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The Dairy Cows' Fertility Improvement

Dauletbek Muratbayev[1]*, Zeinolla Tokayev[1], Vasyl Stefanyk[2], Serik Tussupov[1] and Yermekkazy Bilyalov[1]

[1]Shakarim State University of Semey, Agrarian Faculty, Department of Veterinary Medicine, Semey, Republic of Kazakhstan
[2]Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, Lviv Ukraine
***Corresponding author:** dmuratbayev@gmail.com

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ABSTRACT

Modern cattle farming needs to find ways to increase the fertility of dairy cows. That's why we had the goal to study the application of different schemes for stimulating increased fertility in cows. For investigation of the possibility of increasing the fertility of cows, three groups of animals were formed: control and two experimental groups, i.e., The first stimulation scheme included Surfagon (15μg) 1-3h before insemination, Catosal, Gabivit-Se, 10-15min before insemination, and Uteroton. Progesterone (2.5%), Catosal, and Gabivit-Se were injected on the 8th day after insemination. Animals of the second stimulated group received Ovariovit 30-60min before insemination. At the 25-30th inseminated day, were injected Ovariovit and Liarsin. Experimental results were compared by the data of the control group (without stimulation using). Common diagnostics of the animal's wellness was conducted by clinical and laboratory studies. And the pregnancy was additionally diagnosed by a portable ultrasound scanner AcuVista RS880b and MyLabOneVET with a rectal linear probe. It was found using a complex insemination stimulation scheme aimed at preventing infertility in cows can reduce the service period to 85.60±1.93 days and the insemination index to 1.9±0.25 days. Homeopathic preparations using made it possible to achieve a service-period of 89.50±2.42 days and an insemination index of 2.0±0.27. At the same time, animal hematology study results before and after the experiment in the compare with the Control Group demonstrated the safety of the proposed schemes because of the constant of the main blood parameters. So, the introduction of the proposed stimulation schemes can shorten the service period and raise fecundation that have a great impact on the economic efficiency of the cattle breeding.

Key words: Cows, Infertility, Fertility Increase, Stimulation, Fecundation Index

INTRODUCTION

Livestock is an essential element in agricultural manufacture. High-level bloodstock reproduction remains the primary efficient regard. A cattle breeding entirely depends on artificial insemination effectiveness that is relying on sperm quality, methodological support of the optimal breeding time identifying, identification and timely correction of fertility, early diagnosis of pregnancy, and gynecological pathologies. It is crucial to have excellent veterinary support for the reproduction process.

Cow infertility becomes a reason for losses in getting calves by 15-30%. So, it becomes a reason for an economic decrease for the farm (Givens et al. 2009; Qaltaev et al. 2011). It is caused by the fertility decrease. This becomes a connected reason for falling milk yield. Literature data report that decrease in the cows' fertilization by 17–40% causes of calf-missing and falling milk productivity foul by 12–18% (Aminova et al. 2019). Fertility increase remains to depend on minimized infertility days and getting up of the breeding index. The United States of America has these indexes in decrease stably by 0.45% per year for twenty years. In Europe indexes that are influenced by fertility have different movements: getting down by 1% per year in Great Britain but rising in Belgium (Remnant et al. 2015; Morrell et al. 2018).

There are methods for fertility improvement and the hormonal one is shared (Seferi et al. 2018; Bisla et al. 2018). For this aim can be used gonadotropin-releasing hormone or its analogs (Surfagon). It has to be injected at the first 6 h after estrus begins. This gives a positive result by 19.0% in case of double insemination; and by 13.6% in case of single (Kraevskiy et al. 2020). If Surfagon has

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been injected after insemination (on 8th and 12th days) the fecundation became upper at 91.7%. Moreover, this reduced the fetal death. A combination of Surfagon and biologically active preparations increases fecundation to 95% (Boriskin et al. 2005).

The other hormone - Prostaglandin E - has a different activity to fertility by season: fecundation had increased by 16.6% in summer and 23.5% in autumn in artificial insemination (But 2009). The progesterone introduced got up fertility near 5% (Loiola et al. 2018). But the effect from its injection isn't the same in different research conditions: it has no efficiency at the 1st and 2nd estrus day but is positive become in the case of progesterone injection (100 mg) at the 1st, 2nd, 3rd, and 4th pregnancy days (Chacher et al. 2017; França et al. 2017). Common injection progesterone and folliculin provided successful fecundation in 77.7%. But hormone-using stimulation is efficient at the first two cycles and decreases the insemination index. It has been remembered fertility improvement can be obtained (by 16%) in the case of correction feeding and supplements using (Sharkey et al. 2020; Luta et al. 2021). The other way is to correct the artificial insemination and some technical requirements to prevent reproductive tract trauma (de Oliveira Marques et al. 2009; Aminova et al. 2019).

Researchers and practitioners are looking for new variants of fertility increases. So, Luteotropine drug has no properties to change a blood estrogen concentration but have a luteotropic effect. It increases the insemination effectiveness by 10-15% (dosage1.0 mg; at the 6-7th day after artificial insemination) (Baimishev et al. 2018). Peloidin drug (LTD Vektor, 630559, Koltsovo, Novosibirsk region, Russia) in the complex therapy with sapropelic mud and vibroacoustic massage with infrared radiation gets a positive effect (Porfiryev 1996).

Using the pulsed magnetic field and micro-vibration for "problem" cows before insemination improved the ovules' fecundation and embryo survival. Fertility increased by 30%. In case of stimulation before and after insemination, fertility increases by 25% (Lin et al. 2021).

So, the aim of our research was to discover and testing of a new cure for fertility improvement.

MATERIALS AND METHODS

The research was conducted in the 'Kamyshinskoye' farm enterprise (Shemonaykhinskiy region, East Kazakhstan, Republic of Kazakhstan) from 2017 to 2018. Forty-five cows of American Ayrshire breed with an average of 8-11yrs and productivity not less than 6000kg per year were included in the experimental study. These animals were randomized divided into three experimental groups. The first one – a Control group - was without any treatment and was held in common conditions with experimental animal groups. The other two groups had got different stimulation for fertility improvement. All research stages were conducted according to the commonly accepted rules and the Research Protocol was approved by the Ethics Committee of the Shakarim State University of Semey.

The second animal group has got the hormone based stimulation schema that included injection of Surfagon (CJSC Mosagrogen Russia) (dosage 3mL, 15μg), Catosal® (Bayer AG, 51368, Leverkusen, Germany) (dosage 15mL), and Gabivit-Se (VIF LLC, 142279, Festivalna avenue, 9; Serpukhov district, Moscow region, Russia) (dosage 15mL) at 1–3h before insemination. After that, in 10–15min before insemination was injected Uterotone (LTD Nita Farm, 410010 Osipova St. 1, Saratov, Russia) (dosage 10mL). The next stimulation series was conducted on the 8th day after insemination with an injection of 2.5% progesterone solution (dosage 2mL), Catosal® (dosage 15mL), and Gabivit-Se (dosage 15mL).

The third animal group has got the homeopathy stimulation schema that included an injection of Ovariovit (Helvet, 141700, Vinogradnaya St., 13, Dolgoprudny, Moscow region, Russia) (dosage 5mL) at 30-60min before insemination; Ovariovit and Liarsin (Helvet, 141700, Vinogradnaya St., 13, Dolgoprudny, Moscow region, Russia) injection (dosage 5mL) on the 25-30th day after insemination.

A portable ultrasound scanners AcuVista RS880b (ACUVISTA (RAY SYSTEMS), 12F, 221, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea 13494, 2014) and MyLabOneVET (Via E. Melen, 77 16152 Genova Italy, 2016; with a rectal linear probe) were used to diagnose the state of the cow's reproductive organs and set of pregnancy. Hematological tests were hold with total-automatic veterinary hematological analyzer PCE 90 (HTI, 20 Alice Agnew Drive North Attleboro, MA 02763 USA, 2012). The range on the protein in the blood serum was tested by the KFK-3-01 photometer (ZOMZ, Moscow Region, Sergiev Posad, Red Army Avenue, 212 V). And the hemoglobin level was checked by automatic hemoanalyzer ABACUS JUNIOR Pse90Vet (DIATRON Group, Austria, Perchtoldsdorf).

The processing of the research results was conducted by the variation statistics method in the Microsoft Excel of the Microsoft Office package. Arithmetic mean values (mean±SE) were determined and the reliability of the compared values (P). Differences were taken as significant at $P<0.05$.

RESULTS

The Results of Fertility Stimulations Schemes

The introduction of the schema fertility stimulation has shown positive results (Fig. 1; Fig. 2). We can note the reduced service period in two groups that have got fertility stimulation schema. And the group that stimulation was based on the hormonal introduction demonstrated the best result (85 days from the calving to subsequent fertilization). The third group had little worst results of 89 days instead of the control 100 days (Fig. 1).

The other fertilization parameter is the conception rate. It has to be noted that fecundation index had a stabile positive correlation. In the Control group it was at the rate of conception rate 2.40 (Fig. 2), some less rate was fixed for the schema in homeopathy stimulation based (2.0) and for the animals that have got a hormone-stimulation schema it was fixed at the rate of 1.9 (1.9±0.25).

So, we can note that in the case of stimulation using the service period became shorter, and this would have a positive economic effect. The combination of hormonal therapy (Surfagon, Progesterone), vitamin and minera

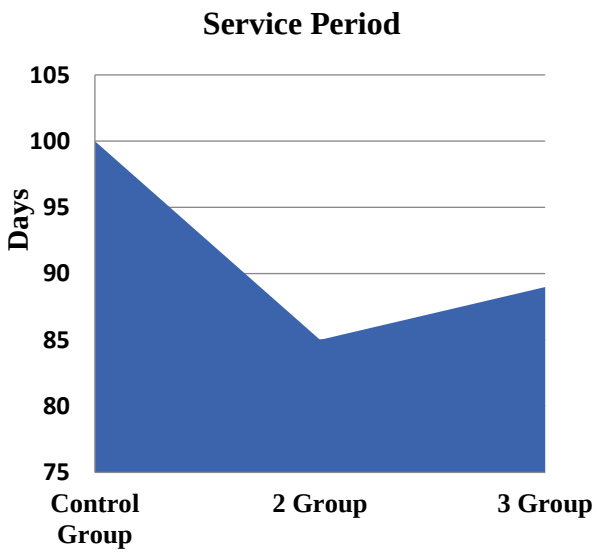

Fig. 1: The measurements of the duration of the service period (Days/hours?) in three tested animal groups. Control group: Animal's group without any stimulation, Group 2: Animals got hormone-using stimulation, and Group 3: Animals got homeopathic stimulation of fertility.

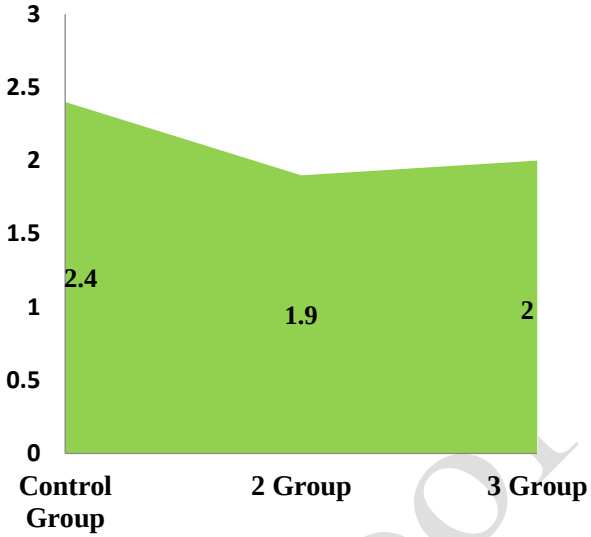

Fig. 2: The conception rate (Units??) in three tested animal groups. Control group: Animal's group without any stimulation, Group 2: Animals got hormone-using stimulation, and Group 3: Animals got homeopathic stimulation of fertility.

Table 1: Cow's blood indices before stimulation (n=15)

Parameters	Units	The standard range	Control Group	Group 2	Group 3
Hemoglobin	g/dL	8-15	11.36±0.36	11.58±0.26*	11.35±0.30*
Total protein	g/L	6-8	7.93±0.02	8.65±0.05*	8.41±0.09*
Total leucocytes	10^9/L	4.5-12	7.36±0.09	7.23±0.04*	7.28±0.08*
Monocytes	10^9/L	2-7	3.70±0.25	3.83±0.20*	3.95±0.18*
Lymphocytes	10^9/L	40-75	65.50±0.19	64.20±0.40*	65.92±0.23*

Each group consisted of 15 animals. Control group: Animal's group without any stimulation, Group 2: Animals got hormone-using stimulation, and Group 3: Animals got homeopathic stimulation of fertility. Values bearing asterisks in row differ significantly ($P<0.05$).

Table 2: Cow's blood indices after stimulation

Parameters	Units	Reference range	Control Group	Group 2	Group 3
Hemoglobin	g/dL	8-15	11.43±0.23*	11.62±0.27*	11.39±0.30*
Total protein	g/L	6-8	8.54±0.04*	8.55±0.04*	8.49±0.09*
Total leucocytes	10^9/L	4.5-12	7.33±0.05*	7.25±0.05*	7.31±0.07*
Monocytes	10^9/L	2-7	3.73±0.24*	4.53±0.18*	4.45±0.17*
Lymphocytes	10^9/L	40-75	65.25±0.25*	63.70±0.40*	66.27±0.23*

Each group consisted of 15 animals. Control group: Animal's group without any stimulation, Group 2: Animals got hormone-using stimulation, and Group 3: Animals got homeopathic stimulation of fertility. Values bearing asterisks in row differ significantly ($P<0.05$).

preparations (Gabivit-Se, Catosal®), and Uteron had better treatment effects on a cows' fertility improvement. Cows could be inseminated at 85.60±1.93 days after calving.

The Ovariovit and the Liarsin using (homeopathy schema) became shorter service periods by 89.50±2.42 days, and the fecundation index was 2.0 compared to the control one. So, represented stimulation schemes became shorter service periods by 11-15%, and the fecundation index became better by 17-21%.

The Blood Indices

Hematological indices were tested to install the general body's parameters of the animals. It hadn't found significant changes (Table 1 and Table 2). It seems that fertility stimulation had no general influence on the cows' body conditions. The test of the blood morphological parameters showed the same condition of all animal groups.

We can observe the almost constant protein level and leukocyte's rate is in norm. This gives us the possibility to declare, there is no progress of any inflammatory process in the body because of the stimulation schemes introduced. So, the proposed stimulation fertility schemes are safe. They didn't change the total common parameters that characterized the organism's state. And the main they had a significant stimulating effect on the reproductive system which was the main task of our findings.

DISCUSSION

There are many research related to fertility improvement with the medic stimulation. Infertility decreasing process needs the organization of the fertility improving specialist job and improving insemination of animals in particular. We have proposed 2 schemes for fertility improvement. Also, has been provided the experimental comparison of the proposed schemes.

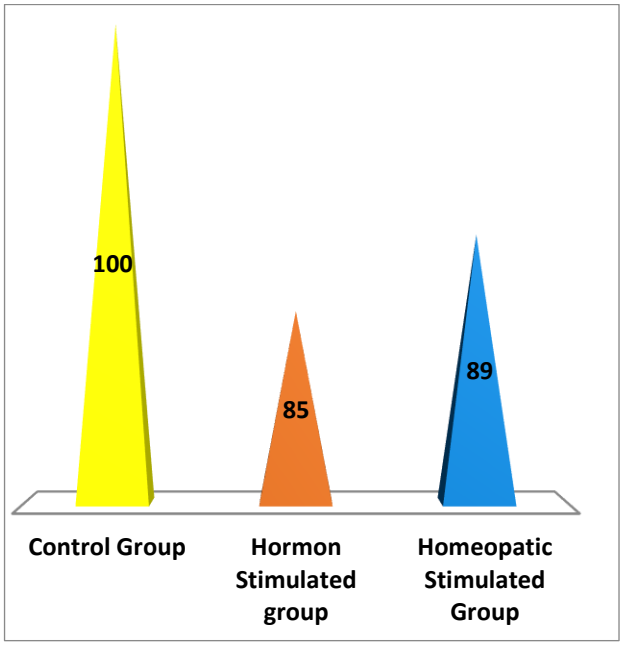

Fig. 3: The duration of the service-period (days) in the studied animal's groups.

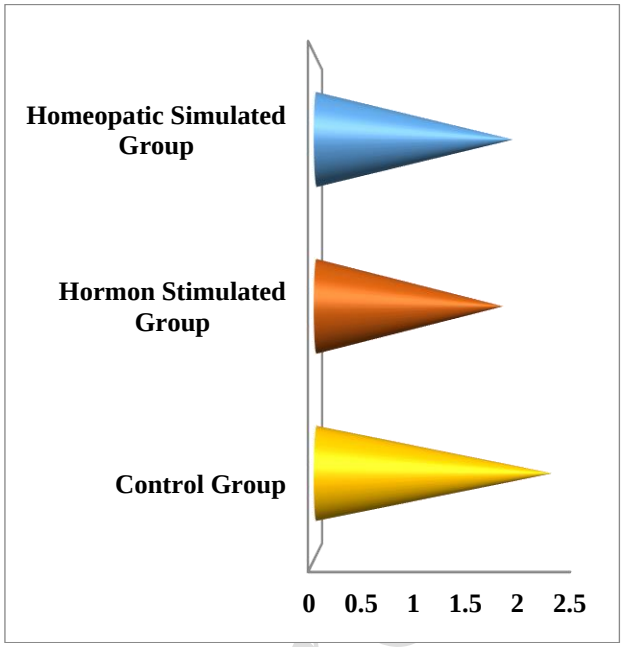

Fig. 4: The assessment of the insemination index (Units???) after calving in the control and experimental groups.

We have regimented complex treatment with a combination of hormone preparations (Surfagon, Progesterone), vitamin-minerals cures (Gabivit-Se, Catosal®), and Uterone. This complex has shown high efficacy. The proposed by us method has advantaged fertility in 14.8%. Surfagon is a synthetic analog of Gonadotropin-releasing hormone (GnRH) (Mann and Haresign 2001; Satterfield et al. 2006). This substance bound to anterior pituitary gland cell receptors (Bekenov et al. 2019) This causes a short-term racing sex hormones level in the blood serum. The increased gonadotropin content persists for 3-4h after injection (Mee et al. 1993; Nowicki 2021).

The second stimulation scheme was based on the homeopathic cure. We used a well-known approach to creating drugs with its based on minerals, plant, and organic components (Kumar et al. 2022). This complex eliminates inflammatory processes at the genitals mucous membranes and regulates Ca^{2+} metabolism, stops genital-inflammation and reduces uterus tone, improves animals' genitals' blood circulation, regulates reproductive cycles, restores animals' reproductive function, and normalize the hormonal background (Kumar et al. 2020; Mimoune et al. 2021; Kondruchina and Ivanova 2021). We can say about a positive effect of using of the homeopathic cure at the cow's reproductive system as demonstrated by Souto et al. (2019) and Dhara and Sharma (2019).

For the assessment of the stimulating schemes results we have compared such parameters as service period (Fig. 3) and insemination index (Fig. 4).

So, the results have demonstrated the service period was 85.60±1.93 days at the Surfagon stimulated Group and the insemination index was at 1.9±0.25. Such parameters in the Homeopathic stimulated Group were 89.50±2.42 and 2.0. Figs. 1 to 3 demonstrate the experimental groups had better results compared to the Control one.

So, all these effects have good action on the cows' insemination and impregnation. Our results were better than other experiments and in the homeopathic stimulated group. Zubova et al. (2017) have decreased the service period to 122±2.0 days. This index was less in our research in 35.5 days. The proposed by us a homeopathic scheme is efficient and can be introduced in the manufacture.

It's well known, all cure uses have to be hard regimented for the efficient livestock manufacture function and to get qualitative production (Bansod et al. 2021). Hematological test results of the experimental group animals have shown there were no significant changes in the cows' blood parameters after stimulation. This fact indicates the safety of the selected stimulation schemes for animals. That's why the proposed treatment can be an alternative to modern hormonal schemes for increasing cow fertility. Homeopathic schemes for fertility improvement are promising. This is proved by using such preparations on ecological farms.

Conclusion

Often cattle of the Kazakhstan farms have not-balanced ration. It is one of the reasons for the fertility stimulation need. The prevention of cow's infertility is ineffective with single preparation using and complex cure regimens are needed. Our studies show that a hormone-based treatment regimen (Surfagon with Progesterone) combined with vitamin-mineral cures (Gabivit-Se and Catosal®) and Uterone was the most efficient to recover cows' reproductive system. The service period was reduced to 85.60±1.93 days, and the fecundation index became 1.9±0.25. In another stimulated group where homeopathic remedies were used. The service period became 89.50±2.42 days, and the fecundation index was 2.0. And such results are significantly better compared to the control group. The homeopathic scheme had a little less efficient instead of

the hormone-using one. However, the homeopathic cure has a range of advantages. The main is a natural action. These drugs do not cause addiction and oppression, so they are harmless. That's why we can recommend using the proposed by us schemes for improving cows' fertility. Complex and homeopathy schemes have demonstrated their usefulness. If we take into account the decrease of the hormone schema efficiency in the long term using we can conclude that homeopathy-based therapy is more perspective direction for introducing it in cattle breeding. This is provided due to the lighter and more nature stimulation effect of the homeopathy stimulation schema of the cattle organism. So, we can get improved fertility possibilities of the animals without cure tolerance creating. The data of the current research can be helpful for practices that are in the problem of cows' infertility treatment, and for final year and postgraduate students.

Author's contribution

Dauletbek Muratbayev and Zeinolla Tokayev were the creators of the research design, had a part in the research data processing and results analysis as well as the creation of the conclusions of the presented research. Dauletbek Muratbayev was the main creator of the experimental and discussion part of the article. Vasyl Stefanyk had a part in the study design creation, consulted in its correction in the manufacture conditions, and made the prime critical review of the presentative of the research data. Serik Tussupov and Yermekkazy Bilyalov conducted the experimental part of the study, collected research data, and created the introduction part of the article.

Additional information

The research has not been sponsored. There is no conflict of interest in the presented research.

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