



ETIOLOGY, PATHOGENESIS, AND PREVENTION OF OBSTETRIC AND GYNECOLOGICAL DISEASES IN HOLSTEIN- FRIESIAN COWS

*Trainee Lecturer at the Tashkent Branch of Samarkand State University of
Veterinary Medicine, Animal Husbandry and Biotechnology*

Elmamatov Shaxzod Inomiddin o'g'li

*Senior Researcher at the Veterinary Research Institute, Doctor of Philosophy
(PhD) in Veterinary Sciences*

N.Sh. Hamraqulov

*Senior Lecturer at the Tashkent Branch of Samarkand State University of
Veterinary Medicine, Animal Husbandry and Biotechnology*

Normamatov Ramazon Qo'ziboy o'g'li.

Abstract

This review analyzes international scientific literature on the etiology, pathogenesis, diagnosis, treatment, and prevention of obstetric and gynecological pathologies in high-producing Holstein-Friesian cows. It discusses the metabolic and endocrine consequences of negative energy balance during the postpartum period, the effects of heat stress on the reproductive system, and the role of dietary and mineral-metabolism disorders in uterine function. Modern diagnostic methods, including ultrasonography and biochemical and hormonal assessment of blood serum, as well as hormonal synchronization protocols, are also considered. The review aims to provide practical conclusions for livestock farms operating in hot climatic conditions.

Keywords

Holstein-Friesian, obstetric and gynecological pathologies, transition period, negative energy balance, heat stress, endometritis, hormonal synchronization, prevention.



Introduction

Improvements in dairy herd management, feeding, and genetic selection have steadily increased milk production in cows. However, Lucy's analysis of data from the United States (2001) showed that increasing milk yield and farm size had been accompanied by a decline in reproductive efficiency. Because the Holstein-Friesian breed is widely used for milk production worldwide, this issue is particularly relevant to the breed.

Obstetric and gynecological pathologies—including retained placenta, metritis, endometritis, uterine subinvolution, and ovarian dysfunction—play an important role in poorer reproductive performance. They lead to lower conception rates, prolonged service periods, and reduced farm income (LeBlanc, 2008). In imported cows kept under local conditions, these problems may be further complicated by high ambient temperatures and the specific characteristics of the feed supply.

The aim of this review is to systematize the principal factors and pathogenetic mechanisms involved in the development of obstetric and gynecological pathologies in Holstein-Friesian cows and to examine modern approaches to diagnosis, treatment, and prevention. The analysis is based on studies published in international scientific literature. It is noted that separate epizootiological observations are needed to establish precise indicators under local conditions.

1. The Transition Period: Physiological and Metabolic Changes

The transition period generally begins approximately three weeks before calving and continues for three weeks after calving. During this period, profound hormonal and metabolic changes occur as the cow shifts from pregnancy to lactation (Grummer, 1995; Drackley, 1999). Dry matter intake declines before calving, while the mammary gland begins to require substantially greater amounts of glucose, amino acids, and fatty acids. As a result, a gap develops between the energy supplied by the diet and the animal's requirements.



According to Drackley (1999), the period extending from three weeks before to three weeks after calving is crucial for cow health, productivity, and profitability, because many diseases occur during this time, although the fundamental biological processes involved remain relatively under-studied. Therefore, proper ration formulation and monitoring of the animals' condition during the transition period are central components of prevention.

2. Negative Energy Balance and Disruption of Neuroendocrine Regulation

Negative energy balance (NEB) is commonly observed in high-producing cows during the first weeks after calving, although its severity and duration vary among animals (Beam and Butler, 1999). The body compensates for the energy deficit by mobilizing body fat. Consequently, serum concentrations of non-esterified fatty acids (NEFA) and beta-hydroxybutyrate (BHBA) increase, while glucose and insulin concentrations decline. Excessive accumulation of fatty acids in the liver creates conditions conducive to fatty liver and ketosis.

NEB affects the reproductive system through several pathways. According to Beam and Butler (1999), cows that lose more body condition have a longer interval to first ovulation, whereas recovery after the nadir of energy balance is associated with improved follicular activity and a shorter interval. The authors noted that modulation of luteinizing hormone (LH) secretion during NEB occurs mainly at the hypothalamic level. Changes in metabolic hormones such as insulin and insulin-like growth factor I (IGF-I) may also alter the response of dominant follicles to gonadotropins. Butler (2003) reviewed the relationship between energy balance, follicular development, ovulation, and fertility.

Clinical observations also support this relationship. Duffield and colleagues (2009) studied the effects of hyperketonemia during early lactation on cow health and productivity. Ospina and colleagues (2010) analyzed associations between elevated NEFA and BHBA levels during early lactation, reproductive performance, and milk



production. Roche and colleagues (2009) reported that body condition score (BCS) at calving, its nadir, and the amount of condition lost after calving are associated with milk production, reproduction, and health, and that these relationships are often nonlinear.

Immune function declines around calving, increasing susceptibility to uterine infection (LeBlanc, 2008). Metabolic disorders, suppression of the immune system, and uterine diseases can therefore be viewed as interconnected components of a single pathogenetic chain.

3. Effects of Heat Stress on Reproductive Function

Heat stress reduces milk yield and reproductive efficiency in dairy cows. Armstrong (1994) showed that cooling systems such as shade, ventilation, and sprinkler-fan systems are important for reducing these effects. The temperature-humidity index (THI) is widely used to assess the level of heat stress.

Heat stress affects the reproductive system both indirectly and directly. Indirectly, reduced dry matter intake prolongs NEB and increases the interval from calving to conception, particularly in high-producing cows (De Rensis and Scaramuzzi, 2003). Direct effects include reduced dominance of the large follicle, decreased steroidogenic capacity of theca and granulosa cells, impaired oocyte quality and embryonic development, and increased embryonic mortality (Wolfenson et al., 2000; Hansen, 2009). De Rensis and Scaramuzzi (2003) also noted that inducing follicular development and ovulation using gonadotropins may reduce the severity of seasonal infertility.

Because Uzbekistan has a hot and prolonged summer, this factor appears especially relevant in the region. However, local studies that measure THI and compare it with reproductive indicators are needed to assess the precise effects of heat stress on farms in the country [add a source from a local study].

4. Nutritional and Mineral-Metabolism Factors

An unbalanced ration is an important cause of obstetric and gynecological pathologies. Goff's review (2006) indicated that diseases such as milk fever and ketosis



are associated with a cow's inability to maintain calcium or energy balance, and that improving feeding before calving may reduce their frequency. Feeding strategies have also been developed for conditions whose causes are not clearly classified, including retained placenta, udder edema, and displaced abomasum. Calcium deficiency may adversely affect uterine function because it influences muscle contractility.

In addition, inadequate energy and protein supply, as well as imbalances in vitamins A, D, and E and trace elements (selenium, copper, zinc, and cobalt), may impair immune defense and tissue repair. When formulating rations, the composition of locally available roughage and succulent feeds (such as alfalfa hay and corn silage) should be determined by laboratory analysis, and mineral-vitamin supplements should be selected accordingly. Monitoring the ration and body condition before calving helps reduce the risk of NEB and metabolic diseases (Drackley, 1999; Roche et al., 2009).

5. Pathogenesis of Uterine Diseases and Ovarian Dysfunction

5.1. Uterine Diseases

Contamination of the uterus with microorganisms during calving is common. Most cows eliminate the infection after calving, but in some animals inflammation persists and develops into disease. Sheldon and colleagues (2006) proposed standardized terminology for postpartum uterine diseases. Under this classification:

Puerperal metritis occurs within the first 21 days after calving and is characterized by an enlarged uterus, foul-smelling reddish-brown discharge, and signs of systemic illness.

Clinical endometritis is characterized by purulent uterine discharge 21 or more days after calving.

Subclinical endometritis occurs without visible discharge and is identified by an increased proportion of neutrophils in endometrial cytology.

Pyometra is characterized by accumulation of pus in the uterine cavity and the presence of a functional corpus luteum.



Uterine diseases negatively affect reproductive performance. According to LeBlanc (2008), clinical endometritis occurs in 15–20% of cows four to six weeks after calving, while subclinical endometritis is detected in a further 30–35% between weeks four and nine. Kasimanickam and colleagues (2004) found that cows with subclinical endometritis had a lower relative pregnancy rate—approximately 41–51%—than unaffected cows.

5.2. Ovarian Dysfunction

NEB and heat stress may affect ovarian function. Beam and Butler (1999) reported a positive relationship among changes in energy balance, blood IGF-I concentrations, and the function of dominant follicles. Under heat stress, the dominance of the large follicle is weakened and plasma levels of LH and follicle-stimulating hormone (FSH) change (Wolfenson et al., 2000). Clinically, these effects may appear as anovulation, persistent follicles, follicular cysts, and inadequate corpus luteum function.

6. Modern Diagnostic Methods

Timely identification of obstetric and gynecological pathologies requires a comprehensive approach. Traditional bimanual rectal examination makes it possible to assess uterine size and tone and ovarian status. Ultrasonography (B-mode ultrasound) complements this method by providing clearer visualization of fluid in the uterine cavity, ovarian follicles, the corpus luteum, and cystic structures. Kasimanickam and colleagues (2004) showed that subclinical endometritis can be detected in clinically healthy cows using endometrial cytology and ultrasonography, and that the condition is associated with a lower pregnancy rate.

Laboratory diagnostics are important for assessing metabolic status. Measuring serum BHBA, NEFA, glucose, total protein, calcium, and other macrominerals makes it possible to identify high-risk animals early during the transition period (Duffield et al., 2009; Ospina et al., 2010). Measuring progesterone concentrations by enzyme-linked immunosorbent assay (ELISA) can help assess corpus luteum function. Diagnostic



results should not be interpreted in isolation but together with clinical examination, farm records, and ration analysis.

7. Treatment and Reproductive Management

Treatment strategy depends on the diagnosis. According to LeBlanc (2008), systemic antibiotics may be appropriate for cows with metritis when at least two of the following are present: retained placenta, fever, depression, and foul-smelling uterine discharge. Systemic administration of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) at five and seven weeks after calving may improve pregnancy rates. When a functional corpus luteum is present, particularly in cases of pyometra, $PGF_{2\alpha}$ and its analogues induce luteolysis and help the uterus clear its contents. The choice of antimicrobial agent, dosage, and duration of treatment must be determined by a veterinarian, and withdrawal periods for milk and meat must be strictly observed.

Hormonal synchronization protocols are used to manage ovarian dysfunction and plan insemination. The Ovsynch protocol proposed by Pursley and colleagues (1995) consists of GnRH, followed seven days later by $PGF_{2\alpha}$, then a second GnRH injection 48 hours later, followed by timed artificial insemination (the exact timing depends on the protocol variant). This method enables insemination without detecting estrus and synchronizes ovulation. Its effectiveness depends on the cow's physiological status, stage of the cycle, and farm management; therefore, it should be evaluated carefully for each farm.

8. Prevention Strategies

Based on the literature review, preventive measures can be organized into the following areas:

Optimize the ration during the transition period. Ensure a balanced supply of energy, protein, minerals, and vitamins, and monitor calcium metabolism (Goff, 2006; Drackley, 1999).



Monitor body condition. Prevent excessive fattening during the dry period and limit BCS loss after calving (Roche et al., 2009).

Reduce heat stress. Provide shade, ventilation, sprinkling, and other cooling systems, and monitor THI regularly (Armstrong, 1994; De Rensis and Scaramuzzi, 2003).

Conduct metabolic monitoring. Screen for BHBA and other indicators during the first weeks after calving to detect ketosis early (Duffield et al., 2009).

Maintain hygiene during and after calving. Provide obstetric assistance under clean conditions, monitor uterine involution regularly, and detect uterine diseases early (LeBlanc, 2008; Sheldon et al., 2006).

Conclusion

Obstetric and gynecological pathologies in Holstein-Friesian cows are multifactorial. Negative energy balance during the transition period, heat stress, disturbances in nutrition and mineral metabolism, and weakening of the immune system play important roles in their development.

Negative energy balance alters LH secretion and the hormonal response of follicles and is associated with delayed first ovulation. Reduced immune function around calving increases the risk of uterine disease.

Heat stress lowers conception rates by reducing dry matter intake and directly affecting reproductive processes. This factor requires particular attention in hot-climate regions.

Combining rectal examination with ultrasonography and biochemical and hormonal analyses of blood serum improves diagnostic accuracy.

Treatment should be selected according to the diagnosis, while prevention should be comprehensive and include transition-period feeding, body-condition management, cooling systems, and metabolic monitoring.



Local epizootiological and clinical studies are advisable in Uzbekistan to determine disease prevalence and its relationship with climatic and nutritional factors.

References

Armstrong D.V. Heat stress interaction with shade and cooling // Journal of Dairy Science. 1994. Vol. 77, No. 7. P. 2044–2050.

Beam S.W., Butler W.R. Effects of energy balance on follicular development and first ovulation in postpartum dairy cows // Journal of Reproduction and Fertility, Supplement. 1999. Vol. 54. P. 411–424.

Butler W.R. Energy balance relationships with follicular development, ovulation and fertility in postpartum dairy cows // Livestock Production Science. 2003. Vol. 83. P. 211–218.

De Rensis F., Scaramuzzi R.J. Heat stress and seasonal effects on reproduction in the dairy cow: a review // Theriogenology. 2003. Vol. 60, No. 6. P. 1139–1151.

Drackley J.K. Biology of dairy cows during the transition period: the final frontier? // Journal of Dairy Science. 1999. Vol. 82, No. 11. P. 2259–2273.

Duffield T.F., Lissemore K.D., McBride B.W., Leslie K.E. Impact of hyperketonemia in early lactation dairy cows on health and production // Journal of Dairy Science. 2009. Vol. 92, No. 2. P. 571–580.

Goff J.P. Major advances in our understanding of nutritional influences on bovine health // Journal of Dairy Science. 2006. Vol. 89, No. 4. P. 1292–1301.

Grummer R.R. Impact of changes in organic nutrient metabolism on feeding the transition dairy cow // Journal of Animal Science. 1995. Vol. 73, No. 9. P. 2820–2833.

Hansen P.J. Effects of heat stress on mammalian reproduction // Philosophical Transactions of the Royal Society B. 2009. Vol. 364. P. 3341–3350.

Kasimanickam R., Duffield T.F., Foster R.A., Gartley C.J., Leslie K.E., Walton J.S., Johnson W.H. Endometrial cytology and ultrasonography for the detection of



subclinical endometritis in postpartum dairy cows // *Theriogenology*. 2004. Vol. 62. P. 9–23.

LeBlanc S.J. Postpartum uterine disease and dairy herd reproductive performance: a review // *The Veterinary Journal*. 2008. Vol. 176, No. 1. P. 102–114.

Lucy M.C. Reproductive loss in high-producing dairy cattle: where will it end? // *Journal of Dairy Science*. 2001. Vol. 84, No. 6. P. 1277–1293.

Ospina P.A., Nydam D.V., Stokol T., Overton T.R. Associations of elevated nonesterified fatty acids and beta-hydroxybutyrate concentrations with early lactation reproductive performance and milk production in transition dairy cattle in the northeastern US // *Journal of Dairy Science*. 2010. Vol. 93, No. 4. P. 1596–1603.

Pursley J.R., Mee M.O., Wiltbank M.C. Synchronization of ovulation in dairy cows using PGF 2α and GnRH // *Theriogenology*. 1995. Vol. 44, No. 7. P. 915–923.

Roche J.R., Friggens N.C., Kay J.K., Fisher M.W., Stafford K.J., Berry D.P. Invited review: Body condition score and its association with dairy cow productivity, health, and welfare // *Journal of Dairy Science*. 2009. Vol. 92, No. 12. P. 5769–5801.

Sheldon I.M., Lewis G.S., LeBlanc S., Gilbert R.O. Defining postpartum uterine disease in cattle // *Theriogenology*. 2006. Vol. 65, No. 8. P. 1516–1530.

Wolfenson D., Roth Z., Meidan R. Impaired reproduction in heat-stressed cattle: basic and applied aspects // *Animal Reproduction Science*. 2000. Vol. 60–61. P. 535–547.