

Technical Bulletin

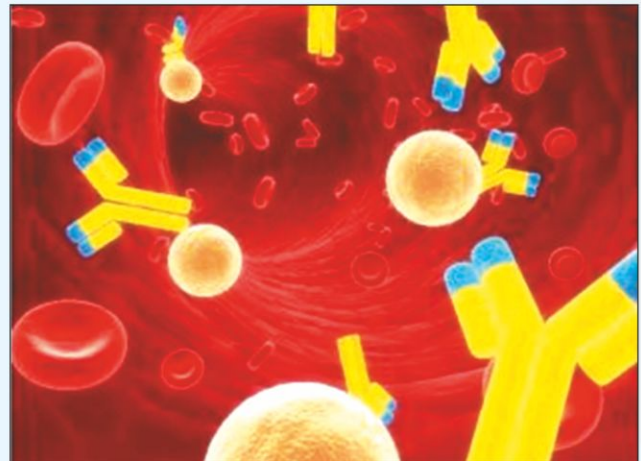
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Nutritional approach to unleash potential under stress conditions

With high density confinement rearing of birds, an additional important role of nutrition is that birds are not only fed for production or reproductive performances but must also be fed to minimize infectious disease and their concomitant stresses. In context of Poultry Industry, problem of immunosuppression has been felt to be prominent due to various factors *viz.*, managerial conditions, nutritional status, intensive production system, high density rearing and infectious diseases. Therefore, it is highly essential to find ways and means for enhancement of immune response by nutritional manipulation. Substantial information is available in literature to indicate that administration of certain vitamins, minerals, amino acids and their different combinations to mammals and chicken in excess of their supposed requirements enhances their disease resistance. This increased resistance has been attributed to significant stimulation of humoral and cellular immunity and phagocytosis. Since, the use of antibiotics has been limited, better use of supplementary immuno-stimulatory nutrients has to be made in poultry feeding.

The relationship between stress and chronic disease has been difficult to establish due to the fact that stress can both increase and decrease disease resistance based on many interacting factors including the type and degree of stress as well as the individual perception of, or response to, the stressor (Biondi and Zannino 1997, Glaser *et al.* 1999, Salak-Johnson and McGlone 2007).

The immune system benefits greatly from proper nutrition of the bird. Not only does the immune system



benefit directly from proper nutrition, but indirectly proper nutrition will also prepare the bird for periods of stress, reducing the adverse effects of stress and enhancing recovery from stressful periods. Therefore, in many instances, proper nutrition lessens the immune suppression associated with the stress response in the bird. The immune system of the bird can be influenced by nutrition in several ways:

1. Anatomical development of lymphoid tissues
2. Mucus production
3. Synthesis of immunologically active substances
4. Cellular proliferation
5. Cellular activation and movement
6. Intracellular killing of pathogens
7. Modulation and regulation of the immune process

Factors related to the genetics of poultry, the frequency of their exposure to pathogens, the virulence of the pathogens, and the efficacy of vaccination programs are predominant detractors of the incidence of infectious diseases in poultry flocks. However dietary characteristics can modulate a bird's susceptibility to infectious challenges and subtle influences due to the level of nutrients or the types of ingredients may at times be of critical importance. The bird's susceptibility to an infectious challenge can be subdivided into two components, resistance and resilience.

Resistance refers to the capacity of a variety of anatomical and physiological systems, including the immune system, to exclude pathogens.

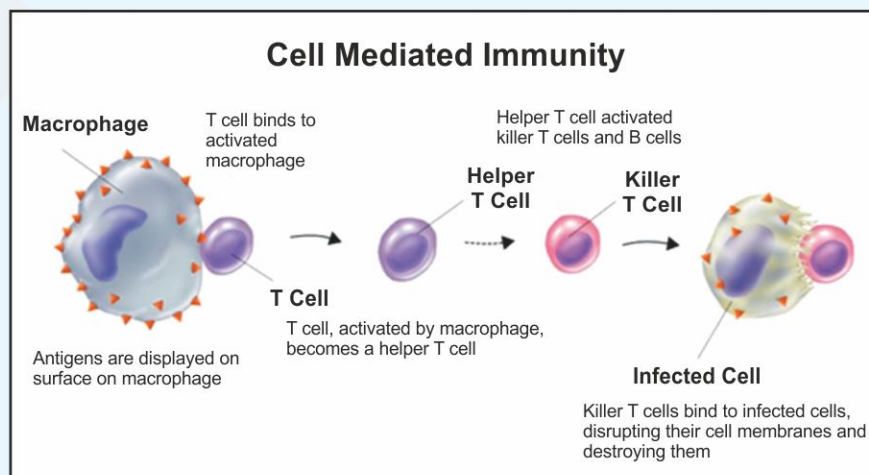
Resilience refers to the capacity of the bird to maintain productivity (e.g. growth, feed efficiency, egg production) during an infectious challenge.

The role of nutrition in maximizing resilience is only now being appreciated and this relationship deserves future attention by poultry stakeholders. There are probably many situations in which diets that optimize resistance to infectious challenges are not optimal for resilience and maximal profitability (Cook, 1996;

Klasing, 1997). However, in many cases it is not known whether the requirement values that maximize productivity in healthy, unchallenged birds are optimal for immuno-competence and disease resistance. An understanding of the mechanisms through which nutrition influences the immune system is necessary to appreciate the many complex interactions between diet and infectious diseases. Several recent reviews of nutrition and immunity provide an excellent survey of nutrition and immunity, including the impact of toxic components (mycotoxins) that may contaminate the feed (Cook, 1991, 1996; Latshaw, 1991; Dietert *et al.*, 1994).

Mechanisms of Nutritional Modulation of Resistance

The mechanisms of nutritional modulation of resistance to infectious disease are divided into seven categories. Obviously these categories are overlapping and nonexclusive. A single nutrient may impact the immune system by several of the general mechanisms that are described as well as mechanisms not listed. The first six of



Mechanisms of Nutritional Modulation of Immune Responses

Mechanism	Nutrients
Effects on the development of the immune system	Linoleic acid, iron, vitamin A
The supply of substrates to the immune system	All nutrients
Nutritional immunity	Iron, Biotin
Changing the hormonal settings	Energy, protein
Direct regulatory actions of nutrients on the immune system	Vitamins A, D, E, polyunsaturated fatty acids(PUFA)
Reduction of pathology	Vitamin E
Physical and chemical actions of feeds in the intestines	Fiber, oxidized lipids, lectins