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Available online at: [www.indianfarmer.net](http://www.indianfarmer.net)  
ISSN: 2394-1227 (Online)**Original Article****Physiological Importance of Faster Availability & Absorption of Phosphorus in Ruminants****Dr. Anuj B. Koli***M.V.Sc. Scholar; Department of Animal Reproduction, Gynaecology and Obstetrics.**College of Veterinary and Animal Sciences, MAFSU, Udgir, Dist.Latur.***\*Corresponding author:** [anujkoli6000@gmail.com](mailto:anujkoli6000@gmail.com)

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**Introduction:**

Phosphorus is the most important element in the diet of all animals including ruminants. The normal inorganic phosphorus content of blood is 4 to 6 mg/100ml. It is found in the body along with calcium. Phosphorus is required for synthesis of proteins, enzymes of the body and play important role in the intermediary metabolism of carbohydrates and creatine in reaction that occur in muscle contractions. It is also utilized in the formation of phospholipid of milk (Reddy, 2001). Whole blood contains 35 to 45 mg of phosphorus per 100 ml of blood. Most of it is present in cell and occurs in variety of forms, mainly organic combinations. Phosphorus is one of the major mineral contributing 29 % of total body minerals. The mean concentration of phosphorus is 10 gm/kg body weight of the animal. Phosphorus is absorbed in phosphate form from the small intestine. It should be at the point of contact with the intestinal mucosa. Any substance that form insoluble complex with the phosphate ion will decrease its absorption. Phosphorus is present in variety of forms and tissues that play important role in normal functioning of the body. Majority of phosphorus (80%) present in bones with the ratio of Ca: P is 2:1. Bone serve as store house for calcium and phosphorus. Bone contains 17% of phosphorus. Phosphorus is largely present in the form of organic combinations such as phosphoprotein, nucleoprotein, phospholipids, phosphocreatine and hexose phosphate. It is component of many enzyme systems. It makes up 0.15 to .2% of soft tissues of the body.

**Availability & Absorption of Phosphorus:**

The term phosphorus availability refers to the proportion of the dietary phosphorus which may be absorbed by the animal when it is absorbing phosphorus at a maximal rate. The reduced ruminal retention time caused by higher dry matter (DM) and concentrate intake in high producing ruminants decreases the available time for phosphorus degradation by rumen microorganisms and consequently enhances ruminal escape of phosphorus. In large animals or specifically ruminants, free choice feeding is recommended but ruminants don't have nutritional wisdom to select the amount of nutrients needed. The dietary requirement of phosphorus or other minerals is difficult to accurately define since many factors determine the utilization of minerals. Interrelations among minerals or between minerals and organic fractions result in enhanced or decreased utilization of phosphorus in ruminants. Also, dietary excess, mineral status of animal, genetic-nutrition relationship, change in management practices, age, sex and productivity level of animal influence absorption of the phosphorus. Phosphorus is also provided by the saliva, but salivary phosphorus can be low when high concentrate diets are fed. The salivary gland of ruminants can concentrate plasma phosphorus up to 16-fold by a combination of the gland's ability to concentrate phosphorus and the high salivary flow rate. High-grain diets are also associated with reduced secretion of saliva, thus possibly decreasing the salivary phosphorus available for microbial use and for absorption in the small intestine (Goselink *et al*, 2015). Phosphorus solubility differs widely between plant feedstuffs, which is mainly related to their phytate contents, the salts of phytic acid. Enzyme phytase catalyzes the stepwise hydrolysis of phytate to inorganic phosphates and inositol with lower phosphorylated inositol phosphates as intermediates. Phosphorus is mainly stored in the form phytates in the plant seeds, thus reduce the rumen solubility and thus availability to the ruminants particularly when rumen function is suboptimal. The enzyme phytase catalyzes the hydrolysis of phytate. In ruminant animals, the important sources of this enzyme are, ruminal microbial phytase, endogenous mucosal phytase, large intestinal microbial phytase, plant phytase and exogenous microbial phytase (Humer and Zebeli,2015).

Approaches to reduce the phytate contents of concentrates are the supplementation of microbial phytase and the application of diverse feed processing techniques like germination, fermentation

and the treatment of feeds with organic acids. In high-producing ruminants, especially in dairy cows, faster passage rate and suboptimal rumen fermentation conditions may limit ruminal phosphorus degradation, because of the short-duration exposure of the phosphorus molecule to microbial phytase. Phosphorus can be supplied to the animals using phosphorus rich feeds such as vegetable protein supplement's, cereal grains and their byproducts (brans) and animal protein supplements. Phosphoric acid is highly available source of phosphorus for animals.

### **Faster availability of Phosphorus**

The most important source of phosphorus for ruminants is plants. The additional supplement of phosphorus is important to fulfill the requirement of the phosphorus for those animals that are only fed on plant based source. To increase the bioavailability of the phytic phosphorus in the plant, extrinsic phytase enzyme can be added in the diet of the ruminants. However, the recent studies focus on feeding phosphorus as a Nano-particle to increase the bioavailability and absorption. It also has higher physical stability and chemical neutrality. Nano-particles increase the surface area for enzymatic action and rapid absorption of phosphorus from the intestinal villi. The commercial products which contain Oral Ionized Elemental Nano Phosphorus has more than 95% availability and absorption that maintain the serum phosphorus level.

### **Physiological Significance of phosphorus in Ruminants:**

Phosphorus play very important role in the animal body. The major important functions are enlisted below,

Function of Phosphorus:

- Protective function as in tooth enamel.
- Structural function as a constituent of bone and teeth which rigidity and strength to skeletal structures.
- Regulatory functions as it occurs in body fluids and tissues as electrolytes that maintain osmotic pressure, acid base balance, membrane permeability and tissue irritability.
- General metabolic function as in activation of many enzymes, digestion of carbohydrates, fats and proteins and storage of energy in the form of high energy phosphate bond

The level of phosphorus should be maintained within the normal range. Any deviation from the given range may predispose the functional deformity in the body. Both the deficiency and excess may be harmful for the animals (Manopriya *et al*, 2022).

The phosphorus deficiency may result in poor quality of flesh, slower growth rate, decreased lactation, irregular reproduction, pica and absence of estrum. It also causes rickets, osteomalacia and anemia. Deficiency of phosphorus causes loss of appetite or deprived appetite. Reduced fertility and reduced or delayed conception, abnormal bones and teeth, stiffness of gait, enlarged and painful joints, bending and deformation of bones, arching of back and fracture of bones (Puggaard *et al*, 2014).

Excess iron in the diet combine with phosphorus and form insoluble phosphate of iron thus causing phosphorus deficiency leading to lameness and frequent fractures.

Also the excess of phosphorus in diet may lead to pathological conditions. The normal ratio of Ca: P is 2:1. If ratio is 2:2.2 or 2:2.4, hyperphosphatemia will result. To balance this, calcium is withdrawn from the bones, thus become porous and brittle also called as osteoporosis and thus animal suffer from lameness. The causes of excess of phosphorus are kidney disease because of which phosphorus is not excreted and high diet of phosphorus containing phytate form etc.

### **Conclusion:**

Phosphorus is the most important component in animal diet as it has significant role the normal body functioning. Its either excess or deficiency may cause harmful effects on the animal body. Therefore, the adequate amount of phosphorus must be given to the animals. Faster availability of phosphorus is helpful in treating the acute deficiency of phosphorus. In most of the recent studies, it was also observed that, the crops grown under the phosphorus deficient soil may lead to the phosphorus deficiency. Thus the additional phosphorus in animal diet in the form of Nano-particles is necessary to maintain the adequate serum phosphorus level.

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