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Technology of manufacture and efficacy of obstetric pessaries for preventive therapy in cows

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Received: 20.11.2024 Revised: 22.02.2025 Accepted: 26.03.2025 **Abstract**. The relevance of this study lies in the need to develop new, effective means of preventive therapy for retained placenta in cows, a common issue in veterinary medicine. Retained placenta can lead to serious complications, highlighting the necessity for the implementation of effective therapeutic solutions. This study aimed to develop the composition and manufacturing technology of polyethylene oxide-based pessaries incorporating the uterine β -adrenoreceptor blocker, anapriline, and to assess their efficacy in the preventive treatment of retained placenta in cows. The

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pessaries were produced by casting into moulds, using polyethylene oxide with molecular weights of 400 and 1500 in a ratio of 1:9, with the addition of anapriline to the base. The study was conducted on four groups of cows: a control group, which did not receive obstetric pessaries, and three experimental groups, in which pessaries with different compositions containing anapriline were tested. The manufactured pharmaceutical compositions were investigated immediately after calving by introducing them into the space between the placenta and chorion. The results of the study demonstrated that the use of pessaries containing anapriline significantly improved the efficiency of placental separation. In particular, compositions No. 2 and No. 3 showed the best performance, reducing the average time of placental separation by 6.8 and 5.6 hours, respectively, compared with the control group. The proposed pessaries proved effective in the prevention of retained placenta. The findings also suggest potential for the development of an industrial manufacturing technology for these pessaries, facilitating their widespread use in cattle farming to enhance animal productivity and reduce economic losses. The practical value of this article lies in the fact that the developed pharmaceutical compositions can be employed in veterinary practice for the preventive therapy and treatment of retained placenta in cows

Keywords: cattle; reproductive health; retained placenta; prevention of obstetric pathology; postpartum period

INTRODUCTION

In the context of the post-war recovery of Ukraine's agricultural sector, the effective reproduction of the dairy cattle population is of particular importance. The decline in livestock numbers caused by military actions significantly complicates the stabilisation and development of the dairy industry. Addressing the challenges associated with improving the reproductive capacity of dairy herds requires a thorough scientific approach and the search for effective preventive and therapeutic measures to reduce the incidence of postpartum complications, particularly obstetric and gynaecological pathologies. One of the most common disorders in the postpartum period is retained placenta, which negatively impacts the overall health of the animals, their productivity, and subsequent reproductive function.

O. Kotykova *et al.* (2024) emphasise that cattle hold a significant place in the agricultural sector of many countries, ensuring the production of milk, meat, and other products. Their importance is not limited to productivity alone, as these animals play a key role in ensuring food security for the population and supporting agriculture. Overcoming the challenges related to the recovery of the dairy industry and ensuring the health of cattle is a priority for veterinary medicine in the current climate. S. Sidashova *et al.* (2024) note that veterinary professionals face the crucial task of minimising the negative impact on dairy herd reproduction, particularly by reducing the incidence of gynaecological diseases in cows.

Numerous scientific studies have highlighted the crucial role of the postpartum period in ensuring cow health and productivity. Notably, K. Macmillan *et al.* (2020) underscored the importance of complete involution of the reproductive organs after calving, which dictates the subsequent reproductive cycle and level of milk yield. V. Vlizlo *et al.* (2024) examined the interrelationship between postpartum disorders and reduced overall cow productivity. R. Schmitt *et*

al. (2023) emphasised that postpartum stress and hormonal changes exacerbate the risk of obstetric complications, which subsequently lead to reduced fertility.

Retained placenta is one of the most frequent complications of the third stage of labour in cows, requiring particular attention to ensure the future health and productivity of the animals. C. Luo et al. (2024) state that retained foetal membranes in dairy cows is a common reproductive disorder resulting from the firm attachment of maternal and foetal placental tissues. F. Mahnani et al. (2021) analysed the multifactorial nature of retained placenta, identifying housing conditions and the physiological and pathological states of the animals as key contributing factors. Among the primary causes of this complication, researchers identify age, parity, hormonal peculiarities, heredity, uterine hypotony and atony, adhesions between the maternal and foetal parts of the placenta, slowed involution, subclinical endometritis, as well as impaired uterine selfcleaning and increased turgor of the caruncles and cotyledons. Additional factors contributing to retained placenta include errors in feeding pregnant cows, lack of exercise, uterine overstretching, inflammatory processes in the placenta, and mechanical obstructions.

In turn, the application of modern approaches to the therapy of such pathologies, particularly the use of innovative agents like polyethylene oxide-based pessaries with the beta-blocker anaprilin, allows not only for addressing the cause of retained placenta but also promotes the normalisation of reproductive system functions. Thus, in the context of rehabilitating the livestock sector in Ukraine, there is a growing need for effective measures for the prevention and treatment of obstetric and gynaecological diseases in cows, which underscores the relevance of developing new veterinary solutions. This study aimed to investigate the efficacy of using intravaginal pessaries based on polyethylene oxide with the beta-blocker anaprilin for the prevention and treatment of retained placenta in dairy cows.

LITERATURE REVIEW

In their studies, S. Sidashova *et al.* (2024) established that, compared to healthy cows in the main dairy herd, a significantly higher prevalence of chronic subclinical endometritis symptoms was observed in the culled group, averaging around 34%. A significant prevalence of multi-organ gynaecological pathology was also detected, particularly chronic adhesive salpingitis. Among culled cows, this indicator increased by almost 31%, indicating the chronicity of prolonged inflammatory processes in the endometrium and the ciliated epithelium of the oviducts, which can lead to chronic, irreversible infertility.

Z. Rodriguez *et al.* (2023) note that the postpartum period involves the transition from pregnancy and parturition to lactation and preparation for a new gestation. During this time, the resistance of the cow's body is reduced, requiring specific management and feeding regimes that promote complete involution of the reproductive organs, high levels of lactation, and the proper functioning of all organs and systems. According to S. Washaya *et al.* (2025), cows enter a period of sexual inactivity after calving, the duration of which can vary significantly. This is due to factors such as inadequate feeding, the suckling process, hormonal imbalances, and the effects of stress.

In the context of modern intensive livestock farming, lactating cows genetically predisposed to high milk yields experience metabolic stress during the postpartum period. As highlighted by I. Hryshchuk et al. (2021) and R. Mylostyvyi et al. (2021), the transition period from pregnancy to lactation is a critical phase accompanied by significant physiological, metabolic, and inflammatory changes. Successful lactation is largely dependent on the efficiency of adaptation during the postpartum period. Consequently, challenges in lactation adaptation have been the subject of intensive research in dairy farming over the past 50 years. However, as underscored by S. Huralska and V. Olishevskyi (2024) and V. Vlizlo et al. (2024), the postpartum period continues to be critical for animal welfare, farm profitability, and stable milk production.

Diseases of the reproductive organs in cattle represent a significant challenge in modern veterinary obstetrics and gynaecology, as they are a primary cause of prolonged infertility in cows, leading to reduced milk yield, cessation of lactation, and premature culling. Such diseases result in profound structural changes in the endometrium and myometrium, manifesting as uterine hypotony, oedema of the serous and muscular membranes, diffuse infiltration of the endometrium by lymphoid elements, necrosis, and shedding of the superficial layer. As Matamala *et al.* (2021) emphasise, opportunistic microflora plays a significant role in the development of pathology, particularly through increased virulence and the number of drug-resistant strains, as well as the high incidence among pregnant animals. H. Beiranvand *et al.* (2024) report that an unfavourable intrauterine environment during pregnancy can cause long-lasting structural and physiological changes in foetal development, which may lead to health problems and reduced productivity in adulthood. Clinical conditions accompanying multiple pregnancies in cows include retained placenta, metritis, mastitis, lameness, and disorders of the digestive and respiratory systems.

Retained placenta in cows is a common postpartum complication that typically disrupts the reproductive cycle. As A. Mahnani et al. (2021) point out, subsequent conception can be delayed by 2-6 months, which in turn increases the calving interval, alters the timing of the next calving, raises the risk of uterine infections and infertility, negatively affects cyclicity, and reduces milk yield, thereby lowering the overall economic efficiency of production and the productivity of the industry. Furthermore, retained placenta can prolong uterine involution and provoke the development of cystic ovarian degeneration, chronic endometritis, pyometra, and other conditions. Despite treatment, this pathology significantly increases the risk of reduced productivity and the occurrence of reproductive disorders in cows. According to J. Rajoriya et al. (2024), this leads to a decrease in the number of offspring that could be obtained in a calendar year and negatively impacts the economic performance of farms of various ownership types. Based on the research results of Y. Amin et al. (2021), cows with retained placenta are at high risk of developing postpartum metritis. S. Boudelal et al. (2022) indicate that with complications such as retained placenta, the risk of developing diseases of various aetiologies increases.

Thus, researchers are paying particular attention to studying the characteristics of the postpartum period in cows, analysing its impact on animal health, productivity, and reproductive function, as well as preventive measures. R. Schmitt et al. (2023) demonstrate that the use of flunixin meglumine in the early postpartum period helps reduce inflammation, lowers the risk of metritis in heifers, improves the metabolic profile in cows, and decreases pain manifestations in all animals. F. Magata et al. (2021) in their studies indicate that the efficacy of using oxytocin for the prevention of retained foetal membranes (RFM) in dairy cows remains debatable. The physiological characteristics of animals during calving can influence the body's reaction to oxytocin. At the same time, the authors note that the effect of oxytocin varies depending on the course of calving. Administering the drug in the early postpartum period can reduce the risk of RFM development and mitigate the negative impact of obstetric intervention during calving on subsequent reproductive function. According to the research results of Y. Amin et al. (2023), the combination of prostaglandin F2 α with α -chymotrypsin is an effective method for treating retained placenta. This treatment ensures effective placental separation, promotes rapid uterine involution, reduces the likelihood of postpartum metritis, and improves reproductive performance.

Therefore, early diagnosis and preventive measures are crucial for minimising the risks of obstetric and gynaecological pathology. These actions help reduce economic losses and ensure effective treatment, which contributes to improving the reproductive health of cows and the overall productivity of farms.

MATERIALS AND METHODS

The studies were conducted between 2022 and 2023 at the private agricultural enterprise Savertsi in the Popilnia District of the Zhytomyr Region, on Holstein Friesian cows aged 3-5 years. To determine the efficacy of the therapeutic action of the manufactured moulded pessaries, four groups of cows with a history of the complete retained placenta during previous calvings were selected: a control group (without the use of obstetric pessaries) and three experimental groups: the first treated with obstetric pessaries of composition No. 1, the second with composition No. 2, and the third with composition No. 3. For the studies, a suppository base comprising polyethylene oxide with a molecular

weight of 400 and polyethylene oxide with a molecular weight of 1500 in a 1:9 ratio was chosen for the manufacture of pessaries weighing 10.0 g each. During the studies, the principles of the "General Ethical Principles of Experiments on Animals" (Reznikov, 2003), which comply with the requirements of the Law of Ukraine No. 3447-IV (2006), the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (1986), and the Universal Declaration on Animal Welfare (2007), were observed.

Pessaries were manufactured using a moulding method according to the techniques described in the patents (Utility model patent No. 152703, 2023; Utility model patent No. 152953, 2023). The process involved the following steps: at the preparatory stage, incoming analysis of anaprilin, polyethylene oxide 400, and polyethylene oxide 1500 was carried out to ensure compliance with the current State Pharmacopoeia of Ukraine (SPhU) (2015), after which all components were weighed. Next, solutions of anaprilin in polyethylene oxide 400 were prepared (Table 1). The manufactured medicinal compositions in the form of pessaries were tested immediately after calving by introducing them into the space between the placenta and the chorion.

Table 1. Composition of pessaries					
Composition	Component characteristics, g				
composition	Anaprilin	Polyethylene oxide 400	Polyethylene oxide 1500		
No. 1	0.01	0.6	9.19		
No. 2	0.02	0.8	8.58		
No. 3	0.03	1.0	7.97		

Source: developed by the authors

The process continued with setting the temperature of a water bath within the range of +40°C to +50°C. A suitable vessel (a chemical beaker made of neutra l glass) was placed in the bath, and the weighed polyethylene oxide 1500 substance was added to it. This was heated until it melted, and while maintaining the temperature and constant stirring, the solution of anaprilin in polyethylene oxide 400 was added. The resulting melted suppository mass was poured into moulds at 10 g per mould and cooled to a temperature between +1°C and +20°C until solidified. Next, to release the suppositories (sticks) from the moulds, the outer layer of each pessary was melted by heating and simultaneously rotating the mould with the pessary around its axis in a stream of hot air from a spirit lamp. The pessaries were then immediately pushed out of the moulds. The manufactured pessaries were wrapped in strips of paraffin paper. The average mass of the pessaries was 10.0 ± 0.32 g, and all manipulations were documented in the patents (Utility model patent No. 152703, 2023; Utility model patent No. 152953, 2023).

Sufficiently studied methods for reducing tissue hydration in caruncles and cotyledons involve the use

of osmotically active medicinal compositions. For instance, known soft dosage forms in the shape of sticks weighing 5-50 g include gelatin-glycerine gel, which possesses a complex of osmotically active, bacteriostatic, absorbent, and evacuative properties and is capable of maintaining the endometrial mucin layer due to its properties. Its composition includes 5%-50% gelatin, and 1%-75% glycerine, with the remainder being water. To enhance the absorbent properties of the pessaries, finely dispersed siliceous organic adsorbent Enterosgel was introduced into the melted gelatin-glycerine base. Additionally, to enhance the tonic effect on the myometrium, anaprilin, a non-selective uterine beta-adrenoceptor blocker, was added to the gelatin-glycerine suppository base. This results in increased tonic cholinergic influences on uterine contractions. Particular attention was paid to increasing the shelf life of the pessaries. Concurrently, the feasibility of using suppository bases comprising an alloy of polyethylene oxide 1500 with polyethylene oxide 400 in a 9:1 ratio was investigated. It was established that such bases exhibit more pronounced osmotic and antiseptic properties. Consequently, they were

concluded to be suitable for the treatment of obstetric and gynaecological complications in cows (Utility model patent No. 152703, 2023; Utility model patent No. 152953, 2023). The manufactured sticks complied with the requirements of the SPhU and were used in clinical trials (Table 2).

Table 2. Characteristics of pessary components					
Component name	Composition, No.	Weight, g	Influence of parameter on product quality		
Anaprilin _	1	0.01	Lower limit – insufficient tonic effect on uterine contractions		
	2	0.02	Optimal content – sufficient tonic effect on uterine contractions		
	3	0.03	Upper limit – excessive tonic effect on uterine contractions, risking cervical spasm		
Polyethylene – oxide 400 –	1	0.60	Lower limit – insufficient osmotic action and permeability into the interstitial space		
	2	0.80	Optimal content - sufficient osmotic action and permeability into the interstitial space		
	3	1.00	Upper limit – stick loses hardness		
Polyethylene oxide 1500	1	9.19	Upper limit – unacceptable brittleness of the stick		
	2	8.58	Optimal content – sufficient osmotic action of the substance and rheological properties of the stick		
	3	7.97	Lower limit – stick hardness is lost		

Note: the manufactured sticks complied with the requirements of the SPhU *Source:* developed by the authors

Statistical analysis of the obtained results was performed using Statistica 6.0 software (StatSoft Inc., USA). Fisher's F-test was used to assess significance. Differences between indicators were considered statistically significant at P < 0.05.

RESULTS AND DISCUSSION

Based on the study results, retained placental expulsion was observed in 2 cows in the control group. In the remaining cows, the placenta was expelled spontaneously, with an average time of 10.31 ± 4.13 hours (Fig. 1).





Note: * – *P* < 0.05 compared to the control group *Source:* developed by the authors

Pessaries of composition No. 1 (Table 1), with the minimum content of active substances, were administered to 10 experimental cows. Trials showed satisfactory therapeutic action, with complete retention of the foetal membranes for over 12 hours observed in one cow, representing 10% of the total number of experimental animals. The average time for placental detachment significantly decreased by 1.8 times (P < 0.05) compared to the control, amounting to 5.72 ± 2.82 hours. Trials of the pessaries manufactured according to composition No. 2 (Table 1), with a medium content of active substances, demonstrated

high therapeutic efficacy. No cases of placenta retention were diagnosed in this experimental group. The average time for detachment of the foetal portion of the placenta was 3.53 ± 1.53 hours, which was 2.9 times shorter (P < 0.05) compared to the analogous indicator in the control group cows. Trials of the pessaries manufactured according to composition No. 3 (Table 1), with the maximum permissible content of active substances, showed their sufficiently high therapeutic action; no cases of placenta retention were observed, and the average time for their detachment was 4.72 ± 1.11 hours.

Thus, the comparative analysis showed that the use of the manufactured medicinal compositions in the form of sticks on an osmotically active base comprising an alloy of polyethylene oxide with molecular weights of 400 and 1500 and the active substance anaprilin, for preventive therapy, ensures the detachment of the foetal placenta from the maternal part 4.6, 6.8, and 5.6 hours earlier than in the control group cows (which received no therapeutic intervention during the third stage of labour). During the analysis of the postpartum period in the control group of cows, subinvolution of the uterus was diagnosed in three animals, necessitating appropriate treatment. Oestrus was observed in 5 cows within the first 30 days postpartum and in another 3 by day 40. Purulent-catarrhal endometritis was detected in 2 cows, for which appropriate therapeutic measures were implemented.

According to the livestock management system at the research farm, the first oestrus in cows is not used for service to allow for the completion of involutionary processes in the reproductive organs; artificial insemination is performed at the second oestrus. In the control group, 7 cows exhibited a second oestrus cyclically (19-21 days after the first), while a prolonged oestrous cycle was diagnosed in three. Following artificial insemination, taking into account the treatment administered, the conception rate at first service in the control group cows was 50%. In the experimental groups, the involution of the reproductive organs proceeded without complications. Oestrus was recorded within 30 days postpartum, and the second oestrus was characterised by cyclicity. The conception rate at first service was significantly higher than in the control group: 70% in the first experimental group, 80% in the second, and 90% in the third. This confirms the high efficacy of the developed and applied preventive therapy. The obtained results indicate the advisability of using the proposed therapeutic approaches for the prevention of postpartum complications, which allows for timely uterine involution, improves the reproductive performance of animals and optimises breeding processes on farms.

The high prophylactic and therapeutic efficacy of the proposed medicinal products is attributed to the biological and physicochemical properties of each component in the composition, as well as the environment of the uterine cavity during calving and the postpartum period. An important factor is the preservation of the endometrial mucin layer, which provides optimal conditions for the restoration of the reproductive system. Key characteristics of this layer include its ability to absorb moisture, optimal viscosity, and low shear stress values, which promote effective placental detachment and the prevention of complications. The sufficient efficacy of local prophylactic and therapeutic agents formulated with water, oxidising agents, surfactants, coagulants, and astringents is hindered by their capacity for irritation and tissue denaturation; the destruction of cells, which become a nutrient medium for pathogenic microflora after losing morphological integrity; insufficiently active penetration to accumulations of causative agents of purulent-inflammatory processes deep within tissues; insufficiently intensive absorption from the surface of the endometrial mucous membrane; and the destruction of the endometrial mucin layer, which possesses a complex of beneficial properties (ensuring sufficient cell hydration; absorbing pathogens with subsequent evacuation from the uterine cavity; significantly reducing shear stress, thereby creating conditions for placental slippage) (Utility model patent No. 152703, 2023; Utility model patent No. 152953, 2023).

Several authors, such as Y. Li *et al.* (2022), have described the efficacy of using various interventions in the postpartum period, including pharmacological preparations, immunostimulants, osmotically active compositions, and other therapeutic solutions aimed at improving the involution of the reproductive organs and the prevention and treatment of gynaecological diseases in cows. Notably, L. Cui *et al.* (2021), in their studies, used meloxicam, a non-steroidal anti-inflammatory drug, to reduce pain and control inflammatory processes in cows with metritis. The results showed that meloxicam effectively reduces inflammation and prevents the growth of pathologically altered tissues, playing a key role in reducing the clinical manifestations of the disease.

H. Li *et al.* (2024) draw attention to the importance of selenium (*Se*) as a key trace element that influences animal growth and development, as well as rapid endometrial recovery. The researchers established that *Se* promotes the regeneration of the endometrial epithelium and restores the natural protective barriers of the uterus, allowing cows to return to normal reproductive cyclicity more quickly. The authors studied the effect of *Se* on the proliferation of endometrial epithelial cells in cows and concluded that *Se* can reduce their damage and stimulate cell proliferation and migration *in vitro* by increasing the expression of growth factor genes.

According to K. Jiang et al. (2024), interferon-tau (IFN- τ) is an innovative type of interferon that plays a key role in regulating inflammatory processes. *IFN-\tau* is capable of protecting endometrial epithelial cells from inflammatory damage. According to the authors, this opens up new horizons in understanding the molecular mechanisms that underpin the anti-inflammatory action of $IFN-\tau$ in cattle endometrial tissues and provides a theoretical basis for further investigation of its in vivo application for the prevention of negative consequences of endometritis. Such studies underscore the importance of a comprehensive approach to the therapy and prevention of gynaecological diseases in cows during the postpartum period using innovative agents and technologies. Comparative analysis indicates a shared trend in both human and veterinary medicine towards the implementation of innovative polymeric drug formulations to prevent pathological processes, which confirms the relevance and potential of further developments in this area. In this context, the results of the study by M. da Cunha Vieira *et al.* (2024), which demonstrate a positive clinical effect from the use of anaprilin, warrant attention.

The proposed medicinal compositions in the form of pessaries possess a unique biotechnological feature: they contain ingredients that do not disrupt the mucin layer, thereby ensuring their therapeutic and prophylactic action. Based on the results of the current studies, the use of these agents promotes the detachment of the foetal placenta on average 5.7 hours earlier compared to cows that did not receive the corresponding therapeutic intervention. The high efficacy of the developed agents is attributed to the optimal biological and physicochemical properties of the components, which preserve the integrity of the endometrial mucin layer, thus contributing to reduced shear stress and improved placental detachment. Calving, like parturition in other mammals, is a complex and stressful process for cows. Prolonged or complicated labour, delayed birth, or the need for difficult obstetric assistance for calf delivery can negatively impact the health, behaviour, and productivity of cows, and also increase the risks of calf morbidity and neonatal mortality. Therefore, ensuring a physiological course of calving is key to improving the welfare of both the cow and her offspring (Matamala et al., 2021). There is a significant body of scientific research concerning the prevalence of infertility in cattle. Researchers such as P. Sklyarov et al. (2023) note that this indicator in cows ranges from 20% to 90%. The main causes of infertility include individual and age-related characteristics of the animals, as well as feeding, housing, and management conditions (Kraievskyi et al., 2020; Bondarenko et al., 2020; Hryshchuk & Huralska, 2022).

The postpartum period in cows is characterised by complex physiological processes that significantly influence the state of the reproductive organs and the overall health of the animal. As S. Bors & A. Bors (2020) point out, it is during this period that uterine involution, endometrial regeneration, and the restoration of reproductive system functions occur. P. Skljarov and O. Zubkov (2020) express a similar view, emphasising the importance of this stage for the animal's subsequent productivity. According to the research results of M. Zhelavskyi et al. (2020), the negative impact of factors such as feeding and housing conditions during the last month of gestation can cause the development of pathological changes. In particular, this often leads to retained placenta after calving, which becomes a cause of inflammatory processes in the endometrium and requires timely diagnosis.

Inflammatory processes in the uterus and oviducts are a key factor in symptomatic infertility. This opinion is shared by S. Fedorenko and L. Kuraksina (2021) and A. Channo (2022), who emphasise the need for further research into the pathogenesis of infertility to develop effective means and methods for its prevention. As F. de Lima (2020) indicates, uterine diseases negatively affect the development of oocytes, follicles, and embryos, and the uterine environment has a prolonged impact on fertility. Uterine-origin pathologies that arise at the start of lactation affect not only the uterine tissues but also the ovaries, which significantly reduces the probability of pregnancy.

R. Chebel (2021) notes that studies predicting the risk of retained foetal membranes (RFM) and metritis development in dairy cows based on pre-calving haemograms, as well as immune and metabolic status assessment, allow for accurate identification of animals likely to develop uterine diseases after calving. The author also emphasises that identifying cows at low risk of uterine pathologies avoids the need for intensive postpartum monitoring. P. Nyabinwa et al. (2020) state that endometritis, a postpartum uterine infection in dairy cows, can lead to significant productivity losses, including reduced milk yield, milk discarded during treatment, and increased veterinary costs. To minimise milk yield losses and reduce economic damage, it is advisable to conduct timely diagnosis and effective treatment of such diseases.

According to R. Cocco et al. (2021), systematic review and meta-analysis (SR-MA) is a powerful tool for quantitatively assessing parameter variations using comparative data. This contributes to maximising productivity and ensuring animal welfare. For example, changes in the rumination activity of dairy cows before or immediately after calving can be considered as early markers of postpartum diseases. Such studies aimed to assess, using SR-MA, whether rumination time recorded during the pre- and postpartum periods would be a consistent and reliable early indicator of metritis in dairy cows. Retained foetal membranes in farm animals are a significant factor contributing to the development of inflammatory processes in the reproductive system. In such cases, the main general approach to treatment is the use of antibiotics, as supported by the research data of C. Hanzen and H. Rahab (2024). According to the results of the current study, obstetric pessaries with anaprilin demonstrated high efficacy in the prevention and treatment of retained placenta in cows. For instance, in the control group, the average time for placental detachment was 10 hours, whereas with the use of pessaries of composition No. 1, this indicator significantly decreased to 5 hours. Similar results were observed by V. Zakharin et al. (2024), who reported a significant reduction in the time for placental detachment when using pessaries with anaprilin. Specifically, in their study, the average time for placental detachment was approximately 7 hours. Thus, the obtained results indicate the high biotechnological efficacy of pessaries with anaprilin in the treatment of retained placenta in cows, leading to a reduction in the duration of retention

and a decreased risk of complications compared to traditional treatment methods.

CONCLUSIONS

The proposed medicinal compositions in the form of pessaries consist of components that do not disrupt the mucin layer covering the endometrium, thereby ensuring their therapeutic and prophylactic action. Pessaries containing anaprilin, based on an alloy of polyethylene oxide 400 with polyethylene oxide 1500, have significantly longer shelf lives compared to using a gelatinglycerine gel. The use of anaprilin in a polyethylene oxide suppository base, owing to its osmotic activity, more effectively reduces the hydration of endometrial cells compared to a gelatinglycerine base and exerts a better antiseptic effect on the protective mucin layer covering the endometrium. The application of anaprilin within pessaries on osmotically active polyethylene oxide bases, after their insertion into the uterine cavity of cows in the space between the placenta and the chorion, significantly improves and shortens the time of placental expulsion, thus preventing the development of complications.

Obstetric pessaries containing anaprilin in medicinal compositions of formulations No. 2 and No. 3 proved effective for the preventive therapy of retained placenta in cows, as evidenced by the reduction in the average time for its detachment. The medicinal compositions of

pessaries No. 2 and No. 3 demonstrated potential for further development of industrial production technology and implementation in veterinary practice. Specifically, in the control group, the average time for placental detachment was 10.31 ± 4.13 hours, while with the use of pessaries of formulation No. 1, this indicator decreased to 5.72 ± 2.82 hours (P < 0.05), in formulation No. 2 – to 3.53 ± 1.53 hours (P < 0.05), and in formulation No. 3 - to 4.72 ± 1.11 hours. The obtained results indicate the advisability of using the proposed therapeutic approaches for the prevention of postpartum complications, which allows for timely uterine involution, improves the reproductive performance of animals and optimises breeding processes on farms. In the future, the development of a technology for manufacturing pessaries with serratiopeptidase and the investigation of their clinical efficacy in obstetric practice for the prevention and treatment of postpartum complications in cows are planned.

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CONFLICT OF INTEREST

None.

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Технологія виготовлення та ефективність акушерських песаріїв для превентивної терапії корів

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Анотація. Актуальність роботи полягає у необхідності розробки нових, ефективних засобів превентивної терапії затримання посліду у корів, яке є поширеною проблемою у ветеринарії. Затримання посліду може спричинити серйозні ускладнення, що підкреслює необхідність впровадження ефективних терапевтичних рішень. Метою роботи була розробка складу, технології виготовлення та вивчення ефективності песаріїв на поліетиленоксидній основі з використанням β-блокатора адренорецепторів матки анаприліна для превентивної терапії затримання посліду у корів. Песарії виготовляли методом виливання у форми, використовуючи поліетиленоксид з молекулярною масою 400 і 1500 у співвідношенні 1:9 з додаванням анаприліну, який вводився до основи. Дослідження проводили на чотирьох групах корів: контрольній, в якій акушерські песарії не застосовували та трьох дослідних, на яких тестували песарії різного складу з анаприліном. Виготовлені лікарські композиції досліджували безпосередньо після отелення шляхом їх введення у проміжок між плацентою і хоріоном. Результати дослідження показали, що застосування песаріїв з анаприліном значно покращує показники ефективності відділення посліду. Зокрема, склад № 2 та № 3 продемонстрували найкращі показники, скорочуючи середній час відділення посліду на 6,8 і 5,6 годин відповідно у порівнянні з контрольною групою. Запропоновані песарії виявилися ефективними у профілактиці затримання посліду. Отримані результати також відкривають перспективи для розробки промислової технології виготовлення песаріїв, що забезпечить їх широке використання в скотарстві для підвищення продуктивності тварин та зниження економічних витрат. Практична цінність роботи полягає в тому, що розроблені лікарські композиції можуть використовуватися у ветеринарній практиці для превентивної терапії та лікування затримання посліду у корів

Ключові слова: велика рогата худоба; репродуктивне здоров'я; затримання посліду; профілактика акушерської патології; післяотельний період