

Role of Macro- Nutrients in Animal Health and Immunity

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Introduction

Immunity is classified as, innate and acquired immunity. Innate immunity represents animal in born defense mechanisms such as secretion of sweat & mucous, ciliary secretion. The lavaging action of bacteriocidal fluids such as, lysozyme in tears, gastric acid and microbial antagonism.

Further, innate immunity includes physical or chemical barriers, the complement system, phagocytes such as macrophages, neutrophils and natural killer cells, macrophages derived cytokines such as α and β interferons and tumor necrosis factors. If infection of bacteria occurs in animal's body, then bacteria is destroyed by soluble factors such as lysozymes and by phagocytosis with intracellular digestion. Acquired immunity develops after birth and it develops as antigen (Foreign substances) induce an immune response in the body. It includes antibodies, lymphocytes and lymphocytes derived cytokines such as interleukin-2 (IL-2), interleukin-4 (IL-4) and transforming growth factor β . Besides, there two classifications, another is passive immunity that can be acquired by maternal antibodies or from homologous pooled γ -globulins e.g. natural immunity is passed from mother's colostrum/milk to a newborn protecting it from infection.

Balanced diet

Balanced diet provides the essential nutrients to the animals in such proportion and amounts that is essential for the proper nourishment of the animal. The various nutrient are essentially

linked to the development of immunity. There are two aspects of animal nutrition, one is what animals eat and other what cells absorb and assimilate. Infact, disease resistance in animals is a triangle of defense consisting of the immune system, the digestive system and the endocrine system, which work in harmony against infections. For examples, the activities of endogenous anabolic hormones in the animals are enhanced by using the immunomodulators in the diet (Further the deficiency of zinc prevents the production of biologically active thymulin that depresses immune response in animals.)

Proteins and lipids

Severe protein energy malnutrition causes immunosuppression where helper function of T-cells is lost resulting in decreased lymphocytes proliferation and delayed humoral antibody reaction. It has been enumerated that various protein sources and amino acids influences plasma amino acid pattern determines the immune reactions. Thus, immunosuppression can occur when low grade protein is feed to animals. Further, the cytokine response to a bacterial toxin was significantly reduced at the higher level of protein in diet. Some proteins present naturally in the feeds may result in antibody production. For examples the hypersensitivity to soyabean meal protein is probably the cause of intestinal disturbances in the preruminant calves. Moreover, the antibodies to a variety of widely accepted dietary proteins are present in the serum of ruminating sheep. Further calorie restriction in animals delay the asset of autoimmunity. Beside proteins, lipids supplementation in diet influences the immune system by stimulating the macrophages. It has been found that dietary fatty acid composition could augment the specific anti-vaccine immune response. Hence it's pertinent to state that the dietary protein & lipids influencing the immune system related to livestock health might be important.

Minerals

Among trace elements, iron is an important component of metalloenzymes such as catalase and peroxidases that are an essential part of the immune system. Iron deficiency may result in lower protein synthesis, in the tissues of the immune system. Iron supplementation in diet significantly improves phagocytic activity of neutrophills while iron deficiency can significantly impair natural killer (NK) cell activity and bactericidal activity of

polymorphonuclear leukocytes. The main classes of immunoglobulins and T- lymphocytes are decreased while B- lymphocytes are relatively increased in deficiency of iron. Thus, it was concluded that iron deficiency has less effect on humoral immunity but has severe effect in cellular immune response. The supplementation of other element like calcium, chromium and selenium may enhance the humoral immune response.

Immuno suppression was observed in deficiency of zinc and copper where as over supply of iodine, zinc and molybdenum also cause immunosuppression. The copper lysine supplementation strengthens the oxidative burst mechanisms and phagocytic activities of monocytes. Moreover, sufficient information is available on the effect of combination of trace minerals with or without addition of other nutrients (eg. Lysine, methionine) on the immune system or health of animals. Therefore, additional research with individual trace minerals is required to provide better knowledge on effects of specific minerals and their possible interaction on the immune system and health of animals.

Vitamins

Vitamin A and it's metabolite (Retinoic acid) enhance the functional capacity of cells (Macrophages- T and B- lymphocytes killer cells) of the immune system. Vitamin A in combination with the vitamin, D, E and C are recommended for better immune response. Vitamin E (Tocopherols) treatment stimulates the rise in T- lymphocytes percentages as well as in metabolic activity of phagocytes but oversupply reverses the effects. No interaction effects between Vitamin E and iron on the immune system were observed. Carotenoids, Vitamin E, Vitamin C and retinoids are responsible for maintaining the structural integrity of immune cells. Vitamin B complex deficiency also affects the immune response to vaccination and infections in animals. The riboflavin sodium phosphate increased the macrophages function of the immune system. Pyridoxine supply is essential for lymphoid tissue renewal and antigen antibody reactions.

Others factors

Immunosuppressive effects are also lesson for the taurine derivative gallic acid and for a seaweed carrageenon. Also positive effects are found on digestive gland secretions and immunity by some probiotics. Beside the nutrients some contaminants and pathogenic

microorganisms can affect the immune response. Immunity can be impaired by some virus infections and biogenic amines. Lead poisoning suppresses the antibody –mediated immunity and aflatoxin is a potential suppressor of both cell mediated immunity and humoral immunity in rabbits.

Conclusion

Nutrients have significant influence on immune system of animals. Therefore, balanced diet can keep animals more potent to fight infection and can maintain good health with optimum production. Hence mortality, morbidity and medicinal cost can be reduced through better nutritional management. The risk of drug resistant can be controlled by avoiding repeated use and over use of drugs like antibiotics and anthelmintics. Thus, by over all study good nutrition for our animals is essential for better immunity, health and consequently for higher production.