



Nutritional Substances Affecting the Immune System

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ARTICLE INFO	ABSTRACT
<p><i>Reviewed Article</i></p> <p>Received : 17/03/2021 Accepted : 26/04/2021</p> <p><i>Keywords:</i> Boron β-glucan Immune System Minerals Prebiotic</p>	<p>There are many nutrients that affect animal health and strengthen immunity. Some of these are recognized as additives. Ascorbic acid has a very important function in the immune system, in the synthesis of carnitine and in the use and absorption of other nutrients. β -glucan is a stimulator of the cardiovascular system and immune system. β -glucan has a stimulating effect on macrophages, increasing the cytotoxicity and phagocytic capacity of macrophages. It also shows antioxidant, antiviral, antibacterial, and antifungal activity and has a healing effect on wounds. Inulin is a prebiotic that is isolated from the roots of chicory and yams and is effective on the immune system. It has been determined that prebiotics, which are very difficult to digest under normal conditions, are the food of probiotics. Probiotics affect the immune system with the metabolites they secrete. Another important nutrient for immunity is amino acids. Having sufficient amino acids has a positive effect on immunity. When the minerals required in chemical reactions are at a sufficient level, they have an immune enhancing effect. Studies are carried out on the effects of boron mineral, which has rich deposits in our country, as an additive in animal feeds.</p>

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Bağışıklık Sistemine Etkili Besin Maddeleri

MAKALE BİLGİSİ	ÖZ
<p><i>Derleme Makalesi</i></p> <p>Geliş : 17/03/2021 Kabul : 26/04/2021</p> <p><i>Anahtar Kelimeler:</i> Bor β-glucan İmmün Sistem Mineraller Prebiyotik</p>	<p>Hayvan sağlığını etkileyen, bağışıklığı güçlendiren birçok besin maddesi vardır. Bunların bir kısmı katkı maddesi olarak tanınmaktadır. Askorbik asit immün sistem üzerinde, karnitin sentezinde ve diğer besin maddelerinin kullanım ve emiliminde çok önemli bir yer tutar. β-glukan kardiyovasküler sistem ve immün sistem stimülatörüdür. β-glukan, makrofajlar üzerine uyarıcı etkilidir. Makrofajların sitotoksitesini ve fagositik kapasitesini artırır. Ayrıca antioksidan, antiviral, antibakteriyel ve antifungal aktivite gösterir ve yaralar üzerinde iyileştirici bir etkiye sahiptir. İnülin hindibağ ve yer elmasının köklerinden izolasyonu yapılmış, bağışıklık sistemine etkili prebiyotiktir. Normal şartlarda sindirimi çok güç olan prebiyotiklerin prebiyotiklerin besini olduğu tespit edilmiştir. Probiyotikler salgıladıkları metabolitleriyle bağışıklık sistemine etki ederler. Bağışıklık için etkili olan bir diğer konuda aminoasitlerdir. Aminoasitlerin yeterli seviyede olması bağışıklığa pozitif yönde etkilidir. Kimyasal tepkimelerde gerekli olan mineraller yeterli seviyede olduklarında bağışıklığı güçlendirici etkiye sahiptir. Ülkemizde zengin yatakları bulunan bor mineralinin de hayvan yemlerinde katkı maddesi olarak etkileri üzerinde çalışmalar yürütülmektedir.</p>

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Introduction

The productivity losses that occur during the illness of the animals continue for a while after they recover, and it takes time to reach their previous performance. Meat, milk or egg of medicated animals cannot be used for a certain period of time. The treatment of sick animals causes economic losses. At the same time, there should be separate compartments in the farm to prevent the spread of the disease. It should be easier to strengthen preventive medicine instead of dealing with all these problems. For this, it is necessary to keep the immune system active. In order not to weaken the strength of immunity, a stress-free life and sufficient nutrients should be provided. In cases where routine practices are not sufficient, supplements or additives to be added to the diet come to the fore when high immunity is needed.

Vitamin C

Ascorbic acid (vitamin C) plays an important role in collagen, carnitine, neurotransmitter biosynthesis (Karabayır and Gökçay, 2006). In animals (except Primates), ascorbic acid can be synthesized from glucose and galactose in the organism by L-gulonolactone oxidase enzyme. In poultry, it can synthesize sufficient amount of ascorbic acid for metabolism in the kidneys under normal conditions. The synthesis of vitamin C may decrease with the effect of factors that cause stress in poultry, such as disease, vaccination, high temperature and congestion. The most important properties of Vitamin C are that it has an antioxidant effect (Yarsan and Güleç, 2003).

Vitamin C is a powerful water-soluble antioxidant. It contributes to the preservation of the structure of vitamins E, A and B and to fulfill their functions. It neutralizes the negative effects of heavy metals such as lead, mercury and arsenic and strengthens the immune system (Levine, 1986).

Vitamin C increases the leukocyte activity, interferon level and effect, antibody number and response in the immune system. In addition, it has an effective role in the production of hormones and transmitters in the nervous tissue, the synthesis of carnitine, and the absorption and use of nutrients (Synlab, 2018).

Sızmaz and Yıldız (2014) reported that, dietary addition of ascorbic acid (200 mg / kg) significantly increased the feed conversion ratio and egg yield and decreased serum cholesterol level.

Inulin

Inulin is usually found in roots and stems and is used by many plants to store energy. They are fermented in the large intestine through the microflora and support the healthy growth of microorganisms in the microflora (Srinivasjois and Patole, 2009). The main sources of inulin are chicory and Jerusalem artichoke. Purified inulin can be obtained from berry or chicory tubers (Niness, 1999). Chicory roots contain glucose, fructose and sucrose (6-10% sugar) (Sabater-Molina et al., 2009). β -2,1- linkages determine the specific properties of inulin, protecting it against digestion in the upper part of

the gastrointestinal tract (Niittynen et al., 2007). Inulin has been found to increase the cytotoxicity of NK cells (natural killer immune cells). Inulin has stimulating properties on the immune response against carcinogenic agents (Watzl et al., 2005).

It has been determined that inulin originating from Jerusalem artichoke provides improvement in feed utilization and egg production in laying hens and improves house environment (Yıldız et al., 2008).

β -Glukan

β -glucans are non-starch polysaccharides found in grain feeds. Glucans are formed by the combination of many glucose molecules in different conformations. The β -glucan used in animal nutrition is isolated from natural sources. Yeast (*Saccharomyces cerevisiae*), fungus, seaweed, and bacteria are used to obtain biologically active glucan. Oat grain is also a good source (Vetvicka, 2003). Polysaccharides have been shown to stimulate the immune system. Literature reports show that beta-glucans show antioxidant, antiviral, antibacterial, and antifungal activities and have a healing effect on wounds (Chen and Seviour, 2007; Wei et al., 2002).

Studies have shown that β -glucan can activate cells belonging to the innate nonspecific immune system. Thanks to this effect, animals that consume β -glucan can more easily fight viruses, bacterial infections, fungal and parasitic infections (Engstad and Robertsen, 1994).

The advantage of β -glucan in the body defense system is that it binds to specific receptors on different cell types in the first step. In this way, glucans are particularly effective in macrophage stimulation (Vetvicka, 2003). Glucans have macrophage and nonspecific tumor-destroying activation (Mansell, 1986). The presence of glucan affects the bone marrow, affects the proliferation of substances that stimulate and activates the general immune system, and plays a role in the release of more cytokines. Malnutrition, long-term infections, advancing age create individual differences in immune system stimulation. In order to eliminate this individual difference in immune system stimulation, β -glucan can be used to activate the immune system in cancer, delayed wound healing, arthritis, and in cases where the risk of fungal, bacterial and viral infection increases. Likewise, it can be used in cases where the marrow within the bone needs to be stimulated due to the decrease in the number of white and red blood cells (Price and Makinodan, 1972).

The broad anti-infective benefit of β -glucan is explained by its immunostimulant properties. The use of β -glucan reduces the amount of antibiotic or antiviral substance use in bacterial diseases such as *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Escherichia coli*, when given in addition to antibiotic treatment in animals affected by Herpes virus. The antifungal effect of β -glucan has been observed especially against *Candida albicans* (Wyde, 1989).

Significant increase in colostrum IgG level was formed as a result of 1,3 / 1,6 β -glucan administration to pregnant mares and foals (Krakowski et al., 1999). The positive effects of the use of β -glucan in broilers (Cheng et al., 2004) and the combination of β -glucan and inulin were observed (Elrayeh and Yıldız, 2012).

Minerals

Trace minerals; They play a very important role in normal growth and many metabolic events. Many trace minerals are involved in immune system functions. Positive effects are observed in the presence of trace minerals, especially Zn, Cu and Se, in the ration, especially under stress conditions. It is important that trace minerals in farm animals are of inorganic and organic origin. It is understood that organic forms have higher bioavailability and are more effective on the immune system (Saçaklı, 2019).

Boron; It is an essential element for humans, animals and plants. It has been reported that boron is involved in immune function and increases interleukin-6 production in mammalian macrophages. On the other hand, it has been stated that cholesterol and triglyceride levels decrease, lipid peroxidation decreases, antioxidant effective enzymes increase the endurance, improves mineral substance balance, and increases the synthesis of some steroid hormones (Yıldız and Abacıoğlu, 2007). boron has improved feed consumption (Yeşilbağ and Eren, 2008) and improved the level of damaged eggs (Kurtoğlu et al., 2002).

Valin

Limiting amino acids in broiler diets are lysine, methionine, tryptophan. Threonine has been included in the limited amino acid list in recent years. Valine is an amino acid that has not been sufficiently studied. Thornton et al. (2006) studied the effect of different valine concentrations on the immune system in the second period, and studied different valine uses between the 21st and 42nd days. In his studies, different valinates in the second period increased lymphoid organ development. Bhargava et al. (1971) mentioned that antibody titers increased with the increase in the valine level. Kaplan and Yıldız (2017) reached a high thymus weight level with 0.1% and 0.2% additional valine amounts in their study, valine incorporation increased the development of the thymus and relative organ weight. It is thought that it is appropriate to have a valine ratio of 1% in the first period feeding in broiler chickens and 0.82% in the second period ration.

Essential Oils

Many studies have shown that the active components of essential oils obtained by distillation from plants have bacteriostatic, bactericidal and fungicidal properties. Essential oils have shown successful results in the control of pathogenic microorganisms, their use as antioxidants, stimulation of digestive enzymes activity and nitrogen absorption, reducing environmental pollution caused by fertilizers, and extending the shelf life of foods. Essential oils and extracts obtained from medicinal and aromatic plants improve the growth performance, utilization of the feed, the flavor of the feed, have a stimulating effect on the efficiency of pancreatic enzymes and bile secretion, accelerate the regeneration of epithelial cells in the small intestine and increase the absorption of nutrients by establishing the microflora balance, and prevent the adhesion of harmful microorganisms to intestinal epithelial

cells. It is reported that it prevents them from settling in the system and gives strength to the immune system (Karasu and Öztürk, 2014; Khalafalla, 2009; Tonsy et al., 2011; Turan et al., 2012). Jamroz and Kamel (2002) stated that essential oils also improve the fat digestion in broilers. Kitandu et al. (2006) revealed that herbal extracts have anticoccidial properties. It is known that herbal extracts reduce the lesion score (Saini et al., 2004), have antimicrobial (Lee et al., 2004), anti-inflammatory, and immunomodulatory effects on microorganisms (Vieira et al., 2008).

It has been observed that the synergistic effect created by the use of vegetable oil and extracts together has a significant improvement effect on mortality and intestinal health (mixture of thyme oil and black seed oil) (Aydın and Yıldız, 2020).

Result

It is extremely important to keep immunity high, when the importance of immunity is better understood. Many substances that can be taken orally can play a role in enhancing immunity. Vitamin C, inulin, β -glucan, boron, valine and essential oils that added to animal feeds or foods at certain levels will contribute to strengthening the immune system.

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