



Minerals and Reproduction: An Interaction

R. Kumar, K. Sethy*, R. P. Kharade and O. S. Andure

Department of Animal Nutrition, C.V.Sc and AH

Odisha University of Agriculture and Technology, Bhubaneswar, 751003, Odisha

<https://doi.org/10.5281/zenodo.11004203>

Introduction

Minerals are inorganic fraction of body that presents @3-4% of the body weight. According to their concentration in the body or amount required in the diet it's classified into macro and micro minerals. Minerals are necessary to perform essential function of body and also maintain optimal health condition of animals. Minerals are the Integral part of some hormones, enzymes and vitamins. Minerals play very important role in the reproductive processes of animals like fertility, conception rates, and overall reproductive health. Minerals plays very important role in sperm viability, embryo development, and maintenance of pregnancy. Deficiencies or imbalances of minerals can lead to suboptimal reproductive performance, resulting in reduced fertility rates, increased calving intervals, and economic losses for dairy enterprise. In various studies it is found that proper mineral supplementation, either through dietary means or through mineral injections, can significantly improve reproductive outcomes in dairy animals. Furthermore, the balance between different minerals is critical, as excessive levels of certain minerals can be just as detrimental as deficiencies. The mineral requirements for reproduction in mammals depend on the mineral content in the body of the animals and mineral requirement for the fetal growth. Regular and efficient reproduction is important factor for profitable dairy enterprise. It is necessary to provide adequate amount of minerals in the ration. Deficiency of these minerals in ration ultimately decreases reproductive efficiency which leads to unprofitable dairy enterprise.

Macro minerals

Calcium

Ca is the most abundant mineral in the animal body. Majority of the Calcium (99%) and Phosphorus (80%) are present in bones and teeth so that is why bone serves as store house for Ca. At the time gestation animal has tremendous need of Ca for the development of fetal bone, deficiency of Ca at this time may cause acute case of Osteomalacia. Ca is necessary for the muscle contraction and deficiency may see as prolonged calving and retained placenta. Improper Ca: P



ratio altered the activity of pituitary gland leading to reproductive problems like prolonged estrous, delayed ovulation and increased dystocia and retention of placenta in animals (Sathish Kumar, 2003). In contrast excess Ca impair the absorption of minerals like P, Mg, Zn and CU leading to reproductive problems like anestrous in animals. In regards to male Ca has important role in sperm capacitation. Capacitation is triggered by the influx of calcium ions. .

Phosphorus

Phosphorus is the second most abundant mineral in the animal body after calcium. Deficiency of P leads to reduced appetite or depraved appetite (Pica). P deficiency causes dysfunction of ovaries leading to poor fertility, irregular estrous and reduced conception rate in animals. Post parturient problems like vaginal prolapsed and inactivation of ovaries may occur. Moderate deficiency of P may lead to repeat breeding and poor conception rate in animals (Sathish Kumar, 2003). In some cases, P deficiency may lead to longer inter calving period, still born, embryonic death in livestock's (Chaudhary and Singh, 2004).

Magnesium

Magnesium has no direct effect on the reproductive functions of animal but when it is high in diet then may increase Ca requirements and then signs of Ca deficiency may be seen like anoestrus, prolonged calving and retained placenta. Any disturbance in Ca-P-Mg homeostasis can alter normal reproductive physiology (Sathish Kumar, 2003).

Sodium and Potassium

Soft tissues and body fluids contain most of the sodium and potassium in the body. They regulate the acid–base balance and osmotic pressure of the body fluids. Nutritional deficiency may cause delayed sexual maturity, impaired estrus rhythm in females, but in case of male impotency is a major symptom. Lack of sodium and potassium in the diet also lowers the utilization of digested Protein and energy which causes slow growth and ultimately delays sexual maturity.

Trace Minerals

Copper

It is important mineral for reproduction of dairy animals. Deficiency is responsible for early embryonic death and resorption of embryo. Deficiency of copper leads to necrosis of placenta and increased chances of retention of placenta and delayed estrus. Supplementation of Cu is important to improve conception rate. Cu deficiency leads to increased incidence to early embryonic mortality, low conception, repeat breeding and delayed onset of puberty. In males, deficiency of Cu causes severe damage of testicular tissue, decreased libido and low-quality semen.



Cobalt

Cobalt (Co) is necessary for cell division, gamet formation, reproduction and growth because its involvement in the thiamin synthesis which is required for DNA synthesis. Deficiency of Co causes reduction in fertility, poor fetus development, prolonged involution of uterus, early calf mortality, irregular estrus and lower conception rate (Sathish kumar, 2003). Deficiency also causes silent heat, nonfunctional ovaries, delayed onset of puberty and abortion (Sathish Kmar, 2003). Low level of Co in diet is also associated with increased early calf mortality.

Manganese

Mn is important for synthesis of cholesterol which is required for synthesis of sex hormones like testosterone, estrogen, progesterone. Mn deficiency may cause irregular estrus and also reduction in conception rate. It also causes birth of deformed calves, abortion, congenital limb deformity & poor growth rate in calves. It also causes cystic ovary, poor follicular development, delayed ovulation, low conception rate, high embryonic mortality increases in service per conception. Mn deficiency in males also causes decreased sperm motility & lower sperm concentration in ejaculates of animals. It also causes restricted testicular growth in male animals

Iodine

Iodine is a key factor in reproduction as it required in the fetus for development, maintaining metabolism as controls basal metabolic rate. As Iodine is incorporated into the thyroid hormones, Thyroid gland has effect on anterior pituitary for releasing gonadotropins ultimately affects estrous cycle. Due to deficiency of Iodine fertility reduced and abortion rate and retention of placenta is also increased (Mishra and Tiwari, 2014).

Conclusion

Maintaining optimal mineral levels in the diet of dairy animals is essential for ensuring reproductive success and maximizing productivity. When animals are raised in a particular geographic area where the soil lacks certain minerals, the surrounding water and plants also lack those minerals, causing the deficiency signs in those animals which are reared under this particular area. So, Area-specific-minerals supplementation can play a crucial role in ensuring optimal health, growth, reproduction, and overall performance of the animals.

References

- Mishra, G. and Tiwari, P. R. 2014. Infertility Management of Dairy Animals. *Indian Dairyman*, 66: 56-60.
- Sathish Kumar. 2003. Management of infertility due to mineral deficiency in dairy animals. In: *Proceedings of ICAR summer school on "Advance diagnostic techniques and therapeutic approaches to metabolic and deficiency diseases in dairy animals"* IVRI, Izatnagar, UP, pp: 128-137.