

Cattle Infertility and Possible Prevention Strategies

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Abstract

Considering the future of livestock enterprises, it is of great importance to obtain one live calf from cows per year in terms of both milk and calf production. Achieving this situation depends on the realization of fertility parameters. Fertility rates play a major role in the production and economic efficiency of modern enterprises. In herds where these parameters are not met and infertility is observed, there are significant economic losses due to the inability to produce offspring at the desired time, additional semen and drug costs, and removal of animals from the herd. Infertility is caused by viral, infectious, and bacterial diseases, congenital and acquired structural defects, and other factors. The purpose of this chapter looks at infertility problems caused by the diseases and other factors we have listed, and what can be done about them.

Keywords: Reproductive disorders, Diagnosis, Treatment, Hormone.

Cite this Article as: Gökdemir T and Yıldız S, 2025. Cattle Infertility and possible prevention strategies. In: Kausar R, Nisa ZU, Jamil M and Bashir I (eds), Integrated Health and Sustainability: Plants, Wildlife, and Genetic Resilience. Unique Scientific Publishers, Faisalabad, Pakistan, pp: 274-281. <https://doi.org/10.47278/book.HH/2025.177>



A Publication of
Unique Scientific
Publishers

Chapter No:
25-037

Received: 12-Feb-2025
Revised: 21-Apr-2025
Accepted: 12-May-2025

Introduction

Reproduction is one of the most important elements of livestock enterprises. In many farms, reproductive performance targets are not met, resulting in serious economic losses (Ptaszynska, 2009). The main objective of reproductive herd management is to ensure that cows become pregnant again at the most appropriate time after calving and, accordingly, to keep the period between two calvings within economic limits (Polat, 2008).

Fertility refers to the willingness and ability to mate, conceive, nurture the embryo, and give birth to a normal calf. Sterility refers to an absolute lack of reproductive ability, while infertility refers to reduced fertility with an inability or delay in producing a normal live calf (Arthur et al., 1992). In order for the phenomenon we call infertility to not occur, certain parameters must be met. When these parameters are not met, infertility occurs (Table 1).

Table 1: Some physiological limits for the evaluation of reproductive performance, cases that are not in between these values are considered infertility (Gökçe, 2013).

Age of use in breeding	14-15 months
Age at calving	22-24 month
The period between calving and first insemination	Average 75 day
Number of days left open	115-125 day
Calving interval	13.0-13,3 month
First insemination pregnancy rate	% 45 >
Pregnancy rate per insemination	1,8 <
Insemination rate per cow	2 <
Estrus detection efficiency	% 70 >
The period between two estrus	35 day <
Abortion rate	% 4 <
Retention	% 10 <
Cystic ovary	% 10 <
Metritis	% 10 <
Dropout rate	% 8 <

1. Functional Causes of Infertility in Cows

Although this phenomenon is usually seen individually, it constitutes a significant part of total infertility. It is seen in many animals, especially in enterprises where care and feeding conditions are inadequate (Arthur et al., 1992).

Some common causes are listed below:

- Silent estrus (non-detected)

- Anoestrus
- Ovulation defects
- Persistent corpus luteum
- Cystic ovaries
- Repeat Breeder

i. Latent Estrus

These are situations where the cow is in estrus but no one can follow it. In a normal situation, cows should show continuous ovarian activity from puberty onwards except for a short period during pregnancy, and the way to monitor this is for the observer to know and see the signs that the cow is in heat approximately every 21 days (Pearson and England, 1993).

In cows and heifers whose estrus cannot be monitored, when two consecutive rectal examinations are performed 10-15 days apart, the corpus luteum is observed on the ovaries in one of the examinations (Nak, 2000). In cases where estrus monitoring is insufficient, ovsynch application is appropriate because it is a method that allows insemination without estrus detection (Mialot et al., 1999).

ii. Anoestrus

It is a situation where signs of estrus cannot be detected despite regular estrus detection. Most forms of functional infertility result in anoestrus. Although estrus is not observed in animals in this situation, they respond positively to ovulation synchronization because they have a normal estrus cycle. Anoestrus cases can be treated with PMSG and GnRH (Peter et al., 2009).

True anoestrus: It is the absence of any function in the ovaries. Inadequate production or release of gonadotropins that will initiate folliculogenesis or the failure of the ovaries to respond to these hormones leads to failure of normal activity. When a rectal examination is performed, small, smooth ovaries are examined and the corpus luteum is not detected. Equine chorionic gonadotropin at a dose of 3000-4500 IU can be used to stimulate ovarian activity. Additionally, progesterone, GnRH, and estrogen are also used in the treatment of anoestrus (Kumar et al., 2014).

Sub estrus or silent heat: It is the condition in which signs of estrus are not seen although normal ovarian activity continues. Generally, signs of heat are not observed in the first and second ovulation after birth. This may be because the short-term symptoms are not observed (Arthur et al., 1992). In a rectal examination, the corpus luteum is sought. Diagnosis is made by checking progesterone levels in milk or blood. If the cow is not pregnant and has a mature corpus luteum, PGF_{2α} can be used followed by fixed-time insemination. Alternatively, progesterone implantation and fixed-time insemination can be performed (Cunningham, 2002).

iii. Ovulation defects

Delayed ovulation: In some cows, ovulation may be delayed or may not occur at all in the maturing Graafian follicle. This condition is caused by inadequate secretion of LH. If ovulation has not occurred 24 hours after insemination, the animal can be inseminated again. Ovulation can be accelerated by GnRH administration (Cunningham, 2002). Ovulation defects often result in delayed ovulation and anovulation (Figure 1).

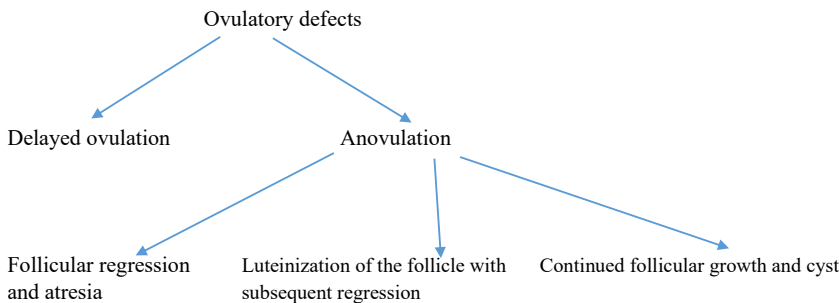


Fig. 1: Figure of ovulatory defects. (Arthur et al., 1992).

Anovulation: Lack of ovulation leads to true anoestrus and cystic ovaries. If the follicle detected by rectal examination or ultrasonography has been present longer than suspected, a diagnosis can be made and GnRH can be administered (Abraham, 2017).

iv. Persistent Corpus Luteum

It is the condition in which the corpus luteum does not regress within the normal period after ovulation and continues its existence. The rectal examination evaluates the presence of the corpus luteum, its fluid, and surrounding tissues. Progesterone levels can be measured to see if the corpus luteum is active. PGF_{2α} can be applied to ensure luteolysis (Niswender et al., 2000).

v. Cystic Ovaries

This condition is generally accepted to occur due to a disorder in the hypothalamus-pituitary-ovary axis. The most widely accepted view on cyst formation is that the LH released from the hypothalamus-pituitary gland is altered. Before ovulation occurs, the LH wave is either absent, insufficiently large, or occurs at the wrong time during the maturation of the dominant follicle, leading to cyst formation as shown in Figure 2 (Peter, 2004).

Follicular cysts: They are thin-walled (≤ 3 mm) structures that can be found singly or in multiple numbers in one or both ovaries. They are characterized by the presence of anechoic structures on the ovary on ultrasonographic examination (Isobe, 2007). LH, hCG, and GnRH hormones can be used to ensure ovulation (Vanholder et al., 2006).

Luteal cyst: Its walls are thick (>3 mm) due to the high content of luteal tissue. They are found singly and have a harder structure than follicular cysts. These cysts are less common. In ultrasonographic examination, the cyst lumen has an echogenic appearance and the wall has a hyperechogenic appearance (Vanholder et al., 2006). These cysts secrete high amounts of progesterone and small amounts of estrogen (Isobe, 2007).

The majority of cysts (60 - 65 %) heal spontaneously in the early postpartum period. However, waiting for recovery on its own prolongs the time between birth, first insemination, and pregnancy. In addition, due to the risk of infertility caused by trauma, bleeding, and oviductal-bursal adhesions, manual rupture (which is not preferred), aspiration of the fluid within the cyst, the use of various hormones (GnRH, PGF2 α , hCG) and the ovsynch protocol are effective methods (Vanholder et al., 2006).

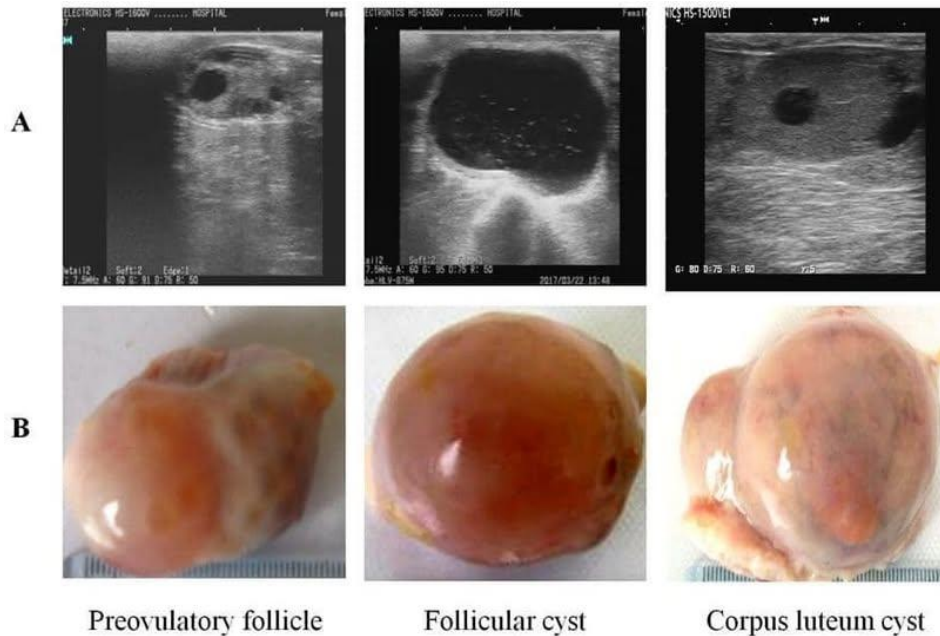


Fig. 2: The appearance of preovulatory follicles and cysts in cattle (Anonymous).

vi. Repeat Breeder

Cows that cycle regularly, have no clinical signs such as reproductive organ defects or abnormal discharge, and have not become pregnant despite being inseminated at least 3 times are defined as repeat breeders (Ileri et al., 2005). In practice, some animals may have been inseminated at the wrong time, some animals may have undetected uterine infections, and some animals may have pathological changes in the bursa or oviduct that may be difficult to detect by rectal examination. In addition, early embryonic death, poor semen quality, fertilisation failure, care and feeding disorders and infectious diseases can cause this condition (Lehimcioglu et al., 2019, Singh et al., 2008).

The following practices can be used in repeat breeder cases; GnRH application immediately after insemination, GnRH application after a certain period after insemination, inseminating the animal at different times of estrus, using better quality straws in insemination, intrauterine antibiotic application after insemination, vitamin mineral supplements and estrus synchronisation methods (Ileri et al., 2005).

2. Infectious Causes of Infertility in Cows

i. Uterine Infections

Uterus is sterile before birth. During parturition and the postpartum period, the uterus becomes contaminated with the cow's tissues or skin or with the expanded tissues contained within it (Sheldon & Dobson, 2004). These pathogenic bacteria present in the uterus cause inflammation in the endometrium, delay in uterine involution, histological lesions in the uterus, and thus a decrease in the chance of embryo survival. Bacteria can suppress the release of GnRH and LH, reducing the chance of ovulation of the dominant follicle. Uterine infections prolong the time to first insemination and conception after birth, causing a decrease in pregnancy rates (Foldi et al., 2006). Uterine infections are a common condition in cows. Depending on the severity of the fire, conditions such as metritis or endometritis may be encountered. Inflammation of the endometrium, glandular and muscular tissues is called metritis, and inflammation of the endometrium and glandular tissue is called endometritis (Sheldon et al., 2006).

It is important not to confuse contamination occurring in the uterus with uterine infection. The uterus is often contaminated in the postpartum period, but this does not always cause an infection (Noakes et al., 2002). To call it an infection, the agent must bind to the mucosa and release toxins (Sheldon et al., 2006). The uterus has its defense mechanism against microorganisms. This mechanism includes the epithelial cells lining the endometrium, mucus secreted from the endometrium, and immunologically, polymorphonuclear inflammatory cells and antibodies (Dhaliwal et al., 2001).

Disruption of the vitamin and mineral balance, deterioration of the fat and protein structure in the body, formation of a negative energy balance, changes in estrogen and progesterone levels, especially in the last period of pregnancy, and increase in cortisol levels during birth weaken the body's defense mechanism. Disruption of these mechanisms makes it easier for pathogens to enter the endometrium and endometritis occurs (Dhaliwal et al., 2001).

ii. Puerperal Metritis

Although it is usually seen within the first 21 days following birth, it occurs in the first 2 weeks postpartum and between the 4th and 10th days after birth. It is a condition characterized by abnormal growth of the uterus, containing abundant red-brown, foul-smelling, watery, necrotic discharge, and additional symptoms such as loss of appetite, stagnation, and fever over 39.5°C (Azawi, 2008).

iii. Clinical Metritis

It is a case with clinical symptoms such as purulent vaginal discharge and a large uterus that has not completed its involution within the first 21 days following birth, but no systemic symptoms (Sheldon et al., 2006).

iv. Clinical Endometritis

It is a uterine inflammation that progresses with purulent vaginal discharge from the 21st day after birth and mucopurulent vaginal discharge from the 26th day, and does not show any systemic symptoms. Purulent discharge is when more than 50% of the vaginal discharge originating from the uterus is purulent, while mucopurulent discharge is when this percentage is less than 50% and the remaining part consists of mucus (Sheldon et al., 2006).

v. Subclinical Endometritis

These are conditions where there are no clinical signs of inflammation in the uterus in the postpartum period, but there are high amounts of neutrophil leukocytes in the endometrium. The increase in the mentioned cells can only be detected by cytology. When cytology is performed, when the rate of neutrophils is more than 18% on postpartum days 20-33 or 10% on postpartum days 34-47, or when an image with mixed echogenicity is obtained on ultrasonographic examination performed after the 21st day in the postpartum process, it is defined as subclinical endometritis (Sheldon et al., 2008). Although no clinical signs are observed in cows with this condition, significant decreases in pregnancy rates are detected (Földi et al., 2006).

A rectal examination can determine the size of the uterus and cervix, the symmetry and consistency of the cornu. However, considering that uterine involution is affected by conditions such as age, race, and nutrition, size determination should not be considered a clear diagnostic method for infection (Sheldon et al., 2006). In the ultrasonographic examination, the diameter of the cornu and cervix, the structures in the ovary and the uterine contents are visualized. Nonechogenic areas seen during estrus and pregnancy are observed as echogenic if there is a uterine infection (Youngquist et al., 1997). Vaginoscopy and bacteriological examination are also methods used to diagnose the infection. Diagnosis can also be made by cytology; if the neutrophil leukocyte ratio in the samples taken is more than 10% of the epithelial cells, it is accepted that there is inflammation in the area (LeBlanc et al., 2002a).

vi. Use of Antibiotics In Treatment

When starting to use antibiotics, care should be taken to ensure that the antibiotic used is effective against the causative pathogen and does not harm uterine activity. It should be taken into account that there are tissue debris in the existing infection (fluid). Aminoglycosides are ineffective in the postpartum period. Sulfonamides cannot be effective in environments containing necrotic tissue, pus, blood and leukocytes. Penicillin use is also not recommended because bacteria produce penicillinase in the early postpartum period. It should be noted that antibiotics used intrauterinely can also inhibit leukocyte activation and phagocytosis (Hussain and Daniel, 1991). The antibiotic must be in sufficient concentration at the site of infection. The antibiotic used must quickly diffuse into the uterine cavity and reach a level that will affect the endometrium. If the infection has general symptoms that pose a life-threatening threat, systemic antibiotics should be preferred, otherwise if it is localized in the uterus, intrauterine applications should be preferred (Lewis, 1997).

An effective defense mechanism facilitates healing, therefore the antibiotic chosen should not suppress the existing defense mechanism of the uterus and should not have an irritating effect on the surrounding tissues. High levels of intrauterine antibiotics, especially Lugol's solution, suppress phagocytic activity for several days (Azawi, 2008). Oxytetracycline is a broad-spectrum antibiotic that acts on both gram-positive and gram-negative bacteria that are sensitive to tetracycline group antibiotics. When used intrauterine, it takes effect in a very short time and passes into the blood in low amounts (Azawi, 2008). Many pathogens that grow in utero are susceptible to cephalosporins. The low concentration of cephalosporins and the short washout period in meat and milk allow them to be used both systemically and intrauterinely in the treatment of metritis (Földi et al., 2006).

vii. Use of Antiseptics In Treatment

Antiseptics such as Lugol's solution, chlorhexidine, povidone-iodine, entozone, and rivanol are used in uterine infections. Although it has been stated that these preparations have negative effects, they have been used for a long time due to their short residue period on meat and milk, low cost and proven effectiveness. Iodine antiseptics cause lysis of the corpus luteum and shortening of estrus intervals due to their irritating effects (Carleton et al., 2008).

viii. Use of Hormone In Treatment

PGF₂α used in treatment has different effects. Firstly, as a result of PGF₂α application, the corpus luteum lyses and progesterone levels decrease. Thus, the defense-suppressing role of progesterone will be eliminated and the defense mechanism will be stimulated by the increasing amount of estrogen with the formation of new estrus. Secondly, the administered PGF₂α stimulates uterine contractions and the tissue debris resulting from the infection is expelled. Third, PGF₂α administered to cases of endometritis with a functional corpus luteum increases the phagocytic activation of polymorphic nuclear leukocytes (Azawi, 2008).

3. Venereal Diseases of Cause Infertility

i. Genital campylobacteriosis (Vibriosis)

The causative agent of the infection is the gram-negative bacteria *Campylobacter fetus*. It is a venereal phenomenon. Asymptomatic carriers are bulls. It can be transmitted through the use of carrier bulls or contact with infected materials reproductive organs. Identification and non-use of carrier bulls and antibiotics used when freezing sperm prevent transmission through artificial insemination. If females are infected, vaginitis, cervicitis, and mild endometritis are seen. Although rare, pyometra may be observed. Following infection, infertility, early embryonic deaths and, rarely, abortion between the 4th and 7th months of pregnancy are observed. In infected herds, calving is reduced, while the time from birth to re-pregnancy is extended by approximately 40 days (Yaeger and Holer, 2007).

Increased rates of re-estrus, a serious decrease of 40-70% in pregnancy rates in the herd in acute conditions, prolonged re-pregnancy times and rare abortions help make the diagnosis. Preputium samples taken from bulls and vaginal mucus samples taken from cows are cultured and examined in a laboratory environment. Pregnant females and those younger than 5 months old should be separated from the herd and monitored for disease (Yaeger and Holer, 2007).

While aiming to control the disease, it should be kept in mind that the disease is transmitted venereally, that bulls can carry the infection chronically if they are old, that cows gain immunity within 3 to 6 months after infection, and that bulls and cows can be vaccinated for preventive purposes. From the moment the disease is detected, necessary tests should be performed and sick animals should be isolated. It should not be forgotten that the main source of infection is bulls. When bulls are to be used, tests should be done 6 to 8 weeks before and the sick ones should be removed from the herd. Young bulls should be vaccinated. Vaccination should be done at least 30 days before the breeding season, in 2 doses, 2-4 weeks apart. The effectiveness of the disease has decreased with artificial insemination applications (Yaeger and Holer, 2007).

ii. Trichomonosis

The causative agent is *Trichomonas fetus*, a flagellated protozoan. It is transmitted from bulls to cows through natural insemination. No symptoms are observed in bulls. Although rare, it can also be transmitted through the use of contaminated speculums. The disease causes edema in the vulva, vaginal tissues, and uterus. It can lead to endometritis and vaginitis. Although fertility impairment is not observed as a result of the disease, embryonic deaths occur. After death, pyometra forms, as a result of which the uterus fills with plenty of pus. Abortions are observed between the 2nd and 4th months of pregnancy due to infection. After the fourth month, abortions can occur rarely (Parkinson, 2001a).

The most effective way to combat the disease is artificial insemination. Treating cows and bulls is not effective because the treatment does not affect the time it takes to develop immunity against the disease (Parkinson, 2001b).

4. Viral Agents of Causing Infertility

i. Bovine Viral Diarrhoea (BVD)

The disease is caused by bovine viral diarrhoea virus (BVDV), a *Pestivirus*. It is one of the important viruses that affect reproduction. As a result of the infection, abortion, mummification, stillbirth, calves with anomalies or persistent infection may be observed (Parkinson, 2001b).

The virus can be detected in the ovary, follicular fluid, luteal, granulosa and theca cells. Causes decrease in pregnancy rates. Studies have shown that reproductive losses seen in the early stages of infection are due to the disruption of follicular development as a result of ovarian inflammation, inflammation of the uterus and direct damage to the embryo caused by the infection (Kelling, 2007).

For diagnosis purposes; virus isolation, immunohistochemistry test, PCR and elisa tests are performed. The main purpose of controlling the disease is to minimize the birth of persistently infected calves and reproductive losses resulting from fetal infection. The best way to prevent this is to identify persistently or acutely affected animals and implement an immunization program. Animals in the herd and new members of the herd should be tested so that infected animals are prevented from entering the herd. The tests should be performed on the entire herd, including the bulls. New animals to be added to the herd should be selected from clean enterprises. In any case, newly arrived animals should be kept in a separate place, subjected to tests and included in the herd if they are found to be negative (Kelling, 2007).

Vaccination programs are implemented, but it should be remembered that no vaccine provides complete fetal protection and that persistently infected calves can be born from vaccinated mothers. For this, vector animals must be removed from the herd along with the vaccine. (Kelling, 2007).

ii. Bovine herpes virus – I (infectious bovine rhinotracheitis virus) Infection

It is a pathogen that affects the reproductive, respiratory systems and the fetus. The genital form of the disease (infectious pustular vulvovaginitis (IPV)) is transmitted venereally. It can also be seen as a result of animals sniffing or licking the vulva area or as a result of waste contaminated with the virus. Acute vulvovaginitis occurs within 24-48 hours following venereal infection. The vulva lips swell and red vesicles form on the mucosa. A mucopurulent discharge is observed in the vagina. Although the acute phase lasts about 2 weeks, vaginal discharge can continue for a very long time (Parkinson, 2001b, Kelling, 2007).

This factor accounts for a significant portion of abortions, and abortions are usually observed in pregnant women who have not developed immunity between the 4th and 8th months of pregnancy. Sometimes calves are born healthy, live for a while and then die (Parkinson, 2001b, Kelling, 2007).

Endometritis occurs as a result of the virus affecting the uterus. Infections cause temporary infertility or embryonic death. Infection affects the ovaries and causes non-permanent ovarian lesions. Severe endometritis and decreased pregnancy rates are observed with the use of infected semen or carrier bulls (Bradd and BonDurant, 1997). Prevention of the disease includes vaccination and isolation of animals exposed to the virus. Vaccination is important for this disease because vaccines are effective. Additionally, bulls used for artificial insemination or natural mating must be negative (Bradd and BonDurant, 1997).

5. Bacterial Diseases of Cause Infertility

i. Brucellosis

Brucella abortus is the causative agent of brucellosis, which is considered one of the most important reproductive diseases in cows. It settles in lymphoid tissues and phagocytic cells and multiplies. The main source of the disease is infected females. Infection occurs through the digestive tract as a result of licking the aborted puppies, the fetal membranes and the uterine contents. Infected animals can sometimes give birth to live offspring, and the agent enters the body as a result of the licking of these offspring. In addition, contaminated pasture, food, water sources and infected semen are also factors in transmission. The agent that settles in the breast and supramammary lymph nodes persists for life, which means that microorganisms are present in the milk and are a source of infection for calves and humans. The time from the agent entering the body to causing abortion is 30 days. The incubation period is longer, but generally varies between 2 weeks and 1 year. In an animal that has reached puberty, the infection occurring once means that it will persist for life. Although abortions are seen from the 5th month, sometimes early abortions are also seen. Infection sometimes leads to fetal death, but abortion is not observed; the fetus becomes macerated or mummified (Seleem et al., 2010).

Agglutination test is performed using blood serum for diagnosis. With this diagnostic method, positive results can also be seen as a result of vaccination. Therefore, the complement fixation test is added to the agglutination test to see the difference between the titer caused by infection and the titer of vaccination. Another test performed to select healthy animals in dairy cattle farms is the brucellosis ring test (BRT) (Kelling, 2007).

Periodic vaccination is performed in areas where infection is present to ensure immunity. The normal vaccination age is accepted as 5 months. Live vaccines are dangerous in male animals because the microorganism settles in the testicles. The main way of protection is to test sick animals at regular intervals and remove them from the herd (Kelling, 2007).

ii. *Haemophiles somnus* Infections

The causative agent, *Haemophilus somnus*, constitutes the normal bacterial flora of the genital area in female and male animals. It is transmitted to other animals through the infected animal's vaginal discharge, urine, or respiratory tract through contaminated environmental conditions. It is possible to be transmitted through natural mating from carrier bulls. It causes abortions, vaginitis, endometritis and cervicitis in cows. The pathogen damages the embryo by attaching to the zona pellucida of the embryo. Even though rare, it causes testicular degeneration and epididymitis in bulls (Bondurant, 2007).

Agent isolation is performed from the fetus and placenta. Endometritis, vaginitis and purulent discharge developing after copulation and increased bacterial isolation suggest the presence of the agent (Bondurant, 2007). The use of penicillin and streptomycin is effective in treatment. Appropriate vaccines are also available. Artificial insemination practices, hygiene and appropriate antibiotic use are important factors in controlling the disease (Bondurant, 2007).

iii. Mycoplasma Infections

Mycoplasma bovis causes decreased sperm motility, infertility, abortion, endometritis, seminal vesiculitis and granular vulvitis in bulls. It is determined in the head part of the spermatozoon, especially in the acrosome (Parker et al., 2018). *Mycoplasma bovis* causes mastitis, pneumonia and polyarthritis in cattle. It also affects the reproductive organs, causing lesions in the uterus and oviduct (Salpingitis) (Parker et al., 2018). Artificial insemination practices prevent spread via bulls. Additionally, the use of fluorquinone in reproductive problems provides beneficial results (Parkinson, 2001b).

iv. Ureaplasma Infections

Ureaplasma diversum is a microorganism normally found in the genital tract of cows. It is generally transmitted venereal. The use of infected semen in artificial insemination directly infects the uterus. It causes granular vulvovaginitis. A thick vaginal discharge is seen and the vulva is hyperemic. The agent also infects the penis and prepuce. It causes abortions (Parkinson, 2001b).

Artificial insemination is of great importance in the fight against infection. Additionally, it has been reported that in patients thought to have this infection, an increase in fertility rates occurs when 1 g of tetracycline is administered intrauterine the day after artificial insemination (Parkinson, 2001b).

v. Leptospirosis Infections

Leptospirosis is a serious disease of economic importance in beef cattle, causing diseases such as septicemia, nephritis, meningitis, and reproductive problems caused by abortion, stillbirth, and infertility. Leptospirosis is considered to be the most common zoonosis in the World (Levett, 2011). *Leptospira hardjo* and *Leptospira pomona* are the most important serotypes of *Leptospira interrogans* associated with abortion in cattle. There are more than 200 serotypes of leptospirosis worldwide. The serotype that lives in cattle is *Leptospira hardjo*. Within this serotype, there are two genotypes *Leptospira hardjobovis* and *Leptospira hardjoprajitano* (Delooz et al., 2018).

Abortions and infertility are observed 1-3 months after infection with *Leptospira hardjo* serotypes. Cattle usually abort after the 4th month of pregnancy. Trimester abortions are observed 1-6 weeks after infection with *Leptospira pomona* serotypes. It is reported that microorganisms can cross the placental barrier and invade the fetus. In some cases, abortions occur without any visible disease. The survival rate of the offspring that are not aborted despite the disease is also very low (Ellis, 2015). The most common diagnostic method used for the agent is the serum agglutination test. Annual vaccinations are important to combat the disease (Corbeil and Bondurant, 2001).

6. Fungal Diseases of Cause Infertility

i. *Aspergillus fumigatus*

Several infections caused by fungi cause abortions. The main causative agent is *Aspergillus fumigatus*. Inappropriate storage conditions of feeds in humid environments cause mold. This mold and spores inhaled from spoiled food cause infection. Abortions occur in the middle to the end of pregnancy.

For diagnosis, culture is performed from fetal membranes and stomach contents of the expelled fetus. The best method of protection is to process the feed well and to store it in storage conditions that will prevent mold (Daşkın, 2005).

Conclusion

Livestock production makes a great contribution to the economic development of a country. The increase or decrease in reproductive performance is immediately noticeable in this development. Fertility is a multifactorial trait and is subject to impairment due to the factors listed above. Infertility occurs in many ways, with or without clinical findings, reducing reproductive performance in enterprises and causing major economic losses. For this reason, the factor causing infertility should be determined in businesses and accordingly, measures should be taken to reduce the effects without the need for protection, control and treatment or treatment. For this purpose, adequate diagnostic opportunities for infertility problems should be provided. Frequent and detailed examinations of the reproductive organs should be performed, and infertility resulting from hormonal imbalances caused by feeding should be considered, and this awareness should be created in businesses.

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