which has two remarkable functions: firstly, it stimulates fetal lungs functional maturation and secondly in the placenta it enhances the expression of the steroidogenic enzyme P450c17, thus allowing P_4 conversion to estrogens [1]. The correlation between maternal plasma F levels and the duration of labor as well as the correlation between pain intensity and plasma Beta-endorphin (B-end) concentration have been studied [2]. Still, there are no reports of any correlation between these hormones, the severity of parturition pain and the environment. The aim of this study was therefore to determine whether, in sheep plasma concentrations of F, adrenaline (A), noradrenaline (NA), B-end, estradiol (E_2) and P_4 could be correlated to labor phase and intensity, and to the birthplace (sheepfold versus pasture). Sheep were well suited for handling. Animal care and use, as well as the experimental design of the study, were approved by the local animal ethics committee of the Department (DETO) (protocol n°1091/III/13 del 18/09/2017). The reproductive activity and pregnancy of 20 Comisana sheep (4-8 years old, multiparous) reared with a semi-wild system were monitored. Parturitions were classified in: eutocic, eutocic twin birth, dystocic and dystocic twin birth. Blood samples were taken from day 144 until labor and then during each stage of labor at the following time points: T0 (24 hrs before labor), T1 (prodromic stage), T2 (dilated stage), T3 (expulsive stage) T4 (stage of the fetal membrane expulsion), T5 (24 hrs after labor). Haematic concentrations of F, A, NA, B-end, E_2 and P_4 were evaluated by ELISA kits. Recorded data were then analyzed by SPSS software and statistical significance was set to $P<0.05$. We found that 1) the kind of labor and the place in which it occurred affected significantly F, A, NA, B-end, E_2 concentrations; 2) from T2 until T4 there was a significant increase of A and NA concentrations; 3) at T3 a significant increase of F concentration appeared; 4) B-end was the only compound whose concentration increased from T0 to T5; 5) dystocia induced significantly higher concentrations of all hormones related to stress. The present study shows that during labor a positive correlation between hormonal changes and phases/encountered difficulties exists (labor/F at T3 R=0.628; P=0.003 at T4 R=0.631; P=0.003 at T5 R=0.557; P=0.011: labor/A at T2 R=0.931; P=0.000; at T3 R=0.957; P=0.000: labor/NA at T1 R=0.470; P=0.037 at T2 R=0.982; P=0.000 at T3 R=0.956; P=0.000: labor/B-end at T0 R=0.788 P=0.000; at T1 R=0.562; P=0.10 at T2 R=0.885; P=0.000 at T3 R=0.929; P=0.000 at T4 R=0.720; P=0.000). Moreover, hormonal peaks were reached around the time of expulsion, suggesting that they could have been associated with muscle work, stress and pain.

[1] Wood et al. Fetal and neonatal HPA Axis, Compr Physiol, 6(1): 33-62, 2015.

[2] McMillen et al. Chronic stress – the key to parturition? Reprod Fertil Dev. 7(3): 499-507, 1995.