

Optimization methods for correcting the duration of the anovulatory period of cattle

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Abstract. Post-calving anestrus leads to serious economic losses and is the reason for the animal culling. Deficiency of estrogen and hypofunctional state of the ovaries due to negative energy balance, as well as violations of the timing of postpartum involution of the uterus are considered the leading causes of an extended anovulatory period in fresh cows. A comparison was made of the therapeutic efficacy of Ovsynch scheme and Ovariovit preparation when used in first heifers with post-calving anestrus against the background of ovarian hypofunction. When using Ovsynch scheme, the fertility of the first insemination was 50%; estrous cyclicity recovered in 80% of first heifers. When using Ovariovit, the fertility of the first insemination was 60%; the estrous cycle was restored in 100% of first heifers.

1 Introduction

Post-calving anestrus has common occurrence in dairy farms. Even in the absence of postpartum complications, the lactation dominant significantly suppresses the reproductive function of a highly productive cow in the first months after calving. Long service period leads to serious economic losses and is the reason for animal culling, reduces the period of their economic use.

Normally, the first wave of follicular growth after calving appears on days 5-7 and ovulation of the first dominant follicle should occur by 18-20 days, and, accordingly, signs of estrus should appear (1). In those cases when a cow does not come to oestrus for a long time, it signals post-calving anestrus.

In livestock farms, up to 38% of cows have an extended anovulatory period, including as a result of a negative energy balance [2]. With a lack of energy in the body, the secretion of gonadotropins decreases, which in turn negatively affects the ability of the follicles to produce estradiol, which is necessary for their maturation and ovulation; the timing of the first ovulation, and hence the estrus, is significantly lengthened [3, 4].

Since ovulation of the dominant follicle is possible only when the estradiol level is sufficient to stimulate the preovulatory release of LH and FSH, a decrease in the basal level of estradiol is considered one of the leading causes of postpartum anestrus [2, 5, 6, 7].

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In addition to energy deficit, heat stress, changes in the functions of individual organs (liver, adrenal cortex), low levels of precursors (acetate, cholesterol), as well as steroid substances (phytoestrogens, phytoecdysteroids) and fats supplied with feed may lead to lower estradiol levels [8, 9, 10]. Significant estrogen losses during birth can also contribute to a decrease in their level in cows' blood in the postpartum period [11].

Postpartum diseases associated with a violation of the uterus involution timing are also one of the causes of postpartum anestrus. The incidence of postpartum endometritis is positively correlated with cases of uterine subinvolution and ovarian dysfunction. So, for example, of 222 fresh cows of the black pied Holstein breed with a productivity from 7000 kg to 11000 kg, 46% showed signs of endometritis, 39% had ovarian hypofunction and 13% had cysts; complete involution was observed only in 12% of cows [2].

The relationship was established between the nature of postpartum involutinal processes course with the hormone-synthesizing function of the ovaries. So, if rhythmic activity of the ovaries is noted during the normal course of cows' postpartum period, then in the pathological one there is a weekly delay in the third wave of follicular growth (at 25-30 days), which results in cystic atresia of the follicles. [12]. The lack of prostaglandins $PGF2\alpha$ synthesized by healthy mucous membrane of the uterus lowers the contractility of the myometrium and simultaneously slows down luteolysis, disrupts ovarian function.

In order to ensure the possibility of planning the production cycle at livestock enterprises, hormonal synchronization schemes are widely used (Presynch, Ovsynch, Double Ovsynch), which include injections of $PGF2\alpha$ and gonadoliberin and allow planning the manifestation of oestrus in most animals at a certain time.

Frequent use of GnRH can lead to depletion of the receptor apparatus and sensitivity loss of the pituitary gonadotropic cells secreting FSH and LH. In such cases, stimulatory therapy does not result in the desired way.

To resume cyclicity, it is extremely important to ensure the adequacy of hormones-regulators' interconnection in the hypothalamus-pituitary-ovary system against the background of metabolic imbalance correction. The combination of Ovariovit and Liarsin preparations has proven itself well in the hypofunctional state of the ovaries. Liarsin is a metabolic, it optimizes energy metabolism, prevents acidosis and ketosis. Containing phytoestrogens and inositol, Ovariovit activates the ovaries' function, the production of gonadotropic hormones, promotes the formation of a dominant follicle, and normalizes the estrous cycle.

The aim of this study was to compare the therapeutic efficacy of Ovsynch scheme and Ovariovit preparation when used in first heifers with post-calving anestrus. The objectives of the study were to assess the effect of Ovsynch scheme and Ovariovit preparation on follicular growth, manifestation of oestrus, restoration of the reproductive cycle and the fertility of the first insemination of first heifers.

2 Materials and methods

The study was carried out on the basis of APC "Druzhba" (Smolensk region, Pochinkovsky district) according to the approved plan for the clinical study PKI OV-R-01/2020. The study included 20 Brown Swiss breed first heifers of average body condition with signs of post-calving anestrus against the background of ovarian hypofunction, without symptoms of clinical or latent endometritis, hyperthermia. Emaciated animals or animals above the average degree of nutrition, as well as first heifers with luteal or follicular cysts, as well as those treated with hormonal drugs 40 days before the start of group formation were not included in the study. According to the farm scheme, all first heifers were administered with only Magestrofan (2.0 ml, i.m., once) within 12 hours after calving.

At the time of groups' formation, there were no signs of oestrus in the animals for 41-79 days after calving.

Ovarian hypofunction was confirmed by rectal and ultrasound studies. Ultrasound examinations were performed using a PS-301V veterinary ultrasound scanner (Partner-Vet LLC, RF).

The distribution of first heifers into the experimental and control groups was random. The groups were formed on the basis of analogs. In the experimental group ($n = 10$), Ovariovit was used at a dose of 5.0 ml intramuscularly 3 injections with an interval of 5 days (Day 1/Day 6/Day 12; on Day 1, Liarsin was additionally administered, 5.0 ml IM, once). Ovsynch scheme was used in the control group ($n = 10$): Day 1 - 1st injection of GnRH (Surfagon 50 μg , i.m.); after 7 days (Day 7) - introduction of prostaglandin F2 alpha (Magesτροφan®, 2 ml i.m.); Day 10 (morning 6:00) 2nd injection of GnRH (Surfagon 25 μg , i.m.) / after 12 hours - artificial insemination.

The animals' conditions of feeding and keeping (tied with daily walking on a specialized site) in the experimental and control groups were identical. Feeding: fully mixed diet: roughage (silage, haylage, hay) 55-60%, concentrates (flattened grains, cake (rape, soybean), compound feed (with a protein content of at least 19%) 40%, vitamin and mineral premix 1- 1.5 %%, salt, chalk, soda 1% each. Free access to water.

The effectiveness of ovarian function stimulation was assessed by oestrus manifestation and the growth of the dominant follicle (ultrasound and rectal examination). The timing and productivity of the first insemination and the effectiveness of estrous cyclicity restoration was also assessed. Additionally, adverse events and complications were considered.

3 Results and discussion

At the time of inclusion in the CS, all heifers were diagnosed with hypofunction: at rectal examination the ovaries were small (0.5 - 1.0 cm), smooth, had a dense consistency. Ultrasound examination revealed no cysts, small primordial follicles that did not protrude above the surface of the ovaries and were not detected during rectal examination were visible.

In the control group all the animals showed oestrus after 10 days after treatment according to Ovsynch scheme; during rectal and ultrasound examination, a growing dominant follicle was found in one of the ovaries. All animals were inseminated according to Ovsynch schedule. Pregnancy was confirmed in 5 heifers (50%). Three of the remaining five non-pregnant cows came back to oestrus within a month; in two (20%) - the estrous cyclicity did not recover, no growing follicles were found in these animals during rectal and ultrasound studies (Table 1).

In the experimental group, all the animals also reached oestrus. One heifer showed signs of oestrus on the 4th day from the start of treatment, two - on the 10-11th day from the start of treatment (after the 1st and 2nd Ovariovit injection, respectively). Thus, 7 first heifers (70%) required a full course of treatment (three injections of Ovariovit), and in 30% ovarian function recovered faster. Oestrus manifestation in the experimental group was observed on average by 15.2 ± 2.0 days (4-27 days), while the growing dominant follicles were visualized during rectal and ultrasound examination (Table 1).

Insemination of first heifers in the experimental group was carried out by visual detection of estrus and rut, as well as in the presence of dominant follicles according to the ultrasound results. After the first insemination (on the day of oestrus), pregnancy was confirmed in 60% of the animals. (Table 1). Nonpregnant cows (40%) re-showed signs of estrus in the following month. Thus, estrous cyclicity was restored in 100% of first heifers in this group (Table 1, Figure 1).

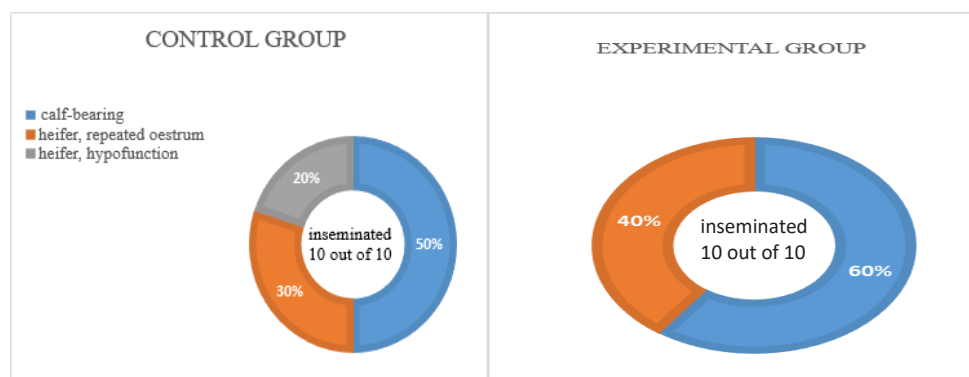


Fig. 1. Results of stimulating therapy in first heifers with post-calving anestrus in the experimental and control groups.

Comparative efficacy of ovarian hypofunction treatment in cows from of experimental and control groups is shown in table 1 and in figure 1.

Table 1. Treatment efficacy of ovarian hypofunction in first heifers with postpartum anestrus in the experimental and control groups.

N o.	Indicator	Control group (n = 10) scheme Ovsynch	Experimental group (n=10) Ovariovit preparation
1.	The proportion of animals in the group with signs of ovarian hypofunction at the start of treatment	100%	100%
2.	Proportion of animals with signs of ovarian hypofunction after treatment	0	0
3.	Proportion of animals with follicular or luteal cysts after treatment	0	0
4.	Proportion of inseminated animals within one month from the start of treatment	100%	100%
5.	Timing of the first insemination	10th day	15.2 ± 2.0 (4-27)th day
6.	Fertility of the first insemination	50%	60%
7.	The proportion of animals with restored estrous cycle	80%	100%

Thus, the use of both Ovsynch scheme and Ovariovit preparation ensured the activation of ovarian function, the growth of the dominant follicle, followed by ovulation and the manifestation of estrus signs in all animals in the group for a month. The fertility rate of the first first heifers' insemination did not differ significantly between the groups, but in the experimental one (Ovariovit) it was 10% higher. It should be noted that despite the initially expressed follicles' growth in all first heifers under the influence of hormonal stimulation, in the following month some non-inseminated animals showed signs of ovarian hypofunction again, i.e., estrous cyclicity was not restored in 20%. After the use of Ovariovit in the experimental group, the growth of follicles and signs of oestrus were observed in all non-inseminated first heifers - restoration of estrous cycle occurred in 100% of animals.

Adverse reactions and side (undesirable) effects. During the study period, no adverse reactions and / or adverse events were observed in either the experimental or control groups.

4 Conclusions

The use of Ovariovit in first heifers with postpartum anestrus against the background of ovarian hypofunction in the conditions of APC "Druzhba" (Smolensk region) ensured the restoration of the reproductive cycle in 100% of the animals; the fertility of the first insemination amounted to 60%. When using Ovsynch scheme, the fertility of the first insemination was 50%; estrous cyclicity recovered in 80% of first heifers. Ovariovit can be recommended for the treatment of ovarian hypofunction, restoration of the reproductive cycle in cows and first heifers with postpartum anestrus.

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