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Factors affecting fertility in small ruminants

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Abstract

A complex interaction of genetic, nutritional, environmental and health factors affect fertility in small ruminants like sheep and goats. Breed selection, dietary management, reproductive tract pathology, trace element deficits, and management techniques are some of the major factors influencing reproductive performance in small ruminants. It is described how these factors affect lambing rates, prolificacy, and fertility, developing successful techniques to increase reproductive efficiency and output in small ruminant farming systems.

Introduction

Sheep and goat are an important part of the world's livestock industry since they provide millions of people with meat, milk, and wool. The long-term viability and financial success of systems that raise tiny ruminants depend on their reproductive efficiency. Genetics, diet, environment, health, and management practices are just a few of the many elements that affect fertility, an important part of reproductive function. Due to decreased fertility, prolificacy, and lambing rates, the world's small ruminant population suffers enormous economic losses. These problems are made worse by things like disease outbreaks, nutritional inadequacies, and climate change. In order to improve reproductive efficiency, boost productivity, and guarantee the long-term sustainability of small ruminant farming systems, it is crucial to realize the factors impacting fertility in these animals.

Crucial factors affecting fertility in small ruminants are:

Farmers, particularly those in developing nations, rely on small ruminants for their economic, survival, and social livelihoods. Problems related to fertility in small ruminants mainly arise due to nutritional, Environmental, Managemental factors, Pathogens (bacteria, virus, parasite), age and puberty, stress etc.

The most common reproductive disorders in small ruminants include

- Brucellosis
- Leptospirosis
- Toxoplasma
- listeriosis
- Campylobacteriosis

1. Genetic factor:

Twenty to thirty percent of infertility in small ruminants is attributable to genetic causes. Finn sheep, for example, have a genetic tendency that makes them more fruitful than other kinds. But infertility can be a result of inbreeding depression, genetic diseases, or mutations. Reduced fertility is a possible symptom in breeds predisposed to certain genetic illnesses, such as those involving the reproductive system or cystic ovarian disease. And heredity plays a role in fertility by affecting ovulation rate, embryo survival, and litter size. In order to increase fertility,

breeding programs should prioritize selective breeding, cross-breeding, and genetic testing. It is still difficult to find an ideal balance between fertility and other desirable qualities, such as growth rate and milk output. More efficient breeding techniques are being developed in genomics, epigenetics, and genetic testing, which are assisting in the identification of genes related to fertility.

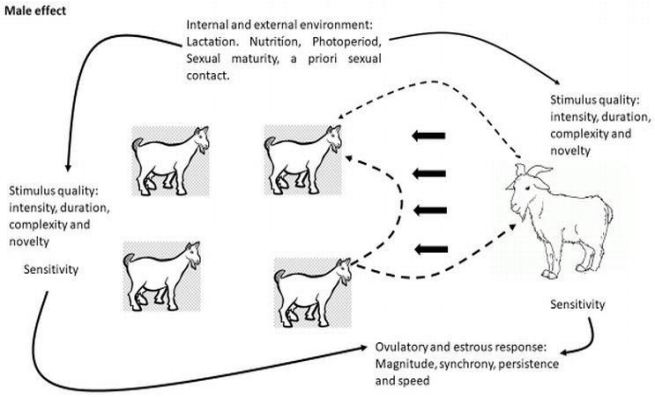
2. Environmental factors: (socio - sexual, photoperiod)

Factors related to the environment cause 20-30% of infertility in small ruminants. High humidity, high temperatures, and high altitude are some of the climate extremes that might lower fertility by interfering with reproductive cycles. As an example, a drop in the estrogen band and a late pre-ovulatory spike of GnRH and LH can result from heat stress in sheep during their follicular phase. lessen the viability of embryos and lower the quality of sperm. Delays in estrus are observed in ewes when the temperature is higher than the critical point. Transport stress is another potential cause. Sexual dysfunction, inability to mate, and difficulty carrying a pregnancy to term are all symptoms of thermal stress. Fetal growth is reduced by heat stress as well. All of the mechanisms leading to the control of GnRH secretion converge in the brain, where environmental influences are coordinated. The unexpected arrival of new males can trigger ovulation in sexually quiescent females, altering the timing of other reproductive processes. Other factors that reduce fertility include toxic exposure, insufficient water supplies, and poor-quality feed. Management techniques such as overpopulation, insufficient housing, and stressful handling can also raise cortisol levels, which in turn reduce the synthesis of reproductive hormones. Photoperiod and sunshine duration are two seasonal factors that can impact fertility and breeding behavior. Infertility can be caused by a variety of diseases and parasites, including brucellosis and internal parasites.

3. Nutritional factors :

There is a strong correlation between nutritional parameters and reproductive success in small ruminants, particularly in sheep. Optimizing fertility is based on the golden rule: proper nutrition and ovarian function go hand in hand. Inadequate nutrition lowers fertility, but sufficient nutrition increases conception rates, litter size, and breeding efficiency. Inadequate nutrition, especially in the areas of energy, protein, and minerals such as selenium and copper, can hinder the ability to conceive. Decreased fertility is caused by a shortage of food resources. Fertility and reproductive efficiency are enhanced by consuming a high-calorie diet. Ovarian activity is negatively impacted by both short-term and long-term underfeeding. The management practice of feed flushing in sheep and goats lengthens the time it takes for them to reproduce. Pregnant sheep' fertility is affected by the long-term effects of malnutrition. Showing a reduced stress response at 1 year of age, as well as a lowered progesterone level during luteal phase and impaired fertility, when given 50% of their need after mating for 20-78 days. The amplitude of GnRh, which ultimately produces an LH pulse, decreases due to feeding restriction. Ewes that quickly diminish the magnitude of the FSH and LH pre- ovulatory surge. The glucose level in ewe follicular fluid is affected by a short-term feeding of a high-protein and high-energy diet. Follicle fluid glucose content is inversely related to progesterone levels. Alterations to the IGF-I mechanism connect nutritional impacts on fertility. Reduced IGF-I levels persist despite acute dietary restriction. A reduction in the expression of FSH receptors by the developing follicle in response to FSH is caused. It is GnRH and IGF-I that control the production and secretion of progesterone, which is a critical component for the growth of granulosa cells and ovarian secretory cells. Follicle responsiveness to GNRH is affected by glucose and insulinemia. Granulosa cells in ewes have insulin-dependent glucose transport. Case cells and granulosa cells are both affected by insulin. Elevated insulin-mediated glucose levels promote development and shield against atresia. When ewes fast, their ovulation rates drop. Limiting food intake for a brief time during the luteal phase changes the rate of ovulation and the rise

of luteinizing hormone. Energy deficit feeding led to an increase in plasma non esterified fatty acids. A decrease in the quantity of oocytes occurs as a result of the negative energy balance in goats.The quantity of granulosa cells and oocytes is reduced by urea and non-esterified fatty acids. Inadequate intake of magnesium, phosphorus, and calcium hinders the ability to conceive .Deficiencies in copper, selenium, zinc, and iodine have an impact on fetal development, embryonic survival, and fertility. Reduced fertility is associated with insufficient vitamin A, D, and E. Reproductive performance declines due to insufficient water consumption.



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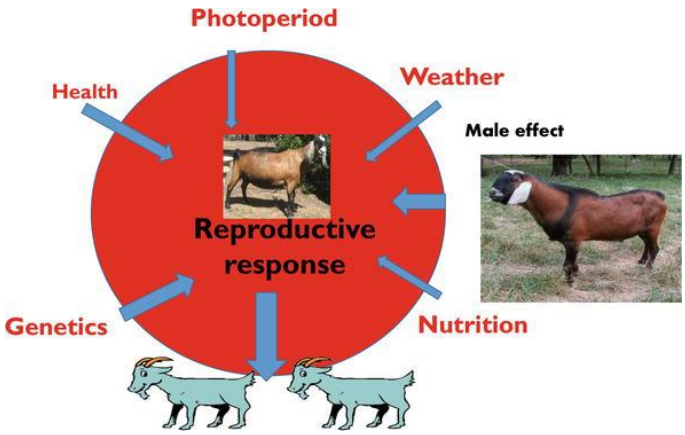
4. Health factor:

Diseases, parasites, and problems with the reproductive system all have a major influence on the fertility of small ruminants. Brucellosis, chlamydiosis, and campylobacteriosis are examples of reproductive tract infections (RTIs) that can lower fertility and raise the risk of abortion. Malnutrition and decreased fertility can result from internal parasites (such as gastrointestinal nematodes) that hinder the absorption of nutrients. Pneumonia, mastitis, and foot rot are systemic disorders that reduce fertility because they take energy away from the reproductive processes. Infertility can also be caused by hormonal imbalances, cystic ovarian syndrome, or abnormalities in the reproductive system. Reduced conception rates and increased embryonic mortality are associated with poor reproductive tract health, which includes conditions like endometritis and vaginitis.



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5. Managemental factor:

Ten to twenty percent of infertility in small ruminants is attributable to management-related difficulties. Inadequate vaccination, parasite control, monitoring of reproductive tract health, incorrect estrus synchronization, improper artificial insemination, inadequate breeding season, insufficient male-to-female ratios, improper reproductive record-keeping, and inadequate breeding strategies all contribute to reduced fertility and increased susceptibility to diseases. Immune function and the generation of reproductive hormones are suppressed by overcrowding, insufficient housing, and handling stress. Future reproductive success is diminished due to insufficient consumption of colostrum, poor newborn care, and improper kidding and lambing procedures. Damage to the reproductive tract and decreased fertility are results of handling and transportation procedures that are too stressful. Fertility drops when agricultural workers aren't properly

trained, don't communicate well, and don't have enough competence.

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