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The instrumental method of pregnancy and infertility diagnosis in cattle: Age-wise efficiency

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Abstract

Background and Aim. This article shows the results of the effectiveness of an instrumental method for diagnosing pregnancy and infertility of cows, taking into account the age of the animals. Due to changes in the body of animals of different ages, it is necessary to pay attention to the specifics of the work on the diagnosis of pregnancy and infertility.

Materials and Methods. Research work was carried out in 3 farms. The determination of pregnancy in animals is carried out using clinical and biophysical studies. The device "Pregnancy diagnosis" was used for the instrumental diagnostic method.

Results. The effectiveness of an instrumental diagnostic method has been revealed, which allows to diagnose pregnancy and infertility of cows with high accuracy in the conditions of livestock farms in veterinary medicine, paying attention to the results in cows of different ages. The effectiveness of the instrumental method in the diagnosis of cows under the age of 2 years, 3-5 years of pregnancy is 83%, infertility is 84.6%; and in cows older than 5 years of pregnancy is 79.6%, infertility is 63.6%. The determination of pregnancy of cows showed an error of 7%, and the determination of infertility-3.3%.

Conclusion. There are many methods for early detection of pregnancy in cows, but the most accurate and common are ultrasound and rectal palpation. These methods are safe and effective for diagnosing pregnancy in cattle. Although ultrasound may be more expensive, in this regard, our research shows the results of an instrumental method for diagnosing pregnancy.

Key words: age; cow; infertility; instrumental method; pregnancy diagnosis.

Introduction

Age-related variation in the animal organism is one of the main issues in cattle breeding. In addition, physiological criteria can be considered as one of the most important criterion for this variation, which varies not only during sexual development, but throughout the entire reproductive period of the animal. The value of the animal's age during the birth period is distinguished by the animal's body's resistance to external factors and diseases, that is, this indicator has an impact on the quality and maturity of the young cattle in utero.

Pregnancy detection in cattle is of great practical and economic importance and is one of the most important veterinary and zootechnical measures. This allows controlling the fertilization of animals [1].

The age of the herd may vary from year to year, proper herd management must include an understanding of the impact of age on birth rates, calving intervals, and birth weight [2].

The age of the female during pregnancy has an important influence on the nutritional environment for the growth of the embryo and fetus. The potential influence of the age of the heifer and cow on the

initial period of gestation, fetal growth and development, as well as on the period after calving has been determined [3].

Currently, there is very little data on the influence of the age of an animal on pregnancy and on the young cattle, the specifics of diagnosing pregnancy and infertility in connection with variations in the body of animals of different ages.

In this regard, the effectiveness of the instrumental method for diagnosing pregnancy and infertility of cows, taking into account the age of the animals, was studied.

Materials and methods

The conducted scientific research was approved by the ethical commission of the university "Minutes of the meeting of the local ethical commission on biological and medical ethics for research, the object of which is an animal S. Seifullin Kazakh Agrotechnical University No. 3 dated 03.11. 2022.

Research work was carried out by S. Seifullin Kazakh Agrotechnical University in the Akmola region, Production cooperative "Izhevskoye", "Zhaksylyk-Agro" LLP, "Salut" North Kazakhstan Oblast LLP.

Research materials: obstetric equipment, ultrasound scanner "EMP V-9" (China), ultrasound scanner "Easi-Scan" (UK), device for detecting pregnancy and infertility "Pregnancy Diagnosis", animal registration log, cows of different age, disposable rubber gloves, gown, rubber boots, Vaseline, etc. [4].

Determining the impact of cow age on instrumental diagnostic studies of pregnancy and infertility is directly related to age-related variations in the genital organs that occur in the animal's body.

Pregnancy detection in animals is carried out using clinical and biophysical studies. Clinical methods include both external (inspection, palpation, auscultation) and internal examinations (rectal).

External examination - the cow is checked outdoors or in a well-lit room. During the examination the protrusion of the right abdominal wall from the second half of the uterus and filling of the right hungry fossa are revealed. By the end of the seventh month of gestation period, the lower part of the right abdominal wall goes down, swelling of the abdominal wall and limbs, breast enlargement, and swelling of the vulva are observed [5].

The presence of the fetus and its movement can determined by palpation. To palpate the fetus, the examiner stands to the right of the cow, placing his right hand on the abdominal wall in the lower leg area. Palm pressure pushes the abdominal wall inward and then quickly releases the pressure. When the fetus is present, a push from the solid body is felt. This method is used no earlier than 5 months of pregnancy. Absence of hard body sensation does not exclude pregnancy [6].

Auscultation is mainly carried out using a phonendoscope; on the right, in the hungry lateral fossa, you can hear the fetal heartbeat, which occurs twice as often as in an adult animal (120-130 beats per 1 min) [7].

The method of rectal diagnostics determines pregnancy, its timing, identifies pathologies of the genital organs, and the causes of infertility [8].

Using ultrasound diagnostics, an embryo can be seen within a month after successful fertilization, and gynecological diseases can also be identified.

The method of instrumental diagnostics using the device "Pregnancy Diagnosis" determines the anatomical and topographical changes in the genital organs of animals during pregnancy [9].

The device for diagnosing pregnancy and infertility of cows consists of three zones of red, green and yellow, which are graduated with a division scale to measure the position of the uterus in the pelvic cavity relative to the external genitalia. At the end of the device body there is a receiver with the help of which mucus is extracted from the genital tract. The head of the device has a handle that helps secure the device and is easy to grip. When working with animals, the handle protrudes from the top of the rod by 1-1.5 cm, so as not to contaminate your hands with mucus [10].

The technological scheme for using the "Pregnancy diagnosis" device for diagnosing infertility and infertility in cows includes the selection of animals for diagnostics of infertility 50-90 days after fertilization of animals. After registration and anamnesis of the animal, the genitals are sanitized, the device is inserted into the vagina, vaginal mucus enters a rubber receiver, the position of the uterus in

the pelvic cavity relative to the external genital organs is determined in accordance with the degree of immersion of the rod with a three-color graduated discharge scale, attention is paid to the consistency, color, smell of mucus.

The method of using the "Pregnancy diagnosis" device for diagnosing pregnancy and infertility is explained by the following example (Table 1).

Table 1 – Parameters for diagnosing pregnancy and infertility in cows 50–90 days after fertilization

Indicators	Infertile	Doubtable	Calf-bearing
Anatomical and topographic location of the uterus relative to the external genitalia	Up to 27 cm	28-30	31 and more
Muscus type	liquid, transparent	viscous, sometimes liquid	sticky, viscous,
Mucosal color	pink	pink	pale

In infertile animals, the uterus is located in the pelvic cavity, the immersion depth of the device for diagnosing pregnancy and infertility of a cow is up to 26 cm. After 50-90 days of pregnancy, the penetration depth of the device will be from 31 to 41.5 cm or more. The uterus and ovaries enter the abdominal cavity, as a result of which the distance to the external genitalia increases by 14.9-16.5 cm compared to the topography of the genitals in infertile animals.

In infertile cows, the cervix, the uterus itself, is located in the pelvic cavity at a distance of 27 cm from the external genitalia, the mucous membrane of the genital tract is pink and moist.

If on the 50-90th day after insemination the immersion depth of the device for diagnosing pregnancy and infertility of a cow exceeds 30 cm (green), the cow is considered pregnant. In case of infertility, accordingly, the immersion depth of the device is less than 26 cm (red color) [11, 12].

Results

Based on data from the artificial insemination log, insemination dates and gestational ages were determined. Depending on the timing of insemination, animals can be divided into the following groups: Group I (28-60 days) – 66 cows, Group II (61-120 days) – 101 cows, Group III (121-150 days) – 33 cows, Group IV (151-180 days) - 42 cows, group V (181 days) - 59 cows.

The results of diagnosing pregnancy and infertility of cows in three farms are shown in Table 2:

Table 2 – Results of diagnostics of pregnancy and infertility using instrumental method

Gestational age	Cattle number	Instrumental method						Ultrasound				Error	
		Calf-bearing		Doubtable		Infertile		Calf-bearing		Calf-bearing		Calf-bearing	Infertile
		n	%	n	%	n	%	n	%	n	%		
28-60	66	23	34.8	11	16.7	32	48.5	29	43.9	37	56	9.1%	7.5%
61-120	101	63	62.4	25	24.8	13	12.9	86	85.1	15	14.9	22.7%	2%
121-150	33	26	78.8	4	12.1	3	9.1	29	87.9	4	12.1	9.1%	3%
151-180	42	35	83.3	6	14.3	1	2.4	40	95.2	2	4.8	11.9%	2.4%
181-285	59	49	83	5	8.5	5	8.5	51	86.4	8	13.6	3.4%	5.1%

It has been established that diagnosing pregnancy and infertility of cows using the instrumental method "Pregnancy Diagnosis" makes it possible to identify on average 85.9% of pregnant and 80.3% of infertile cows. Diagnostic error ranged from 3.4% to 22.7%.

The results of the effectiveness indicator of the instrumental method "Pregnancy Diagnosis" in diagnosing pregnancy and infertility according to Table 2 are presented in the diagram below (Fig. 1):

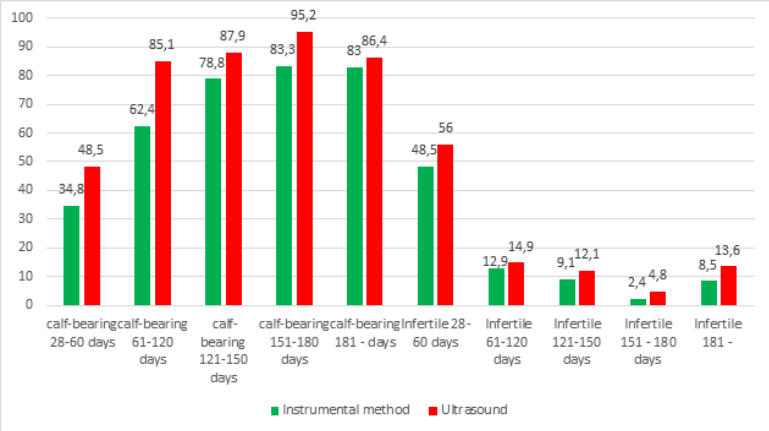

Figure 1– The effeciency of the instrumental method “Pregnancy Diagnosis”

The high efficiency rate of instrumental method of diagnosis “Pregnancy Diagnosis” was 28-60 and 121-150 days after insemination. The diagnostic error was more on days 61-120 after insemination

Studies on the effect of animal age on the reliability of diagnosis were conducted on heifers inseminated under the age of 2 years (n=110), cows aged 3 to 5 years (n=126) and cows over the age of 5 years (n=65). The diagnostic results are presented in Table 3.

Table 3 – The influence of animal age on the effectiveness of determining pregnancy and infertility of cows using the instrumental method

Animal age	Number	Instrumental method						Rectal method				Error	
		Calf-bearing		Doubtable		Infertile		Calf-bearing		Infertile		Calf-bearing	Infertile
		n	%	n	%	n	%	n	%	n	%		
2	110	70	636	14	12.7	26	23.6	81	73.6	29	26.4	10	2.8
3-5	126	83	65.9	21	16.7	22	17.5	100	79.4	26	20.6	13,5	3.1
Above 5	65	43	66.1	15	23.1	7	10.8	54	83.1	11	169	17	6.1

The influence of the animal’s age on the efficiency of diagnosing pregnancy and infertility was revealed; at the age of 2 years, the diagnostic error for pregnancy for the instrumental method is 10%; with age, the error for diagnosing pregnancy increases by 3.5%, and for diagnosing infertility by 0.3-3%.

The efficiency of the instrumental method in diagnosing pregnancy in cows under 2 years of age was, respectively, 86.4%, infertility 89.7%; pregnancy between the ages of 3 and 5 years 83%, infertility 84.6%; and in cows over 5 years of age, pregnancy is 79.6%, infertility is 63.6% (Fig. 2).

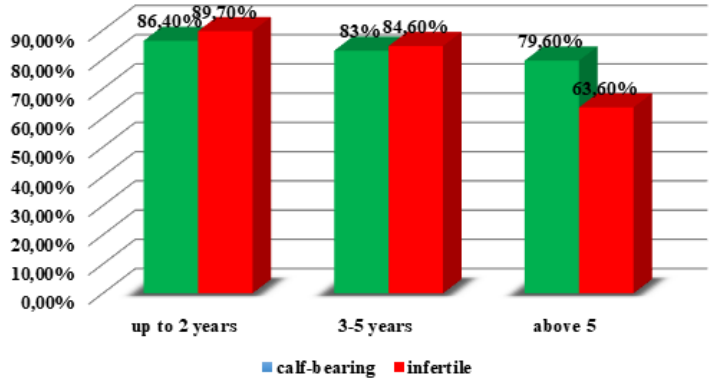

Figure 2 – Efficiency of determining pregnancy and infertility of cows depending on age

Discussion

Pregnancy diagnosis in cows is the decisive point for reducing the calving interval and increasing their reproductive efficiency [12, 13].

A perfect pregnancy test should provide accurate results in early stage of pregnancy (high sensitivity and specificity), be inexpensive and user-friendly [13].

There are many methods for the early diagnosis of pregnancy in cows, but basic and highly accurate detection is often made using ultrasound and rectal palpation. Transrectal ultrasound and rectal palpation are accurate and safe methods for assessing pregnancy in cattle. Although ultrasound may be more expensive, it provides the ability to detect pregnancy early in the breeding cycle, helping to control operating costs [14].

Studies by Hameed O. A. reported the results of using the BioPRYN Visual Pregnancy Test, which had a sensitivity of 99% compared to the BioPRYN ELISA Pregnancy Test Kit. In their work, the authors recommend to use the Bio-RPD visual test as a rapid and accurate method for diagnosing pregnancy on farms where laboratory equipment for enzyme immunoassay or transrectal ultrasound is not available [15].

Rahla Meziane et al [16] conducted a comparative analysis of two methods for diagnosing pregnancy in cows after artificial insemination: analysis of proteins associated with pregnancy (PAG) and ultrasound. The study found that the sensitivity and specificity of the PAG assay were 100% and 93.75%, respectively, and the specificity of ultrasound was 100%. A comparative analysis of these two methods for diagnosing pregnancy confirmed the reliability and earlier availability of biochemical methods.

In our studies we conducted a comparative assessment of the effectiveness of the instrumental method for detecting pregnancy and infertility in cows depending on their age. The results showed that in cows under the age of 2 years, the diagnostic efficiency was 86.4% pregnancy and 89.7% infertility, while in cows aged 3 to 5 years these figures were 83% and 84.6%, respectively. In cows over 5 years the diagnostic efficiency was 79.6% for pregnancy and 63.6% for infertility. The error in pregnancy diagnosis was 7%, and for infertility - 3.3%. It is recommended to use the Pregnancy Diagnosis device to diagnose pregnancy and infertility in cows no earlier than 30 days after insemination. The efficiency of the experimental instrumental method “Pregnancy diagnosis” was 34.8-43.9% for 28-60 days after insemination, 62.4-85% for 61-120 days, and 78.8 – 88% for 121-150 days, 83.3-95.2% for 151-180 days respectively. It has been established that with the help of the instrumental method 85.9% of pregnant and 80.3% of infertile cows are diagnosed. The error in determining pregnancy was 3.4-22.7%, infertility - 2-7.5%.

Conclusion

The efficiency of the instrumental method in detecting pregnancy and infertility of cows, depending on age, was 86.4% pregnancy, 89.7% infertility when diagnosing cows under 2 years of age, 3-5 years of pregnancy 83%, 84.6% infertility; and in cows over 5 years of age, pregnancy is 79.6%, infertility is 63.6%. Determination of cow pregnancy showed an error of 7%, and determination of infertility - 3.3%.

The use of the “Pregnancy Diagnosis” device in diagnosing pregnancy and infertility of cows is recommended to be determined 30 days after fertilization.

Authors' Contributions

IT and EE: Conducted animal research, conducted a comprehensive literature search, analyzed the gathered data and drafted the manuscript. IT, EE and ZhZ: Conducted the final revision and proofreading of the manuscript. All authors have read, reviewed, and approved the final manuscript”.

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