



# Major Reproductive Problems in Dairy Cows; Diagnostic Approaches and Management: A Review

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## Abstract

Reproductive disorders are the principal problems influencing the productivity and production of domestic animals. The main reproductive-related problems that directly affect the reproductive performance of dairy cows are categorized as follows: retained fetal membrane, uterine prolapse, and puerperal infections like endometritis, pyometra, and metritis; accidents that occur before gestation (abortion, vaginal prolapse, and dystocia); and accidents that occur during gestation (abortion, vaginal prolapse, and dystocia). Due to slower uterine involution, decreased reproductive rate, longer inter-conception and calving intervals, adverse effects on fertility, higher prescription costs, decreased milk production, loss of valuable cows and fetuses; these problems cause the dairy industry to suffer substantial economic losses. Research on the main reproductive issues affecting cattle in Ethiopia's various regions has revealed that these issues, which can range in prevalence from 11.7% to 61%, are responsible for significant financial losses for small-scale dairy farms and the dairy industry. A regular vaccination regimen for the herd, and treating animals under a veterinarian's care once the disease's initial signs are noticed, is the most crucial general management strategy that prevents most common reproductive diseases. Other general procedures include removing diseased animals from the breeding program, culling them completely from the herd, or isolating them for a particular period of time. On the other hand, enhancing postpartum care, such as adequate nutrition, hygiene, cleanliness, timely artificial insemination, and accurate heat detection, is also necessary to reduce the risk of reproductive issues and prevent the spread of certain diseases.

**Keywords:** Dairy Cattle; Diagnosis; Management; Postpartum; Reproductive Problems

## Abbreviations

AFC: Age at First Calving; AFS: Age at First Service; AI: Artificial Insemination; BVD: Bovine Virus Diarrhea; CI: Calving Interval; DO: Day's Open; FSH: Follicle-Stimulating Hormone; GnRH: Gonadotropin Releasing Hormone; IBR: Infectious Bovine Rhinotracheitis; LH: Luteinizing Hormone; NSPC: Number of Service Preconception; PGF2a: Prostaglandin F2alpha; PPA: Post-Partum Anestrus; RB: Repeat Breeding; RFM: Retained Fetal Membrane; RP: Retained Placenta

## Introduction

Farm animals' lifespan performance is mostly determined by their reproductive potential [1]. Since an animal's ability to reproduce determines most of its productivity, regular and successful reproduction is essential to the profitability of animal husbandry [2]. Age at First Service (AFS), Age at First Calving (AFC), Day's Open (DO), Calving Interval (CI), and Number of Service Preconception (NSPC) are the most widely used measures of reproductive performance, and they represent the cornerstone of economic production for dairy farms [3, 4].

The reproductive efficiency of dairy cows is affected by a variety of factors, including the managemental systems (which include husbandry procedures, breeding strategies, estrus detection, handling of semen, and transition cow management); animal factors (genetic, age, body condition); nutrition (year-round availability of green fodder); and environmental conditions (location, calving season, and status of the sucklings) under which cattle are maintained. All of these factors have the potential to significantly affect production and productivity [5-7].

The reproductive process might encounter several issues that lead to the loss of normal function. This may result in sub-fertility, or a lower degree of reproductive effectiveness, and infertility, or the complete failure of reproduction [8]. The main problems related to reproductive health that directly

affect the ability of dairy cows to reproduce are anestrus, abortion, dystocia, metritis, Retained Fetal Membrane (RFM), prolapse (uterine and vaginal), and repeated breeding [9]. It additionally appears possible to categorize these reproductive problems as occurring before (anestrus and recurrent breeding), during (abortion, vaginal prolapse, and dystocia), and after (RFM, hypocalcaemia, uterus and uterine prolapse, and infections of genital organs) [4, 10-12].

The majority of common reproductive problems appear during the postpartum period, which is the most vulnerable and aligned with the most dramatic stages of lactation, uterine involution, ovarian activity restart, and conception [13, 14]. In farm animals' reproductive cycles, this is the most important period [1]. The postpartum period in cattle is linked to immunological homeostasis restoration, ovarian cyclicity restart, and uterine tissue remodeling, all of which are essential for future fertility [15].

Reproductive problems cause dairy farmers to suffer significant financial losses as well as public health concerns [16]. These reproductive problems decrease fertility, hinder conception, make it difficult to deliver healthy calves, cause postpartum complications, lengthen the time between calves, lower lifetime productivity, reduce milk yield, and cause early depreciation of cows that might be valuable [5, 6, 17]. In addition, farmers have to pay for treatment (medication and fees from animal health providers) as well as management (feed, housing, labor, water, electricity, etc.) of dairy animals during a longer unproductive inter-calving period in order to manage these issues, which raises costs and lowers profits [18].

Understanding reproductive diseases has been seen as a feasible way to improve reproductive performance [9]. A regular immunization schedule for the herd is the most crucial general management strategy that prevents the primary reproductive diseases. Other general procedures include removing diseased animals from the breeding program, culling them completely from the herd, or isolating them for a specific amount of time. A healthy uterine environment, quality semen, accurate estrus diagnosis, and effective insemination techniques are also essential for high reproductive efficiency [19]. Furthermore, more investigation is still necessary to fully understand the magnitude of reproductive health issues in the dairy business in order to formulate successful preventative strategies. Therefore, the main objectives of this review manuscript were to enumerate major reproductive disorders of dairy cattle, to highlight on different diagnostic and management approaches to reproductive disorders and to describe the status of reproductive health problems in Ethiopia.

## Common Reproductive Disorders in Dairy Cows

### Disorders occurred before gestation

**Repeat breeding:** The term "Repeat Breeding" (RB) refers to as a cow that did not conceive after three or more consecutive inseminations with a fertile bull or fertile semen [13]; despite, it comes normally in heat and shows clear estrous signs with no clinical detectable reproductive disorders or without anatomical abnormalities and infections by exhibiting a variety of reproductive disturbances [16].

The major risk factor and causes for repeat breeding in animals include gonad less condition, hypoplasia of the ovaries, oviduct obstruction, ovary defects, congenital anomalies of the genital tracts, endocrine dysfunction, abnormalities in ovulation, causes of

fertilization failure, spermatozoa aging and genetic defects that affect the ova. Infectious or traumatic inflammatory processes affecting the genital organs-result in repeat breeding due principally to early embryonic deaths [20]. Managerial deficiencies including nutritional deficiencies in the herd are a common cause of lowered fertility and repeat breeding [21]. Additionally inadequate record-keeping, poor estrus detection, inappropriate insemination time and method, and low-quality semen are also responsible for high incidence of repeat breeding among dairy animals [22].

Repeat breeder cows can show physically and physiologically good but they may be suffering from inadequate recognition of their embryos, loss of embryos after conception, social stress, nutritional imbalance, or other management issues that are negatively affecting their fertility. One major factor contributing to low conception rates is thought to be embryo loss, or the embryo's inability to adhere to the uterine wall [3]. One of the main causes of infertility in herds worldwide is repeat breeding; globally, the prevalence of repeat breeding in dairy cows is between 3 and 10% [23].

**Diagnosis and treatment of repeat breeding:** An external examination can detect either genetic or acquired anatomical problems such as traumas, tumors, vulvar defects, and pneumovagina [24]. Examining the vaginal contents might be helpful to discover blood (post-ovulation or certain disorders), clear and clean mucus (associated with heat), urine (if uro-vagina), pus (if endometritis, vaginitis), or other substances. There are hormonal and non-hormonal approaches for treating animals with repeat breeding [21]. Numerous studies have demonstrated that giving GnRH to repeat breeding cows (their third or later service) can increase their conception rate. The mechanism by which GnRH produces its effect is most likely linked to changing the corpus luteum's release of progesterone rather than by stimulating ovulation, because treatment with GnRH improves fertility in repeat breeders [25]. Uterine lavage combined with PGF2 $\alpha$  may also be a useful treatment for repeat breeder cows due to its benefits, which include minimal endometrial side effects or waste and a possible increase in conception rates [16].

**Anoestrus:** Anoestrus is a functional loss of the reproductive cycle that is characterized by the absence of overt indications of estrus, which might occur when the hormone is not expressed or is not detected [6]. A dairy cow is diagnosed with Post-Partum Anoestrus (PPA) if, within 60 days of giving birth, she does not exhibit signs of estrus, regardless of whether she is cyclic. Anoestrus is seen in adult animals during pregnancy, lactation, and the early postpartum period in heifers that have reached puberty [5]. This disorder is characterized by insufficient pituitary stimulation for the release of either Luteinizing Hormone (LH) or Folicle-Stimulating Hormone (FSH), which leads to Graafian follicle rupture and failure of maturation [13].

Anestrus is a result of numerous interrelated conditions, including physiological, pathological, managerial, and dietary aspects. Age, breed, pre- and postpartum nutrition, the animal's physical state, lactation, suckling, the season of calving, the bull's presence or absence, dystocia, delayed uterine involution, genotype, parasitic infection, and the animal's overall health are some of these [26]. Anestrus is a big issue in the tropics and subtropics, where the condition is made worse by disease, large parasite burdens, poor nutrition, and high ambient temperatures. In addition to lactation stress, low body weight and poor physical condition can further prolong the post-partum anoestrous phase [3].

**Diagnosis and treatment of anoestrous:** A key component of diagnosing anestrus is history based on the following information: the animal's failure to exhibit overt indications of estrus after reaching puberty or 60-90 days postpartum; A rectal examination and ultrasonography are two other approaches employed in the diagnosis of anestrus in animals. Progesterone estimation is another component of the diagnosis process, as real anestrus is typically characterized by a lack of ovarian progesterone production [22].

The causes, diagnostic resources, drug availability and efficacy, animal reaction to the drug, dosage, and animal health state all play a role in the anestrus treatment process [16]. Estrogen and progesterone are administered as a hormonal therapy for anestrus. When anestrus animals get exogenous estrogen infusions, they either have concurrent ovulation or develop estrus symptoms. Because of its positive feedback influence over the pituitary for the increase in LH, estrogen treatment causes the expression of estrus and ovulation in the presence of a dominant follicle. It has therefore been used to trigger ovulation [20].

### Disorders associated with pregnancy and parturition

**Abortion:** Abortion is the expulsion of a dead or non-viable fetus at any stage of pregnancy before the time of normal parturition [8]. It is defined as the premature expulsion of the fetus between 42 days (the estimated time of attachment) and approximately 260 days of gestation (the age at which the fetus can survive outside of the uterus) [27]. There are a number of factors that cause proportion of pregnancies to terminate with an abortion. It may be idiopathic (occurring without known cause) or hormonal abnormalities, nutritional deficiencies, trauma, toxicities, or infectious processes [6, 26].

Non-infectious factors can also be genetic and non-genetic disorders. The most important non-genetic factors are heat stress, production stress, seasonal effect and seasonal changes [24]. The most important genetic disorders include chromosomal and single gene disorders and these disorders resulted in high abortion rate in cows and increased calf sterility. Cow parity, sire effect, age at conception and abortion history could be some of the non-infectious maternal and paternal factors that cause fetal death [16]. Non-infectious causes of abortion also include; nitrate toxicity from crops, isocupressic acid toxicity twin pregnancy, large placenta syndrome and premature shedding of fetal membranes, hydroallantois, drug reactions, physical trauma, inherited lethal abnormalities, heat stress, teratogens, iodine deficiency, and endotoxins [28, 29]. The detail about non-infectious causes of abortion is indicated in table 1.

**Table 1:** Summary of non-infectious causes of abortion in animals [21, 28, 30].

| Items                                 | Factors                                                                                                                                                                 |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chemicals, drugs and poisonous plants | Nitrates<br>Arsenic<br>Perennial broom weed,<br>Mycotoxicosis                                                                                                           |
| Hormonal                              | Estrogens<br>Prostaglandins                                                                                                                                             |
| Physical                              | Infusion or insemination of the pregnant uterus<br>Crushing embryo or fetus<br>Removal of corpus luteum,<br>Stress due to work or fatigue<br>Transport or major surgery |
| Nutritional                           | Starvation<br>Multiple deficiencies including vitamin a, iodine and selenium deficiencies.                                                                              |
| Genetic or Congenital                 | Defects of embryo or fetus,<br>Chromosomal or genetic abnormalities                                                                                                     |
| Miscellaneous                         | Twinning<br>Adhesions of uterus<br>Allergies<br>Endometrial deficiencies<br>Tumors<br>Age at conception<br>Cow parity                                                   |

The infectious agents that cause abortion in cattle include viruses (*Bovine herpes virus 1*, *Bovine viral diarrhea virus*, *Bluetongue virus*, *Schmallenberg virus* and others), bacteria (*Brucella abortus*, *Coxiella burnetii*, *Leptospira*, *Listeria monocytogenes* and others), protozoa (*Toxoplasma gondii*, *trichomonas* and others) and fungus (*Aspergillus fumigatus*, *Mortierella wolfii* and *Mucor* spp.) [21,31]; which are indicated in the table 2.

**Diagnosis of abortion in cattle:** The clinical signs of abortion differs depending on their causative agent but the most common are fetal death and abortion, placentitis, necrotic cotyledon and edematous, infertility [20]. Breeding dates, parity, production information and health events (e.g., disease or vaccination) can all help to identify factors which may be associated with the abortions. Other herd level information such as ration changes, new additions, personnel changes, etc., should also be recorded [16].

Generally, diagnosis of abortion in dairy cattle include history of the case and relevant epidemiological data, examination health and feeding records, careful examination of the affected dam, and collection of the expelled fetus and placenta for pathological and microbial examination [3]. A complete reproductive and health history of the affected animals and the herd is necessary and helpful in making a diagnosis. This should include records of the type, brand and date of vaccinations of the dam and any medications given the dam. In addition to these, samples such as serum samples, urine, milk and vaginal swabs can also collect for analysis [6]. A variety or battery of diagnostic serologic tests have been developed to screen or test blood samples from the dam and fetuses after expulsion for bacterial and viral diseases associated with abortion. Thus viral, bacterial or other serological determinations were used in addition with history, clinical signs, necropsy and isolation of infectious agents [21].

**Control and prevention of abortion:** Prevention and control depend on the causative agents and the common control and prevention method is control of exposure to the causative agent, regular immunization against disease that cause abortion, proper housing, handling and environmental control regarding sanitation, artificial insemination and balanced nutritional programs is essential [20]. Management decisions can help minimize losses from infectious causes of abortion. Recognizing disease problems can aid in making decisions concerning the use of preventive vaccines, isolating sick animals, sanitation and other factors that may affect the herd status [5]. Vaccination against infectious causes can be highly effective if given at the appropriate time and should always be done prior to the breeding season and to any new animal in the herd. Other measures

**Table 2:** Infectious causes of abortion [16, 20, 28].

| Causes     | Species involved                 |                                       |
|------------|----------------------------------|---------------------------------------|
| Bacteria   | <i>Salmonella dublin</i> ,       | <i>Bacillus cereus</i>                |
|            | <i>S. typhimurium</i> ,          | <i>Bacillus licheniformis</i>         |
|            | <i>Brucella abortus</i> ;        | <i>Actinomyces pyogenes</i>           |
|            | <i>B. melitensis</i>             | <i>Leptospira hardjo</i>              |
|            | <i>Listeria ivanovii</i> ,       | <i>Campylobacter fetus subspecies</i> |
|            | <i>L. monocytogenes</i>          | <i>C. fetus subspecies fetus</i>      |
| Virus      | <i>Listeria ivanovii</i> ,       | <i>Chlamydia psittaci</i>             |
|            | <i>Bovine virus diarrhoea</i>    | <i>Bluetongue virus</i>               |
| Protozoa   | <i>Bovine herpes virus 1</i>     | <i>Aino/Akabane virus</i>             |
|            | <i>Neospora caninum</i>          | <i>Trichomonas fetus</i>              |
| Fungi      | <i>Toxoplasma gondii</i>         | <i>Anaplasma marginale</i>            |
|            | <i>Aspergillus fumigates</i>     | <i>Mortierella wolffii</i>            |
| Rickettsia | <i>Coxiella burnetii</i>         |                                       |
|            | <i>Ehrlichia phagocytophilia</i> |                                       |

are isolating infected animals for certain period, removing the animal from the breeding program, or entirely culling the animal from the herd. Additionally; Animals with reproductive diseases due to infectious causes should be treated, the moment initial signs of the disease are observed [25].

**Dystocia:** Dystocia can be defined as the incapability of the cow to expel neonates through the birth canal from the uterus [5]. It is defined as challenging parturition that will take a longer period than normal and usually requires external help and assisted delivery [32]. Dystocia can be caused by the dam or by the fetus. The three maternal causes of dystocia are: primary uterine inertia, secondary uterine inertia [33], and anatomical or pathological defects in the birth canal, which includes the bony pelvis, uterus, cervix, vagina or vulva [8]. Fetal causes of dystocia include: abnormal fetal presentation or position, fetal monsters, persomus elumbus, and fetal oversize [30].

The incidence of dystocia is greater in pregnancies that terminate early due to uterine disease, fetal death, twinning or that terminates after prolonged gestation period due to excessive size of the fetus [34]. Difficult births increase direct costs of the herd (veterinary fees, calf or cow death or both and extra farmer labor), as well as indirect costs, such as an increase in the risk of subsequent unfavorable health events, an increase in culling rate and a reduction in productive capacity of the dam. Moreover, dystocia can negatively affect reproductive traits, such as open days or number of services per pregnancy [35].

Dystocia results in increased stillbirth rate and mortality of the offspring, increased neonatal morbidity, increased mortality rate for the dam, reduced productivity of the dam, reduced subsequent fertility and increased chance of [36].

**Diagnosis of dystocia:** The most important points included during diagnosis of dystocia are the knowledge about gestation length, onset of labor pains, kind of discharges being voided, any fetal part observed, any abnormal signs shown by the animal, any assistance provided and treatment given to the animal, etc., [22]. In order to prevent and treat dystocia one must know history of previous occurrences of difficulty calving for each animal, such as any previous zoonotic diseases which caused an early abortion and current gestation length and the length of time that the animal has been in labor are early predictors of dystocia [20]. Disinfected fingers are inserted slowly through birth canal to check for injuries, the degree of dilatation of the cervix, states of fetal sac and fetal presentation and position [6]. The fetus should be examined: whether the fetus is living or dead. The presence of a living fetus is indicated by the reflex movements in the natural orifices, such as the tongue reflex after seizing it, the movement of the jaw the eyelid reflex, sphincter

contraction; and also by pulsation in the umbilical arteries. Signs of death are absence of reflexes, an abundant discharge of meconium about the anus and finally cutaneous emphysema [35].

**Management of dystocia:** The principal purpose of obstetrical operations is to deliver a viable fetus and to prevent injury to the dam [21]. Dystocia in cattle can be relieved by different obstetric methods, including the caesarean operation and fetotomy. Medical management may be considered when the condition of the dam and fetuses is stable, when there is proper fetal position and presentation, and when there is no obstruction. The use of specific ecobolic drugs such as oxytocin, calcium or glucose therapy may be required in cases where a deficiency is suspected [13]. For the case of uterine torsion, antibiotic and non-steroidal anti-inflammatory drugs are provided. Prostaglandin F2alpha and its analogs are used mainly for their luteolytic effects to induce predictable onset of estrus in a variety of species. They cause marked uterine contractions which may be useful for expulsion of uterine contents [37].

The obstetrical operations may be divided into four major classifications: mutation, forced extraction, fetotomy or embryotomy and cesarean section or laparohysterectomy. Surgery is indicated for obstructive dystocia, dystocia accompanied by shock or systemic illness, primary uterine inertia, prolonged active labor, or if medical management has failed [30]. Nowadays, the caesarean operation is one of the most common surgical procedures performed by veterinarians in cattle practice and is considered a routine obstetric technique. It has high maternal and fetal survival rates and often is less exhausting, speedier, and safer than fetotomy [38].

**Uterine prolapse:** Uterine prolapse is a non-hereditary abnormal uterine condition that often manifests as the uterus being expelled to the outside of the body through the vulva, usually within hours of parturition but sometimes up to several hours later [16]. The coming out of the uterus, with or without the vagina and cervix, through the vulva usually happens soon after parturition and hangs out with the inner surface outermost. This condition is known as uterine prolapse. It could be brought on by increased intra-abdominal pressure linked to the uterus's increased size, intra-abdominal fat or rumen distention imposed on the pelvic girdle's relaxation and softening, an excessive force during delivery, or uterine inertia (the uterus stops contracting) brought on by metabolic issues (*i.e.*, milk fever) [20]. Complete uterine prolapse is one of the reproductive illnesses that affects farm animals the most and is always quite serious. This is because an animal with a prolapsed uterus is more likely to experience mechanical damage, trauma, or environmental contamination, which can increase maternal morbidity or even result in the animal's mortality, especially during or shortly after parturition [13].

**Diagnosis and treatment of uterine prolapse:** The diagnosis was made based on the history of the uterus protruding beyond the vagina due to a lack of support from ligaments and fascia [32]; caruncles were visible on the uterus that prolapsed through the vulva [3]. The diagnosis is quite evident. Unless it's a very recent occurrence, the uterine mucous membrane and/or fetal membrane are exposed and typically covered in blood clots, straw, dirt, or excrement. Usually, the uterus is swollen and edematous, particularly if the condition has persisted for at least four to six hours [21].

The successful treatment in uterine prolapsed cases depends on the nature, duration, level of damage, and contamination of uterine prolapsed cases. The prolapsed uterus washed carefully with warm saline [30]. The fetal membranes are detached manually with

fingertips from the maternal caruncles avoiding bleeding. Then the uterine mass is again washed with saline and finally with 1:1000 potassium permanganate solution. Then, it replaced to its normal anatomical position. Rubbing the surface of the uterus with glycerol helps reduce edema and provides lubrication. An epidural anesthetic should be administered first. Then the uterus returned in to its normal anatomical position [6]. Administration of injectable broad-spectrum antibiotics for three to five days after replacement of the prolapsed uterus can prevent secondary bacterial infection [16].

**Vaginal prolapse:** Vaginal prolapse refers to a condition in which part or the entire vaginal wall protrudes from the vulva. It tends to occur during mid to late gestation period, sometimes after delivery [6]. It is observed in the cow most commonly the last 2 to 3 months of gestation, when a large amount of estrogenic hormone is being secreted by the placenta. This causes a relaxation of a pelvic ligament and adjacent structures and an oedema and the relaxation of vulva and vulvar sphincter muscles [3]. Predisposing factors include increased intra-abdominal pressure associated with increased size of the pregnant uterus, intra-abdominal fat, or rumen distention super imposed upon relaxation and softening of the pelvic girdle and associated soft-tissue structures in the pelvic canal and perineum mediated by increased circulating concentrations of estrogens and relaxin during late pregnancy [30]. Vaginal prolapse has been classified based on the severity and duration of the condition. First-degree vaginal prolapse involves only the vaginal floor and occurs only when the cow is recumbent. With second-degree prolapse, the vagina and often the bladder continuously protrude through the vulva [20]. Third-degree prolapse involves the prolapse of the cervix as well as the vagina and bladder, and straining becomes constant. In fourth-degree prolapse, there is extensive tissue necrosis caused by chronic exposure of the vaginal and cervical mucosa. As the prolapse becomes more severe or chronic, the likelihood of systemic problems such as peritonitis and adhesions increases, and the survival of the fetus is endangered [39].

**Diagnosis and treatment of vaginal prolapse:** Cervico-vaginal prolapse is easily diagnosed, however to find out where the bladder is located and whether the fetus is viable, a rectal examination should be done. If the diagnosis of fetal viability or the position of the bladder is unclear, ultrasonography might be utilized as a supplement to palpation [39].

The choice of treatment for vaginal and cervical prolapse varies depending on the animal's type and breed, the severity of the condition, the time of pregnancy, and the owner's capacity to provide for and monitor the animal until after parturition [21]. First, an epidural anesthesia is given to replace the prolapsed vagina. If required, the bladder is emptied and the organ is cleaned and rinsed. This is usually accomplished by raising the prolapsus to allow the urethra to straighten; on rare occasions, a needle puncture through the vaginal wall may be required. After lubricating the vagina thoroughly (glycerol acts as an osmotic agent to alleviate congestion and edema), the vagina is maintained in place until it feels warm once more [40]. In order to maintain retention, a Buhner suture - a circumferential suture inserted well beneath the vestibulum to offer support - must be placed at the site of the vaginal wall's initial eversion [30].

### Post-partum disorders

**Retained placenta:** Retaining the placenta, afterbirth, or retention of fetal membranes is a prevalent disorder that often affects animals after delivering birth. The cow is the primary animal affected, with

other domestic animals experiencing it less frequently [41]. The third stage of labor, known as expulsion of the fetal membranes, is typically completed six hours after parturition. Fetal membrane retention occurs when a cow retains its fetal membranes for a variable amount of time after parturition, ranging from 6 to 24 hours [13]. In these cows, however, the fetal membranes may not be evacuated regularly and instead stay attached to the uterine caruncles. A disruption in the loosening process between the fetal cotyledons and the maternal caruncles is the main cause of retained placenta in cattle, and it is linked to numerous infectious diseases [42].

Predisposing factors for the retention of fetal membranes include mechanical, dietary, managerial, and infectious concerns, among others. The mechanical causes of RFM include dystocia, cesarean sections, uterine torsion, abortion, stillbirth, and twin birth [13]. The management-related causes include: stress, genetics, inbreeding, and obesity. Placental retention is linked to infectious disorders such as brucellosis, leptosprosis, salmonellosis, listeriosis, IBR virus, and BVD virus. Due to the growth of bacteria in the uterus caused by such retention, several issues arise [26]. Delay in uterine involution, longer time to first insemination, more services needed throughout pregnancy, lower pregnancy rates, and longer days open are all detrimental effects of RP. RFM has also been linked to a higher incidence of mastitis, metritis, endometritis, and ketosis. These diseases can in turn lead to decreased fertility and potential losses in milk production [43, 44].

**Diagnosis and management of retained fetal membrane:** The diagnosis is typically obvious when degenerating, discolored, and eventually foul-smelling membranes are observed hanging from the vulva more than 24 hours following parturition [30]. Retained fetal membranes can be treated with collagenase injection, hormone or antibiotic therapy, manual removal, and hyperosmotic solution therapy. Detaching the retained fetal membranes manually from the cotyledonary attachments carries a higher risk of uterine infection than if the animal is left untreated. The membranes will often release after two to eleven days if the animal is not treated [45]. There is a lot of foul-smelling, dark-brown, red fluid in the vagina when the retained membranes are removed, along with tiny placenta fragments [20]. When complications and infection symptoms take place, antimicrobial medication may be necessary in the treatment of RFM. Antibiotics used systemically alone were just as efficacious as those used systemically in conjunction with intrauterine treatment [43].

### Uterine infections:

**Pyometra:** Pyometra is characterized by the distension of the uterus in the presence of an active corpus luteum on the ovary and the accumulation of purulent or muco-purulent material inside the uterine lumen [46-48]. If corpus luteum is generated during uterine infection and ovulation takes place too early in the postpartum period, pyometra may result [5]. Most cows have a closed cervix, but occasionally the cervical lumen does not close completely, resulting in purulent discharge that emerges from the vagina when the cow lies down, urinates, or defecates [49].

**Metritis:** Metritis is a severe inflammatory response that occurs within all the layers of the uterus including the endometrium, sub mucosa, myometrium and perimetrium [48]. It most frequently occurs in the 10-14 days following parturition in the postpartum phase of dairy cattle [50]. Postpartum metritis can usually be attributed to birth canal and/or vulva injuries, protracted manipulations, RFM, twin deliveries, and uterine inertia [51-53].

Puerperal metritis, which often develops within ten days following parturition, is an acute systemic sickness caused by uterine bacterial infection [46]. Clinical manifestations of puerperal metritis include a fetid reddish-brown watery discharge from the uterus and, typically, pyrexia; in more severe cases, there may also be dullness, inappetence or anorexia, increased heart rate, and apparent dehydration [54, 55].

**Endometritis:** Inflammation of the endometrium, the uterus's functional lining, is known as endometritis [56]. When systemic symptoms of sickness do not appear 21 days after delivery, it is characterized as endometrial inflammation and is regarded as the chronic stage of uterine inflammation [20]. Retaining the fetal membrane, causing damage to the reproductive tract during calving or breeding, using excessive force to assist in calving, uterine treatment, uterine contamination during calving and over-conditioning may be contributing factors to the development of endometritis. These factors can also predispose cows to a variety of health problems during parturition or the early stages of lactation, including RFM and endometritis [6].

Endometritis is categorized as clinical or sub clinical [52]. Clinical endometritis is described as localized inflammation of the endometrium and is typically indicated by the presence of mucopurulent or purulent material in the vagina at or after 21 days post-calving, with a pus content of greater than 50% [55, 57, 58]. Risk factors for clinical endometritis in dairy cows include parity, retained fetal membranes, peripartum metabolic condition, cleanliness of the perineum at calving, delivery of twins, and dystocia [53].

Subclinical endometritis is a uterine disease without clinical signs and is challenging to diagnose on a farm. However, as a form of uterine diseases, it is negatively affecting the reproductive system of dairy cows. [56, 59-61].

#### **Diagnostic approaches to postpartum uterine diseases:**

**Rectal palpation:** Rectal palpation is undoubtedly the most frequently used diagnostic technique for uterine infection diagnosis [56]. Trans-rectal palpation is used to look for pathological alterations in the uterus that are indicative of endometritis, such as a harder uterine wall, variable contents, and general enlargement [62].

**Examining the vagina and its discharges:** A uterine infection can be detected by evaluating vaginal discharge [63]. In actuality, the most useful method for uterine infection diagnosis is to look within the vagina to see if there is any pus [64]. A speculum or a clean, gloved hand inserted into the vagina should be used to examine the contents of the female genital tract in order to diagnose metritis and clinical endometritis [65]. For the purpose of detecting purulent discharge, voyaging has been shown to be a more sensitive technique than straightforward exterior inspection [66].

**Ultrasonography:** Concerning evaluation of the female reproductive system, ultrasonography has emerged as a significant diagnostic modality [66]. Trans-rectal ultrasonography makes it possible to measure the cervix and uterine horn diameters more objectively and to see the mucus and pus inside the uterus lumen [46]. The appearance of aberrant uterine fluid on ultrasonography can range from homogenous, purulent exudates that mimic the echogenicity of the surrounding uterus to anechoic fluid with floating particles, sometimes known as "snowy specks" [22].

**Cytology:** The process of collecting and counting cells obtained from the uterus is known as uterine cytology, and it has grown

to be the gold standard by which other methods are compared. Quantification of inflammatory cells is feasible through the use of uterine cytology [60]. The proportion of neutrophils is measured and subsequently utilized to evaluate the level of inflammation within the uterus. Cytological samples can be obtained using a cytobrush or uterine lavage. The cytobrush provides an *in situ* sample that could be indicative of the endometrium's level of inflammation [62].

**Uterine biopsy:** Endometrial biopsies are highly diagnostic for pathology and can yield large amounts of quantitative information about immunological or physiological processes in cows provided that the same biopsy material is used to gather genetic and proteomic information [67]. When the biopsy technique is applied, endometrial tissue fragments are extracted using biopsy forceps; the examination of the uterine samples in all these techniques necessitates laboratory work [68].

**Culture of bacteria:** To identify the cause of a uterine infection, a uterine culture is a crucial diagnostic method. Uterine fluids can be swabbed and cultured to characterize the anaerobic and aerobic bacterial populations during the postpartum period [63]. The most precise way to collect samples for the identification of the particular and non-specific bacteria that cause infection is using a swab [55]. It is important to obtain a genuine uterine culture from the uterus free of external microorganisms [54].

**Treatment options and management for postpartum uterine diseases:** It is possible to enhance dairy herd fertility and overall health by managing post-partum uterine contamination effectively. Considering the high expense of postpartum uterine diseases [69]. Treatment at a later stage, after diseases have become established, is more expensive than prevention and early treatment of postpartum uterine infections [70]. For postpartum care to be effective, early detection or predictions of uterine infections is essential [71, 72].

**Management approaches:** By minimizing the need for assistance at calving due to prenatal knowledge of twin delivery, calf sex, and big calves, the incidence of uterine infections can be decreased. In order to reduce the risk of uterine infections, caving help should only be performed when absolutely necessary and proper hygiene practices should be followed [73]. Uterine infection instances are generally thought to be reduced by cleaning calving equipment, changing bedding often, and maintaining overall cleanliness in the calving area [74]. Prevention of uterine disease requires appropriate nutritional management during the transition period and after calving [55]. Trace mineral and vitamin deficiency early postpartum, particularly selenium and vitamin E have long been identified as a cause of uterine disease, and because of the importance of energy balance on the incidence of uterine disease, nutritional supplements that prevent ketosis may be an important component for the prevention of uterine diseases [75].

**Hormonal treatments:** Metritis, Pyometra, and Retained Fetal Membranes (RFM) have all been treated with drug substances such as estrogens, luteolytic prostaglandins, and Gonadotropin Releasing Hormone (GnRH) either alone or in combination with other therapies throughout the postpartum period [69, 76]. These substances are helpful substitutes for antibiotics in treatment because of their impact on uterine motility and defensive mechanisms. In addition to being luteolytic, PGF<sub>2α</sub> also seems to have pro-inflammatory properties that could improve neutrophil performance. The preferred method of treating Pyometra in cows is to provide normal luteolytic doses of

**Table 3:** Prevalence of major reproductive disorders of dairy cattle at different parts of Ethiopia.

| No | Location/ area                | Prevalence (%)    | Methods of study                                                       | Author and Publication year |
|----|-------------------------------|-------------------|------------------------------------------------------------------------|-----------------------------|
| 1  | Kombolcha                     | 40.3              | Retrospective type of study                                            | [17]                        |
| 2  | Hosanna                       | 43.07             | Questionnaire and observational survey                                 | [11]                        |
| 3  | Wondo Genet district          | 43.90             | Both retrospective and prospective (follow-up)                         | [88]                        |
| 4  | Tole district                 | 37.8              | A cross-sectional study                                                | [92]                        |
| 5  | Bale robe                     | 66.15             | A cross-sectional study                                                | [9]                         |
| 6  | Adea Berga dairy farm         | 54.6              | A retrospective and longitudinal study                                 | [93]                        |
| 7  | In and around Asella town,    | 18.3; 30.3        | Questionnaire survey                                                   | [84, 85]                    |
| 8  | Bishoftu town                 | 30.12; 30.1; 40.5 | Questionnaire and observational study, retrospective study,            | [3, 19, 94]                 |
| 9  | Jimma town                    | 31.6              | Questionnaire and observational survey                                 | [26]                        |
| 10 | Jimma Horro District          | 11.7              | A cross-sectional study                                                | [89]                        |
| 11 | Gondar town                   | 25                | Questionnaire survey and regular follow-up                             | [7]                         |
| 12 | Hawassa town                  | 36.7              | A retrospective study                                                  | [10]                        |
| 13 | Nekemte town                  | 49.74             | Questionnaire survey & Regular follow up                               | [95]                        |
| 14 | In and around Bako            | 30.4              | Questionnaire survey & Regular follow up                               | [86]                        |
| 15 | Central zone of Tigray region | 19.3              | A retrospective study                                                  | [16]                        |
| 16 | South wolo                    | 39.8              | Questionnaire and regular follow up                                    | [87]                        |
| 17 | Mekelle town                  | 42.3              | Questionnaire survey and regular follow up                             | [96]                        |
| 18 | Kembata-Tembaro zone          | 61                | A cross-sectional study                                                | [90]                        |
| 19 | In and around Fitche town     | 42                | Questionnaire and observational study and interview                    | [97]                        |
| 20 | Wolaita sodo                  | 35.5              | Questionnaire and regular follow up                                    | [83]                        |
| 21 | East wollega                  | 36.1              | A combination of cross-sectional, longitudinal and retrospective study | [91]                        |
| 22 | Borena Zone                   | 47.7              | A cross-sectional study                                                | [45]                        |
| 23 | In and Around Chench Town     | 32.5              | A cross-sectional study                                                | [98]                        |

prostaglandin F2a or its equivalents [30].

In order to eliminate abnormal uterine contents, enhance the generation of mucus containing host defense components, and trigger estrus, estrogen may boost uterine tone. This, in turn, lowers progesterone levels, increases neutrophil phagocytosis, and increases the uterus' resistance to infection [73].

**Anti-inflammatory drugs:** According to studies, NSAIDs provide therapeutic benefits that include ovarian function restoration, analgesia, and the management and prevention of uterine inflammation [75, 77]. Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) have been used to treat postpartum inflammation, but their effectiveness has varied depending on the drug, the mode of action (inhibition of cyclooxygenase or prostaglandin-endoperoxide synthase 1 or 2), the timing, and the length of treatment [78].

**Use of antibiotics:** Treatment for uterine infections is dependent upon several factors, including the removal of uterine secretions, the way in which infectious agents react to the medication being used, the frequency and concentration of drug use, and the extent to which the endometrium is exposed to the treatment [79]. Uterine disorders have been treated with both local and systemic interventions [59]. The systemic antimicrobial therapy must be used to treat the cases of RFM, metritis and pyometra while intrauterine treatment is preferred treatment of choice for endometritis as it is local inflammation and does not result in systemic illness [22]. Antibiotics commonly used for the treatment of puerperal metritis include penicillin, third-generation cephalosporins, or a combination of ampicillin with

Oxytetracycline or cloxacillin [30, 50, 80].

Alternatives for the treatment of endometritis caused by Gram negatives that are resistant to gentamicin include amikacin sulfate, polymyxin B, neomycin sulfate, ampicillin, carbenicillin, and kanamycin sulfate. The broad-spectrum antibiotics ceftiofur and ticarcillin, with or without clavulanic acid, are also commonly used in mares [81].

**Intrauterine treatment:** Intrauterine treatment, as opposed to systemic administration, results in greater drug concentration in the endometrium but less penetration into the uterus's deeper layers or other genital tissues [82]. An even distribution of an active drug throughout all layers of the uterus, minimal systemic absorption, reduced tissue irritation, and strong antibacterial activity inside the uterine environment are the goals of local treatment including intrauterine antibiotic infusion. Few researches have been conducted to evaluate the effectiveness of antiseptic agents, such as saline, chlorhexidine, and iodine, when it comes to postpartum metritis [69]. Treatment for uterine disorders has shown promise with intrauterine infusion of a 50% dextrose solution [14].

## Status of Reproductive Disorders of Dairy Cows in Ethiopia

Ethiopia is residence to the largest number of animals, however compared to other east African nations like Kenya, Uganda, and Tanzania, its dairy industry is not as advanced [26, 83]. The low reproductive performance of dairy cattle is a result of various restrictions, including inadequate quality and quantity of nutrition,

**Table 4:** Summary of commonly identified reproductive disorders of dairy cows in some of studies in Ethiopia.

| Study Areas                   | Major reproductive problems and their percentage (%) |          |          |                 |                   |                  |                  |          |                       |          |             | Sources |
|-------------------------------|------------------------------------------------------|----------|----------|-----------------|-------------------|------------------|------------------|----------|-----------------------|----------|-------------|---------|
|                               | Abortion                                             | Anestrus | Dystocia | Repeat breeding | Retained placenta | Vaginal prolapse | Uterine prolapse | Metritis | Clinical Endometritis | pyometra | Still birth |         |
| Kombolcha                     | 9.05                                                 | -        | 7.75     | 3.87            | 7.32              | -                | 0.43             | -        | -                     | -        | 3.01        | [17]    |
| Hosanna                       | 2.56                                                 | 10.26    | 5.9      | 13.08           | 7.18              | 2.05             | 0.76             | -        | -                     | -        | -           | [11]    |
| Wondo Genet district          | 9.76                                                 | 8.29     | 4.88     | 5.85            | 14.15             | 1.46             | 1.46             | 9.76     | -                     | -        | -           | [88]    |
| Tole district                 | 17.5                                                 | 3.2      | 3.5      | 2.5             | 3.4%              | 1.8              | 2.8              | -        | -                     | -        | 4.8         | [92]    |
| Bale robe                     | 4.17                                                 | 1.82     | 3.91     | 17.71           | 6.51              | Mixed (5.47)     |                  | -        | -                     | -        | 0.78        | [9]     |
| Adea Berga farm               | 28.9                                                 | 48.5     | 5.2      |                 |                   |                  |                  |          | -                     | -        | 14.4        | [93]    |
| In and around Asella town,    | 4.5                                                  | 2.3      | 15.5     | 8.1             | 5.3%              | Mixed (1.0)      |                  | 2.6      | -                     | -        |             | [84]    |
| Bishoftu town                 | 7.5                                                  | 3.7      | 3.5      | 7.7             | 10.01             |                  | 0.8              | 0.6      | -                     | -        | 1.9         | [19]    |
| Jimma town                    | 3.6                                                  | 4.7      | 3.3      | 5.3             | 8.6               | 0.6              | 1.1              | -        | 2.5                   | -        |             | [26]    |
| Jimma Horro District          | 2.9                                                  | 0.7      | 2.3      | 0.5             | 2.1               | 0.7              | 1.3              | -        | -                     | -        | 1.0         | [89]    |
| Gondar town                   | 3.48                                                 | 2.53     | 2.21     | 6.96            | 6.01              |                  | 0.95             | -        | 1.58                  | -        |             | [7]     |
| Hawassa town                  | 2.26                                                 | 6.28     | 2.5      | 9.6             | 5.02              | 2.5              | 1.51             | -        | -                     | 2.76     |             | [10]    |
| Nekemte town                  | 12.76                                                | 1.56     | 5.47     | 14.06           | 8.59              | -                |                  | -        | -                     | -        | 4.69        | [95]    |
| Central zone of Tigray region | 3.8                                                  | 4.2      | -        | 9.1             | 1.1               | -                | 0.4              | -        | -                     | 0.8      |             | [16]    |
| South Wolo                    | 5.96                                                 | 2.29     | 2.75     | 8.72            | 6.88              | Mixed (0.92)     |                  | -        | -                     | -        |             | [87]    |
| Mekelle town                  | 5.1                                                  | 43.5     | 2.1      | 25.3            | 6.8               | 0.4              | 1.7              | 0.8      | -                     | -        |             | [96]    |
| Kembata-Tembaro zone          | 3.8                                                  | 34.2     | 12.4     | 19.8            | 8.5               | Mixed (1.8)      |                  | 4.8      | -                     | -        | 0.9         | [90]    |
| In and around Fitcha town     | -                                                    | -        | 9.6      | 14              | 12.6              | -                | -                | -        | 5.4                   | -        |             | [97]    |
| Borena Zone                   | 12.2                                                 | 10.3     | 3.4      | 10.3            | 7.6               | -                | 2.7              | -        | -                     | -        | -           | [45]    |
| East wollega                  | 8.33                                                 | -        | 5.55     | -               | 19.44             | -                | -                | -        | -                     | -        | 2.77        | [91]    |
| In and Around Chencha Town    | 4.7                                                  | -        | 5.2      | -               | 12.2              | -                | -                | -        | 3.7                   | -        | -           | [98]    |

poor management, diseases of varied origin, and poor performance of indigenous breeds, despite the enormous number of cattle and their economic significance in the nation [84]. Even though dairy cattle are kept in Ethiopia under various production systems, the environmental conditions and management practices used to keep the cattle can have a significant impact on the incidence and prevalence of reproductive disorders in various regions [85, 86]. Studies on the main reproductive issues affecting cattle across the country have revealed that these problems exist and are causing small-holder dairy farms and the dairy industry to suffer significant financial losses [6, 87, 88]. The prevalence of these issues varies, ranging from a minimum overall prevalence of 11.7% to a maximum prevalence of 61% [89, 90]. Major reproductive issues include abortion, dystocia, RFM, metritis, vaginal and uterine prolapse, mastitis, anoestrous, bovine brucellosis, and repeated breeding, which are prevalent in various parts of Ethiopia [16, 85, 91] (Table 3 and 4).

## Conclusion and Recommendations

Reproductive problems lead to low reproductive performance, which costs small-holder dairy farms and the dairy sector a significant amount of capital. Retained Fetal Membrane (RFM), repeated breeding, abortion, anestrus, dystocia, endometritis, metritis, genital prolapse, and pyometra are considered to be major factors affecting

the reproductive performance of dairy cows among the major reproductive issues that directly affect the reproductive performance of animals. Thus, it is crucial to apply preventative measures and make an accurate diagnosis in order to lessen the detrimental effects of reproductive health issues. Based on the above conclusion, the following recommendations are forwarded:

- Raising awareness among dairy producers, farmers, and other relevant organizations.
- At the farm level, developing and implementing effective control and prevention strategic procedures.
- Enhancements to the breeding system's management system, adequate nutrition, hygienic conditions, and optimal bull selection and AI timing.
- Routine and regular check-ups on cows in the pre- and postpartum stages.
- Maintaining accurate and thorough records of breeding and calving; always monitor for indications of possible reproductive issues.

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