Prevalence of subclinical abortions in cows due to mycotoxicosis

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Abstract

The article presents data on the distribution and seasonal dynamics of subclinical abortions in cows with mycotoxicosis. Subclinical abortion is a common phenomenon among cows in dairy farms and causes significant economic losses due to multiple unsuccessful inseminations, reduced animal productivity, and premature culling. The research aimed to study the seasonal fluctuations of hidden abortions in cows and the influence of the method of keeping in the conditions of feed contamination with microscopic fungi and their toxins. To diagnose hidden abortions, cows were diagnosed with the pregnancy on the 32nd day after insemination. When pregnancy was confirmed, the animals were examined for 92 days. At the same time, if the pregnancy was not confirmed, it was considered that an abortion had occurred. Seasonal fluctuations of subclinical abortions were established - the most significant number (up to 13.6 %) was diagnosed at the end of spring, associated with many animals entering the hunt after the transit period. It is also important that at that time, the number of mycotoxins in feed reached record values, which led to abortions due to toxic effects on the organs of the reproductive system in particular and the body in general. A large number of abortions (11.2 %) in the summer season was also confirmed. At the same time, animals kept free all year received a similar diet containing mycotoxins. At the same time, a concomitant negative factor was temperature shock at this time of year. This whole complex of reasons led to subclinical abortions followed by the resorption of the fetus. Sonographically, areas of reduced echogenicity of the uterus in cows after abortions were detected, which is evidence of the development of subclinical endometritis, confirmed by the uterus's heterogeneous echogenicity. In infertile animals, the presence of follicles with cavities and small yellow bodies that did not extend beyond the surface of the ovary was established sonographically. This indicates a hypofunctional state and impaired folliculogenesis and luteogenesis.

Keywords: cows; subclinical abortion; mycotoxins; infertility.

1. Introduction

Several exo- and endogenous factors, including subclinical abortions, affect the state of reproduction of cows. Abortion can occur at different stages of pregnancy and for different reasons, but it negatively affects the reproductive and economic performance of the dairy herd (Wiltbank et al., 2016). The problem of abortions in the embryonic period is quite relevant, so several scientists have devoted their research to this topic (Nyman et al., 2018; Albaaj et al., 2022).

According to some authors, abortions from 38 to 90 days of pregnancy should not exceed 10% of the total number of pregnant animals with the corresponding gestation period (Almería & López-Gatius, 2015).

Abortion of cows under the influence of exotoxins (Sheldon, 2014; Smith et al., 2018) and mycotoxins (Cruz-Vázquez et al., 2017) have also been reported. At the same time, pregnancy is interrupted due to the accumulation in the body of such heavy metals as lead, arsenic, mercury, cadmium, mainly in the liver, kidneys, muscle, and fat tissue (Wrzecińska et al., 2021).

Many reports of reduced reproductive performance in cows fed feed contaminated with mycotoxins, particularly zearalenone. Thus, the leading cause of infertility in cows and heifers is considered to be impaired maturation and ovulation of follicles (Fushimi et al., 2015; Kadokawa, 2020), as well as the formation of ovarian cysts (Abbasian et al., 2018).

Other authors claim the occurrence of abortions in cows is due to the effect on the body of Neospora caninum, associating it with a decrease in the resistance of the body of cows caused by the impact of zeoralanone and deoxynivalenol on the liver and kidneys. At the same time, a violation of the protein-synthesizing function of the liver due to the formation of necrosis foci, as well as a violation of the filtering capacity of the glomerular system of the kidneys (Weston et al., 2012), was proven. Other authors indicate significant economic losses from early abortions of cows,
Determination of the frequency of subclinical abortions in cows during the year when repeatedly examined for pregnancy

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keeping in the conditions of feed contamination with micro-

scopic fungi and their toxins.

2. Materials and methods

To compare the frequency of subclinical abortions, households with tethered and untethered housing systems were taken.

Pregnancy in animals was diagnosed using ultrasonography 32–38 days after insemination. Pregnancy in cows was diagnosed by visualization of the embryo, and its viability was determined by monitoring the embryo's heartbeat. The animals were removed from the study if the heartbeat was not noticed. Ovaries were examined at several positions along their surface to identify luteal structures and to determine the number of corpora lutea in each cow. Cavity corpus luteum or different corpora lutea of pregnancy, size, and shape identified as a granular gray structural part of ovarian tissue.

During the repeated transrectal examinations of cows for pregnancy on 92–98 days, animals were diagnosed with subclinical abortions. In our opinion, the absence of a fetus in the uterus during this period can be considered a subclinical abortion.

3. Results and discussion

3.1. Results

Because the technology of growing cereals is seasonal, it would be appropriate to assume that the formation, accumulation, and, therefore, poisoning of cows with mycotoxins are seasonal. Thus, it is known that when the humidity in the grain increases above 30 %, and the temperature drops below 10 °C, zearalenone is transformed into its more toxic derivatives – α-zeralenol and β-zeralenol (Nesic et al., 2014; Ropejko & Twaruzek, 2021). Therefore, we believe the highest concentration of mycotoxins in grain should be at the end of spring (Table 1).

Table 1

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The embryonic bladder had a well-defined echo-positive membrane that adjoined the uterine wall and was filled with fluid that gave an echo-negative image. The embryo was displayed on the monitor screen as an echo-positive area of various sizes and shades of gray against the background of an echo-negative image of the contents of the embryonic bladder attached to its wall or in the form of a small tubercle (Fig. 1).

In the ovary of the amniotic sac of a fat cow, a yellow body of pregnancy was found, which protruded above its surface in the form of a tubercle and was half the size of the ovary, or most of it. On the monitor screen, it was distinguished by a more pronounced homogeneous echogenicity relative to the ovary's surrounding organs and other tissues.

In addition, small-sized vesicular follicles were found in the ovary, which confirms that folliculogenesis does not stop even during pregnancy (Fig. 2).

Small areas with reduced echogenicity were found in the uterus during the sonographic examination of infertile animals, which may be evidence of mucus accumulation with exudate in subclinical endometritis. In addition, the wall on the echogram did not have clearly defined edges relative to the surrounding organs and uterine contents and had heterogeneous echogenicity, which may indicate its swelling due to the course of a subclinical inflammatory process (Fig. 3).

Cavity follicles and small-sized corpora lutea with the corresponding intensity of echogenicity were found in both ovaries of such cows, which indicates their hypofunctional state due to impaired folliculogenesis and luteogenesis. In addition, yellow bodies did not go beyond the surface of the ovaries. Still, they were located in their thickness and were less than half the ovaries' size, indicating their insufficient development (Fig. 4).

The insufficiency of the corpus luteum, in turn, is the cause of embryo resorption since the level of progesterone is...
insufficient to ensure the slowing down of uterine contractions and the development of the uterine glands, which leads to impaired implantation. This process often ends with removing the embryo from the uterine cavity or its resorption. Clinically, veterinary specialists diagnose such clinical cases as unsuccessful insemination. In the future, such animals are inseminated again, and multiple unsuccessful inseminations are indicated.

3.2. Discussion
Abortions of cows are a fairly common phenomenon and bring significant economic losses to farms. Thus, some authors note the genetic component of abortions in cows (Wijma et al., 2022). Other authors point to stress factors that can lead to early subclinical abortions (Thomsen et al., 2020). However, our studies have obtained data indicating massive subclinical abortions caused by poisoning animals with mycotoxins, particularly zearalenone and deoxynivalenol. At the same time, it was established that, on average, this indicator ranged from 4.4 % to 14.7 % of confirmed pregnancies in cows. Other authors obtained similar data, but studies showed heavy metal poisoning (Wrzecińska et al., 2021).

We also established a higher percentage of 13.6 % of cases of subclinical abortions in cows that were kept loose. This is connected with greater feed availability and, therefore, a more significant number of toxins entering the body. In addition, it should be pointed out that constant feed is used with this method of keeping cows, which does not depend on the year's season.

Seasonal dynamics of subclinical abortions in cows varied in different farms but tended to increase in late spring and early summer. This coincides with the studies of other authors (Djellata et al., 2021).

In our opinion, the increase in the number of abortions at the end of spring and the beginning of summer is because, during this period, the most significant number of fertilizations occurs. As one knows, most calving occurs in February, and already at the end of March, the transit period of cows ends, and signs of sexual desire appear. Another aspect is the accumulation of mycotoxins in feed stored at low temperatures during this time, contributing to the formation of zearalenone isomers.

We explain the diagnosis of a significant number of abortions in the summer as an increase in the accumulation of mycotoxins in fodder due to errors in their storage, as well as a temperature shock, which often occurs when the temperature rises above 25 °C (De Rensis et al., 2021).

When examining the ovaries of cows suffering from mycotoxicosis, in which pregnancy was diagnosed on the 32nd day, follicles with cavities and underdeveloped yellow bodies were found on the 60th day, which indicated a violation of lutegenesis and follicle atresia. This is also confirmed by the research of other authors (Pizzo et al., 2016).

4. Conclusions
Thus, by conducting a sonographic examination of infertile cows, it is possible to diagnose subclinical endometritis and a hypofunctional state of the ovaries against its background, which is the reason for the absence of sexual cycles in these animals for a long time after insemination.

According to our literature data in various animal populations, the prevalence of subclinical endometritis in infertile cows can be from 65 to 80 %, often one of the reasons for the resorption of embryos (subclinical abortions) in animals during subsequent pregnancies.

Conflict of interest
The author claims no conflict of interest.

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