

## Role of vitamin C in animal health and production

P.V. Patil and M.K. Patil

College of Veterinary & Animal Sciences, Udgir, Dist.Latur-413517, Maharashtra

ARTICLE ID: 033

### Abstract

Vitamin C is water-soluble vitamin has an important physiological role in the enzyme system, immunity development, nutrient metabolism, de-toxication, reproduction of animals and synthesis of hormones etc. However, deficiency of vitamin C leads to deficiency symptoms/ lesions in the mouth, bone, on skin. Also, there are haematological symptoms and some of the secondary non-specific symptoms will occur. Though the ruminants can able to synthesize vitamin C in their body that can be sufficient for their daily physiological functions, but, it is needed to be supplied in a ruminant diet during certain conditions like heat stress, hepatic lesions, fattening and infectious diseases (mastitis). It is concluded that vitamin C plays important role in the health and production of animals and it is necessary to supply the vitamin C in the diet of an animal during certain conditions.

**Keywords:** Animal, health, Production, Vitamin C

### Introduction

Dietary Vitamin C is essential for In some animals like subhuman primates and guinea pigs vitamin C is dietary essential whereas, in ruminants, swine, horses, dogs, and cats, it can be synthesized from glucose in the liver. Also, many birds can synthesize vitamin C in the liver or in the kidney (Comb, 2008). Vitamin C is the Water-soluble vitamin that performs various functions in the animal body and no toxicity of vitamin C occurs due to the excretion of extra amounts through the urine of animals. Plasma Vitamin C concentration is decreased by heat stress, hepatic lesions, fattening and infectious diseases such as mastitis in cattle, inadequate nutrition of the dam or inadequate colostrum intake, enteric or respiratory disease exposure, Castration, vaccination, tail-docking, weaning, transition from individual to group housing transport stress, parasites, as well as sudden changes and

extremes of weather conditions. (Hidiroglou, 1999 and Matsui, 2012); hence there is a need for vitamin C supplementation during these conditions. Cattle can synthesize Vitamin C from either D-glucose or D-galactose through a glucuronic acid pathway in the liver. Rumen microorganisms destroys the L-Ascorbic acid present in the diet of cattle and rumen making them essentially dependent on its endogenous synthesis, which is supposed to be sufficient to fulfil the physiological requirement (Ranjan *et al.*, 2012).

### **Functions or physiological role of ascorbic acid in the body**

#### **1. Ascorbic acid in enzyme system**

The ascorbic acid functions differently than other water-soluble vitamins of the B complex family. It does not function as a co-enzyme like other vitamins, but rather protect, regulate and facilitate the catalytic and biological processes of the other enzyme system.

#### **2. Immunity and cold resistance**

It increases immunity at the cellular level and influences hormonal immune reactions. It has a prophylactic effect on pathological conditions of life, infectious diseases and immune deficiency disorders.

#### **3. Metabolism of nutrients**

Helps in carbohydrate, Tyrosin, proline, lysine, cholesterol, fat, mineral, vitamins and drug metabolism.

#### **4. Synthesis of physiologically important compounds**

- a. Synthesis of collagen and wound healing.
- b. Synthesis of hormones
- c. Synthesis of carnitine

#### **5. Ascorbic acid and reproduction in farm animals**

The ascorbic acid supplement increase Zn, Mg, Ca, K concentration in semen and is also used to induce ovulation in anovulatory females. It plays a role in the maturation and maintenance of spermatozoa.

#### 6. Ascorbic acid in de-toxication

The ascorbic acid in the stomach prevents the hepato-toxicity produced by feeding secondary amines and nitrates. It also prevents the carcinogenic effect of nitrosamines (amides, amines and urea).

#### 7. Ascorbic acid and cancer

Inhibit the growth of the malignant tumour and correct mental illness, improves well being of many patients, prevents recurrence of tumour, bladder cancer.

#### 8. Ascorbic acid is an antioxidant preservative.

#### 9. Ascorbic acid as anti-metals

A compound glyco-ascorbic acid act as anti-metabolites for vit.C.

### Deficiency of ascorbic acid

The deficiency of vit. C is known by scurvy. This is characterized by general symptoms like weakness, fatigue, listlessness, loss of appetite and body weight, lower resistance to infections and increased susceptibility to bacterial and viral infections, fever, diarrhoea etc. The deficiency of vitamin C common during feminine proposed war, which co-insides with short supply or unavailability of fresh fruits and vegetables.

#### A) Primary specific symptoms of vitamin C

The prolonged deficiency of vit. C gives rise to different symptoms in different organs/systems of the body. The specific clinical symptoms occur in the mouth, bone, skin and blood.

1. **Mouth:** Sore mouth, swollen gums become blue-red spongy, friable. The teeth may loosen, dental carries, loss of dentine filling, structural defects in teeth formation are common, changes in salivary and tear glands leading to dryness of the mouth.
2. **Bone:** The deficiency of vit. C involves the production of three types of specific cells are fibroblast, osteoblast and odontoblast which fail to produce collagen, osteods and dentine of animal characteristics. The osteoblasts fails to function properly, irregular deposition of bone salt, bone de-organization, bones are poorly formed, enlarged ends, ribs, cartilages, decreased density of long bone and teeth, new dentine are not formed. The tissue (cartilages) becomes porous, spongy, increase the brittleness of

bone leading to fractures. Finally, it leads to sub-periosteal haemorrhages of a long bone, ecchymoses, pain in bone, joints, arching of joints.

3. **Haematological symptoms:** A marked regression of RBC, platelets number during convalescence, leading to polycythemia, megaloblastic anaemia of infancy are common signs of scurvy. The blood capillaries are poorly formed, weaken capillary walls, as a result, rupture easily when there is compression and stress on bone leading to massive bleeding in the epiphyseal area, decreased blood clotting. The prolonged deficiency of vitamin C provokes Diabetic Mellitus, which bring about disorders in CHO and ascorbic acid metabolism, leading to local vitamin C deficiency in some tissues.
4. **Skin:** Appearance of peri-follicular, hyperkeratotic papules on the lower half of the body and peri-articular area, an area in contact with the clothing such as belt, garters, brassieres, and shoes are the initial sites of haemorrhage. The peri-follicular petechiae are non-pathogenic scurvy but may be seen in bacterial endo-carritid and follicular hyperkeratosis. The skin becomes dry, feverish, rough and covered with several reddish-black pinhead size dots on arms, thigh, livid spot, chiefly on legs, thigh, arm, breast, trunk, but rarely on head and face. The hyperkeratotic papules on buttock perifollicular haemorrhage oedema, coiled hairs, loss of hair, itching of skin.
5. **Wound healing:** Delayed wound healing scars around the wound, wound breakdown and becomes open. It is mainly due to the failure of collagen synthesis.
6. **In farm animals:** Vitamin C deficiency symptoms in farm animals are loss of appetite, weakness, reduced activities, rough hair coat, dropping of head, stiffness of hind legs, bending of ribs and changes in teeth. In young calves dermatitis in ear and alopecia are common.

#### **B) Secondary non-specific symptoms**

The secondary non-specific symptoms in vitamin C deficiency are 1. Reproductive failure in male and females. 2) Failure in the metabolism of CHO, proteins, cholesterol, drug, carnitine, amino acid, especially phenylalanine, lysine and tryptophan. 3) Failure in the synthesis of bile acids, steroid hormone, Hb, collagen, normal bone and teeth formation. It may lead to atherosclerosis or heart attack.

#### **Sources of vitamin C**



Fruits and vegetables are rich sources of vitamin C. But, many factors that affect the vitamin C content of fruits and vegetables are variety, maturity, length of storage, period of harvesting, part of plant, season, geographical features, and exposure to sunlight. Vitamin C decreases with plant maturity and long period storage. Grains and plant protein supplements are very low in Vitamin C. Pure crystalline vitamin C and various coated products are also the sources of vitamin C.

### References

Combs, G. F. (2008). Vitamin C. In: The vitamins: fundamental aspects in nutrition and health, third edition (Ed. G. F. Combs) Academic Press, San Diego, CA, USA. pp. 235-263.

Hidiroglou, M. (1999). Forms and Route of Vitamin C Supplementation for Cows. *Journal of Dairy Science*. 82:1831–1833.

Matsui, T. (2012). Vitamin C nutrition in cattle. *Asian-Australasian journal of animal sciences*. 25(5): 597–605. <https://doi.org/10.5713/ajas.2012.r.01>.

Ranjan, R. Ranjan, A. Dhaliwal, G.S. & Patra, R.C. (2012). L-Ascorbic acid (vitamin C) supplementation to optimize health and reproduction in cattle. *Veterinary Quarterly*. 32(3-4): 145-150, DOI: [10.1080/01652176.2012.734640](https://doi.org/10.1080/01652176.2012.734640).

Rejeb, M. Sadraoui, R. and Najjar, T. (2016). Role of Vitamin C on Immune Function under Heat Stress Condition in Dairy Cows. *Asian Journal of Animal and Veterinary Advances*. 11: 717-724.