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THE INFLUENCE OF BETA-ADRENERGIC RECEPTORS ON UTERUS MYOELECTRIC ACTIVITY IN SHEEP SENSITISED WITH STILBOESTROL

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ABSTRACT

The research was conducted on 5 inter-breed hybrid sheep, at the age of 10 to 24 months and of the body mass of 30-45 kg, which had bipolar electrodes implanted to uterus horns and shank. The registration of uterus myoelectric activity was performed on sheep 24 and 48 hours after sensitising with Stilboestrol, by the use of Reega Duplex TR XVI electroencephalograph. After recording the output activity, the sheep were applied

intravenously in continuous injection: adrenaline – 0,12-0,18 μg · kg^{-1} · min^{-1}, oxytocin – 0,25-0,4 i.u., propranolol – 1mg · kg^{-1}, isoprenaline – 0,4-1,5 μg · kg^{-1} · min^{-1}, salbutamole – 0,4-0,8 μg · kg^{-1} · min^{-1}. The experiment results are presented in the inclosed drawings. The conducted research revealed that the stimulation of beta-adrenergic receptors causes the decrease or inhibition of uterus myoelectric activity of sheep sensitised with Stilboestrol. Beta-adrenergic receptors in sheep uterus, despite a smaller quantity in relation to alpha-adrenergic receptors, can participate in regulatory processes of the examined activity.

Key words: sheep, uterus, myoelectric activity, beta-adrenergic receptors

INTRODUCTION

The currently performed research demonstrates that molecular receptors bear a significant importance in the regulation of numerous processes occurring in various organism organs – e.g. in the regulation of the alimentary tract motor activity (2.3), the uterus motor activity (7-10, 17,18, 20, 21) and the stomach secretion (2-4). The distribution of these receptors and the character of reactions caused by their stimulation is different, depending on the organism condition, and mainly on the species affiliation. Detailed study on the molecular receptor role enables to control numerous processes in the medical and breeding practice.

Thorough knowledge of the molecular receptor role in the regulation of the uterus smooth muscle cramps has a considerable importance in obstetric – veterinary practice. The possibilities of uterus cramp dynamics control in domestic animals depend on the knowledge of molecular receptor distribution, their density and activity direction in particular species. The influence of the receptors mentioned above can be changed depending on the female physiological condition (estrus, pregnancy, delivery, postnatal period). One of the ways enabling to control the uterus cramp dynamics in females and women is the simulation or blocking of appropriate molecular receptors. There are a lot of receptors in uterus smooth muscles, and adrenergic receptors fulfil an important role among them. In spite of numerous publications on this issue, we do not have sufficient information on their quantitative distribution and activity direction in particular domestic animals, and on the dependence on the physiological condition of a particular female.

The aim of the conducted experiments was to examine the influence of miometrium beta-adrenergic receptors on uterus myoelectric activity in sheep during anestrus after sensitising with Stilboestrol.

MATERIALS AND METHODS

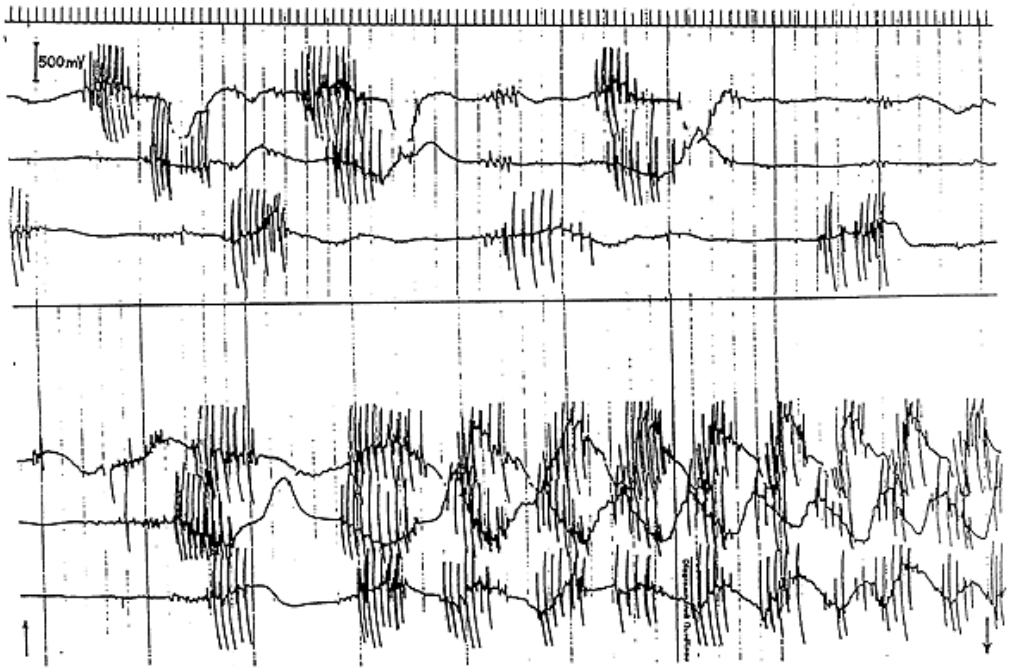
Five inter-breed hybrid ewes, at the age from 10 to 24 months and of the body mass of 30-45 kg, underwent operations, during which they had platinic bipolar electrodes implanted subserously to uterus horns and shank (15). Under general anesthesia, in the animal's dorsal position, after disinfecting the operation area, the skin and abdominal integuments were cut along *linea alba*, from navel to pubic symphysis. After pulling up the uterus shank and horns, electrodes were implanted, based on plastic plates fixed to uterus muscular coat with 4 nodule stitches. Canals were led out through separate holes in abdominal integuments, from electrodes outwards. After leading penicillin into abdominal cavity, the peritoneum, muscles and skin were sutured in layers. Antibiotics and nowalgin were applied intramuscularly for 5 days after the operation. The research was initiated 2 weeks after the treatment. The registration of myoelectric activity was conducted by the use of Reega Duplex TR XVI electroencephalograph, with the time-constant of 0,01. The research was performed on sheep during anestrus sensitised with Stilboestrol-Polfa applying it intramuscularly in the dose of 0,04 mg kg^{-1}. During the experiments the following patent medicines were applied

intravenously in continuous infusion (through a catheter led into the external jugular vein before the experiment): adrenaline (Adrenalinum-Polfa) in the dose of 0,12-0,18 μg · kg^{-1} · min^{-1}, oxytocin (Oxytocin-Forster Vet.) in the dose of 0,25-0,4 i.u., propranolol (Propranololum hydrochloricum-Polfa) in the dose of 1mg · kg^{-1}, isoprenaline (Isoprenalinum hydrochloricum-Polfa) in the dose of 0,4-1,5 μg · kg^{-1} · min^{-1}, salbutamole (Salbutamole-Polfa) in the dose of 0,4-0,8 μg · kg^{-1} · min^{-1}.
In general, 25 experiments were performed on 5 sheep. The achieved uterograms were assessed by a visual method (11).

RESULTS AND DISCUSSION

A cyclic activity was demonstrated both in uterus horns and shank of sheep sensitised with Stilboestrol. The frequency of functional potential spindles in 24^{th} hour after the sensitisation ranged from 5 to 8 min^{-1}. The intensity of this activity – amplitude and needle discharge frequency – was increased 24 hours after the sensitisation and decreased to a total atrophy in 7^{th} – 10^{th} 24-hour period. The results of our research are confirmed by data obtained by other authors (13, 14, 19), who proved the stimulating influence of estrogens on uterus sheep contractibility. Lye et al. (12) are of the opinion that estrogens of these animals act diphasically – first they inhibit the uterus cramps, and then they stimulate them. The adrenaline applied after sheep sensitisation caused an increased myoelectric activity in miometrium. Sheep, 24 and 48 hours after the sensitising, revealed the highest reaction to the intravenous application of the hormone mentioned above. The reaction value depended on the adrenaline dose. In the electrouterographic record, adrenaline increased the needle discharge frequency up to the obliteration of breaks between cycles and the disappearance of occurrence periodicity. Depending on the applied dose value of this hormone, the reaction duration ranged from 2 to 4 min. The results obtained after applying adrenaline prove that alpha-adrenergic receptors are quantitatively predominant in uterus muscular coat of sheep sensitised with Stilboestrol. It is clear that adrenaline stimulates both types of adrenergic receptors (alpha and beta), which is reported by Rang and Dale (16). They state that the hormone mentioned above has lower affinity with the alpha-adrenergic receptor, which strengthens our hypothesis (Figure 1).

Figure 1



The administered isoprenaline decreased, to a various extent, the uterus myoelectric activity in experiments of sensitised sheep. In 20th minute after propranolol administration, the reapplied isoprenaline did not affect the activity mentioned above. These results demonstrate the presence of beta-adrenergic receptors in sheep miometrium. In experiments with salbutamole application, this patent medicine was proved to inhibit the uterus myoelectric activity, similarly as isoprenaline, in sensitised sheep. This reaction was not achieved after blocking beta-adrenergic receptors with propranolol. Salbutamole is a selective agonist of beta$_2$-adrenergic receptors, which indicates that the obtained reactions progress through this receptor-class stimulation (Figure 2-4).

Figure 2

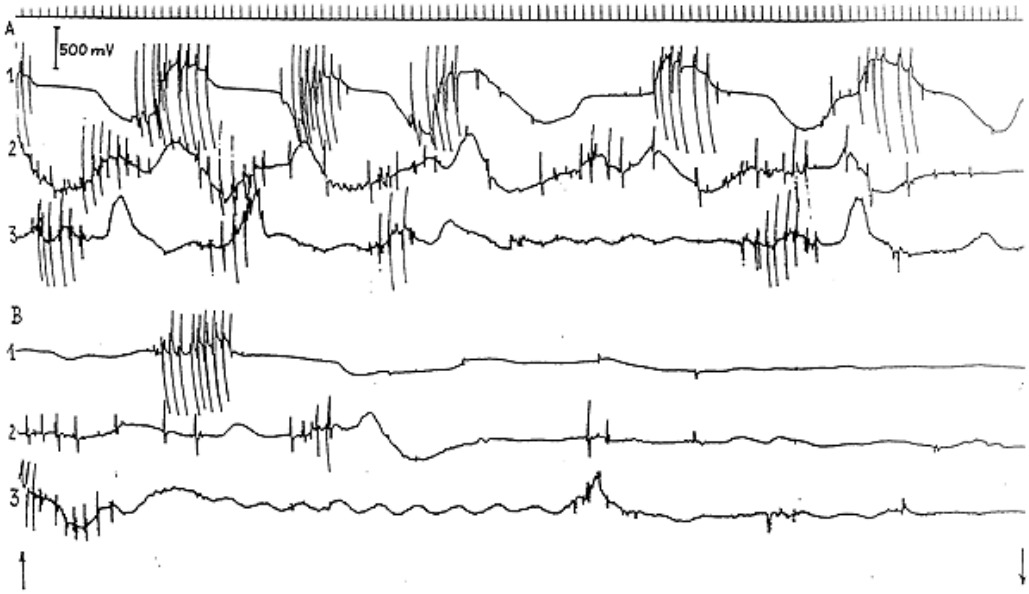


Figure 3

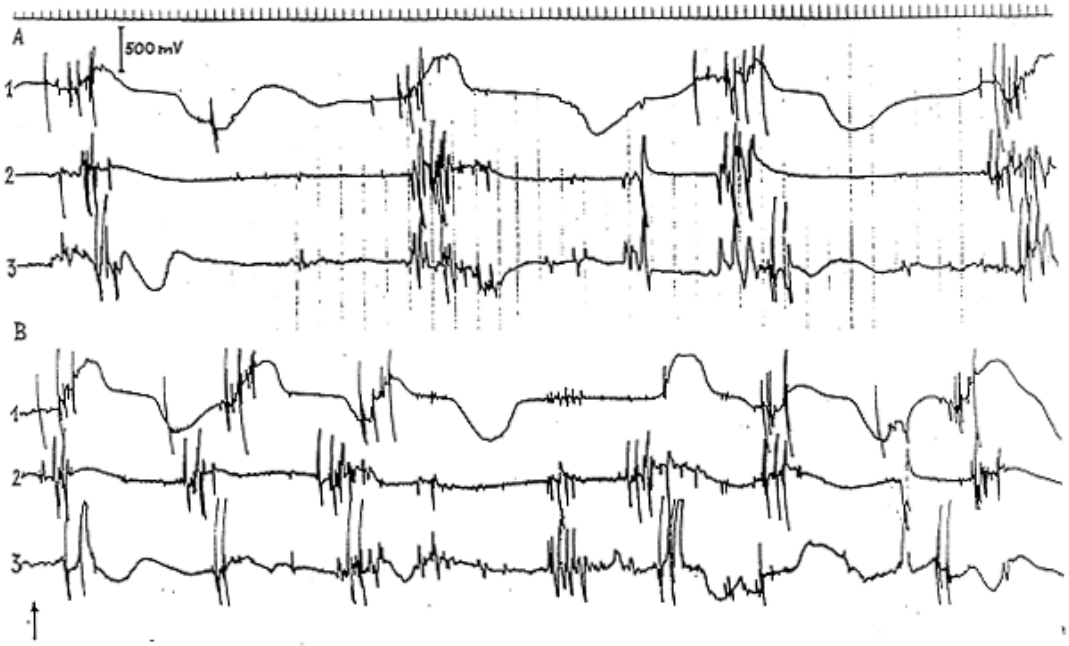
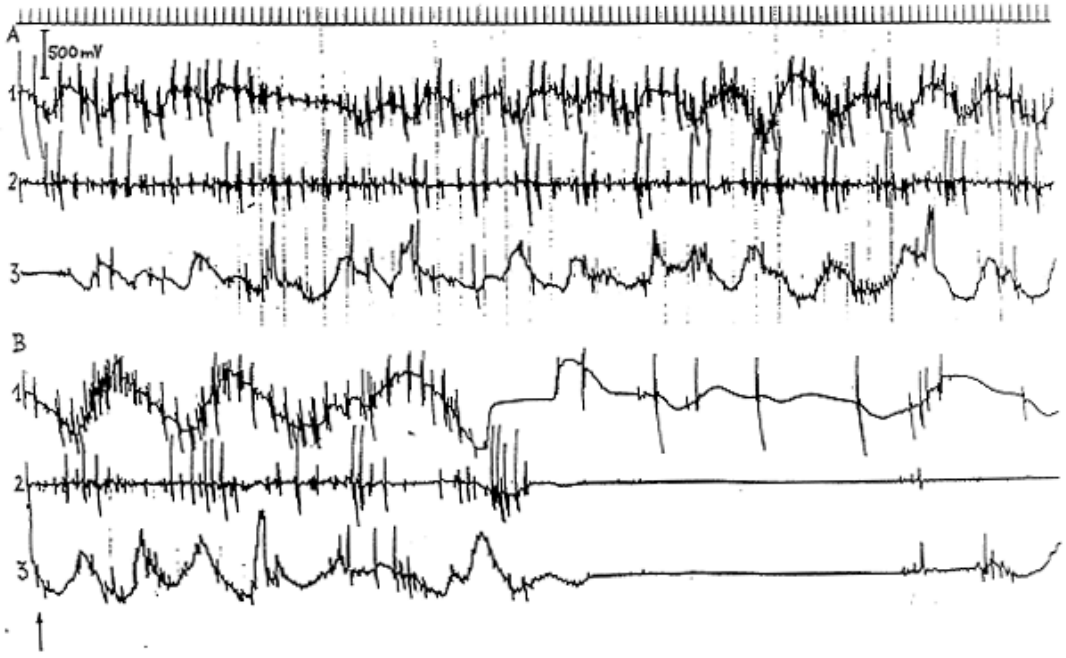


Figure 4

Additional experiments were performed to confirm the regulatory influence possibilities of the myoelectric activity through beta-adrenergic receptors. Sensitised sheep were administered isoprenaline or salbutamole after oxytocin injection. The beta-adrenergic receptor agonists mentioned above inhibit the myoelectric activity of sheep uterus stimulated by oxytocin. It indicates that beta-adrenergic receptors, despite a smaller number in relation to alpha-adrenergic receptors, occur in sheep uterus in a considerable quantity and may affect regulatory processes (Figure 5).

Figure 5



CONCLUSIONS

1. Beta-adrenergic receptor stimulation causes the reduction or inhibition of uterus myoelectric activity in sheep sensitised with Stilboestrol.
2. Beta-adrenergic receptors in sensitised sheep uterus, despite a smaller quantity in relation to alpha-adrenergic receptors, can participate in regulatory processes of the examined activity.

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