

The influence of suckling on prolactin secretion and ethological determinants in lambs during rearing with their mothers

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Instinctive behaviour in animals has its source in changes occurring inside the body, such as hormonal changes. One of the main hormones responsible for lactation and determinants of the maternal instinct is prolactin. A study was carried out on 20 Polish Longwool ewes and their offspring. The aim of the study was to determine the effect of suckling on prolactin secretion and to analyse lamb behaviour during the first 14 days after lambing. On day 7 of the experiment, blood was taken for determination of the prolactin level. The study showed a significant effect of the suckling factor on prolactin secretion. Stimulation of the mammary gland by the suckling lamb stimulated prolactin secretion. The ethological observations indicated that the behaviour of lambs both during the day and at night depends on their age. Younger lambs spent more time with their mothers, while in the second week they were more active.

KEY WORDS: sheep, suckling factor, prolactin, lamb behaviour

Analysis of animal behaviour should take into account physiological and environmental factors [17]. Both the human and animal body depend on endocrine balance, which affects well-being and reactions [1, 18]. Brain plasticity, i.e. continual modification under the influence of a stimulus, is a huge benefit conditioning survival. In mammals, brain plasticity is evident in the functioning of the visual system, communication, and improvement of motor functions [16]. In sheep, olfactory stimulation of lambs from the first moments of life directs the body to respond appropriately to this stimulus. The scent emitted by lambs during suckling affects the ewes, inducing maternal responses [3]. During this period, an

endocrine secretion bond forms between the ewe and her offspring [16]. The young mammal is entirely dependent on its mother. When the ewe licks her new-born lambs, she becomes familiar with their scent and a bond forms between them. The maternal instinct and the mother's appropriate response to the lamb are dependent on correct endocrine balance, including secretion of prolactin (PRL) [4]. A ewe with normal prolactin secretion shows a maternal instinct, which is expressed in her behaviour [6, 15]. Prolactin secretion disorders cause inappropriate maternal behaviour and may even lead to aggression against the mother's own offspring [13]. A lack of appropriate relationships between mother and offspring lead to psychopathologies that negatively affect the adaptation of the young to independent life, which is a condition of their survival [5]. When the olfactory system malfunctions, the mother shows a disturbed maternal instinct and may even ignore her own offspring [3]. Good communication between mother and offspring is also ensured by correctly functioning eyesight and hearing. These senses are a source of basic information about the environment, provided they are not burdened with adverse factors (e.g. total darkness or excessive noise) [14]. Normal endocrine balance and functioning of the body, particularly the senses, as well as the animal's living environment affect its reactions, behaviour, and finally a normal or disturbed maternal instinct. These factors determine lamb rearing parameters and affect the profitability of sheep production.

The aim of the study was to determine the effect of suckling on prolactin secretion and to analyse lamb behaviour during the first 14 days after their birth.

Material and methods

The study was carried out on 20 Polish Longwool ewes aged 4-5 years, with a body weight of 60 ± 5 kg. Oestrus was synchronized with progestogens by the Chrono-Gest method. Polyurethane sponges saturated with 40 mg of Cronolone (Intervet, Netherlands) were introduced into the vagina for 14 days. On the day the sponges were removed, the ewes were given 500 IU of PMSG (Serogonadotropin, Biowet, Drwalew). Oestrus occurred 48-72 hours after administration of the preparation, and its duration was additionally monitored using a teaser ram. The ewes were mated from 15 to 30 October, and lambing took place in the second half of March.

On the first day after lambing, ewes and lambs were observed round-the-clock using cameras placed in the sheepfold, connected to a digital time-lapse recorder (BCS). The behaviour of lambs was recorded during their first 14 days of life. At the end of the experiment, the lambs' behaviour in the recorded images was analysed and the duration of individual forms of behaviour was determined: suckling, staying with the mother, activity, and rest. Then a statistical analysis of the data was performed to determine the percentage share of time allocated to each form of behaviour.

On day 7 of the experiment, blood was taken from the ewes to determine the prolactin level. Blood sampling began at 10:00 and continued every 20 minutes for 6 consecutive hours. Five hours before the start of the experiment, cannulas were inserted into the ju-

gular vein of the ewes, which enabled fast and stress-free blood collection. During the experiment, the sheep were fed in a traditional system, in accordance with the principles and standards of the National Research Institute of Animal Production [11]. The plasma concentration of prolactin was determined at the Institute of Animal Physiology and Nutrition, Polish Academy of Sciences in Jabłonna, by radioimmunoassay (RIA) as described by Kokot and Stupnicki [2]. The Kruskal-Wallis test was used for statistical analysis of the data obtained on changes in prolactin secretion and behavioural data.

Results and discussion

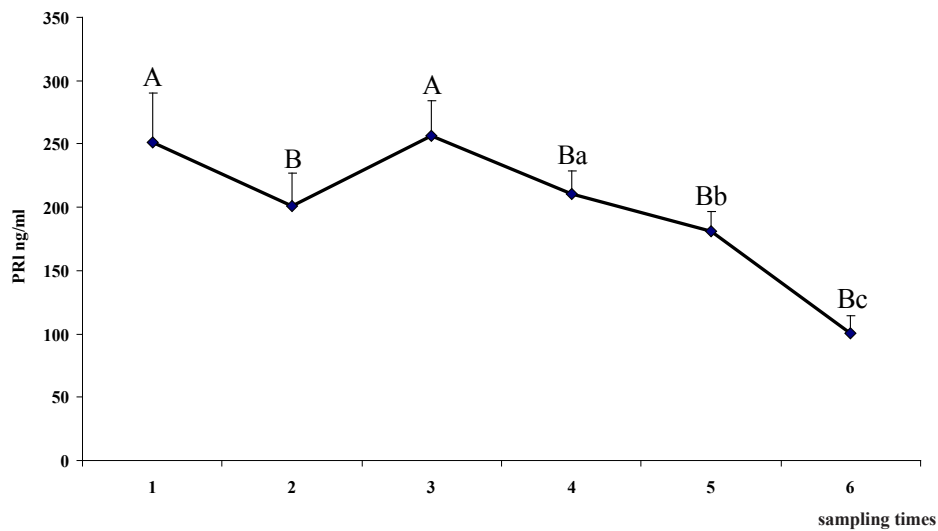
The study showed a significant effect of suckling on prolactin secretion in mother sheep (Fig., Table 1). In the first and third hour of blood sampling, the prolactin concentration was significantly higher ($P \leq 0.01$), at 251.1 ng/ml (± 38.7 ng/ml) and 256.1 ng/ml (± 28.1 ng/ml), respectively. The time lambs spent suckling at these hours (expressed as the percentage share of time allocated to individual forms of behaviour) was 22% and 22.9%, respectively, and was significantly ($P \leq 0.01$) longer than during other hours. In the second hour of the study, prolactin levels decreased significantly, amounting to 200.6 ng/ml (± 26.8 ng/ml). During this period a significant ($P \leq 0.01$) reduction in suckling time was observed, to only 10% (Table 1). In the fourth hour of the study, the prolactin concentration had decreased significantly ($P \leq 0.01$) to 210.1 ng/ml (± 18.2 ng/ml). At this time, suckling intensity was also lower, at 15% (Table 1). In the following hours, the prolactin concentration decreased significantly ($P \leq 0.01$). In the fifth hour it was 180.9 ng/ml (± 16.1 ng/ml), and in the sixth it was only 100.8 ng/ml (± 13.6 ng/ml). At this time, suckling intensity was significantly lower: 10% in the fifth hour and only 5.9% in the sixth (Table 1).

Table 1

Behaviour of lambs over a period of 6 hours (blood sampled 10:00-18:00)

Behaviour of lambs	Time of blood sampling					
	1	2	3	4	5	6
Suckling (%)	22.0 ^A ±2.2	10.0 ^B ±1.2	22.9 ^A ±2.1	15.0 ^B ±1.3	10.0 ^B ±1.2	5.9 ^B ±0.9
Time spent with mother (%)	31.0 ±3.2	29.0 ±2.7	33.6 ^a ±3.4	31.0 ±2.9	27.0 ±2.9	25.1 ^b ±2.3
Activity (%)	23.0 ±2.4	33.0 ±3.6	20.8 ^a ±2.1	24.0 ±2.6	33.0 ±3.4	43.5 ^b ±3.8
Resting (%)	24.0 ±2.5	28.0 ±2.8	22.7 ±2.3	30.0 ±2.8	30.0 ±2.9	25.5 ±2.3

A, B – means marked with different letters in rows differ significantly at $P < 0.01$
a, b – means marked with different letters in rows differ significantly at $P < 0.05$



A, B – means marked with different letters at different sampling times differ significantly at $P < 0.01$
 a, b, c – means marked with different letters at different sampling times differ significantly at $P < 0.05$

Fig. The effect of suckling on prolactin secretion in ewes

Analysis of the remaining types of behaviour in lambs during the 6-hour observation period revealed that in the first and third hours the lambs spent the most time with their mothers, 31.0% and 33.6%, respectively (Table 1). They spent significantly ($P \leq 0.05$) the least time with their mothers in the sixth hour – only 25.1%. In the first and third hours, the lambs devoted the least time to activity in the sheepfold, 23% and 20.8%, respectively, and to rest (lying), 24.0% and 22.7% (Table 1). The lambs showed the most activity in the fifth and sixth hours, 33.0% and 43.5%, which was statistically significant in relation to the other hours of the study (Table 1).

The results of the study regarding the behaviour of lambs during the day (6:00 a.m. to 6:00 p.m.) on the first 14 days of life are shown in Table 2. In the first week of observation, lambs spent significantly ($P \leq 0.05$) more time during the day suckling (4.7%) and staying with their mothers (37.8%) than in the second week (3.2% and 25.3%, respectively). As lactation progressed, lambs devoted more time to activity in the sheepfold: 31.9% in the first week and 36.5% in the second week (Table 2).

Analysis of the behaviour of lambs at night (between 6 p.m. and 6 a.m.) showed that in the first week of life lambs spent significantly ($P \leq 0.05$) more time suckling (3.50%) than in the second week (2.20%; Table 3). Staying with the mother during the night is an expression of safety for the offspring. In the first and the second week of the study the lambs spent similar amounts of time with their mothers, 28.6% and 28.5%, respectively.

Table 2

Behaviour of lambs during the day (6:00-18:00) in the first and second week of observations

Behaviour of lambs	First week	Second week
Suckling (%)	4.70 ^a ±0.9	3.2 ^b ±0.6
Time spent with mother (%)	37.8 ^a ±4.1	25.3 ^b ±2.7
Activity (%)	31.9 ±2.9	36.5 ±3.1
Resting (%)	25.6 ^a ±2.2	34.0 ^b ±3.2

a, b – means marked with different letters in rows differ significantly at $P < 0.05$

Significantly ($P \leq 0.05$) greater activity at night was observed in lambs in the second week of observations (34.0%) than in the first week (24.5%). Younger lambs (7 days old) spent significantly ($P \leq 0.05$) more time resting (43.4%) at night than 14-day-old lambs (35.3%; Table 3).

Table 3

Behaviour of lambs at night (18:00-6:00) in the first and second week of observation

Behaviour of lambs	First week	Second week
Suckling (%)	3.5 ^a ±0.2	2.2 ^b ±0.1
Time spent with mother (%)	28.6 ±1.9	28.5 ±1.9
Activity (%)	24.5 ^a ±1.8	34.0 ^b ±3.1
Resting (%)	43.4 ^a ±3.9	35.3 ^b ±3.2

a, b – means marked with different letters in rows differ significantly at $P < 0.05$

The study showed that suckling stimulates prolactin secretion and strengthens the relationship between mother and offspring. At times when the prolactin concentration was stimulated by suckling, the lambs stayed with their mothers longer. Previous research has indicated that the relationship between the mother and her offspring is very important, and that normal maternal relationships allow the offspring to survive [3]. Prolactin secretion in the pituitary gland is dependent on a number of physiological factors [7]. Studies in sheep

have shown that changes in prolactin secretion significantly influence the amount of milk obtained both during rearing of lambs and throughout lactation [8, 9, 10]. As time passes after lambing and prolactin secretion decreases, the maternal instinct of sheep weakens as well, and lambs show less need to be with the mother [6, 12, 15]. Prolactin secretion disorders significantly affect behavioural determinants and animal productivity. Studies in pigs have shown that administration of bromocriptine as a prolactin blocker causes behavioural disturbances in sows [13, 15].

The ethological observations showed that the behaviour of lambs both during the day and at night depends on their age. Younger lambs (7 days old) spend more time with their mothers, while in the second week of life they show greater activity. The study showed that suckling has a significant impact on prolactin secretion in sheep. Analysis of ethological determinants can be an important criterion in selecting animals for breeding; attention should be paid to the maternal instinct. Proper care of the offspring by the mother is extremely important not only for the survival of lambs, but also for their later breeding value. In sheep farming, the number of lambs reared and the associated prolactin profile (milk secretion) are of great practical importance because they determine the income on the farm.

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