

# proteinews

Issue 8



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## Role of Proteins in Immune System

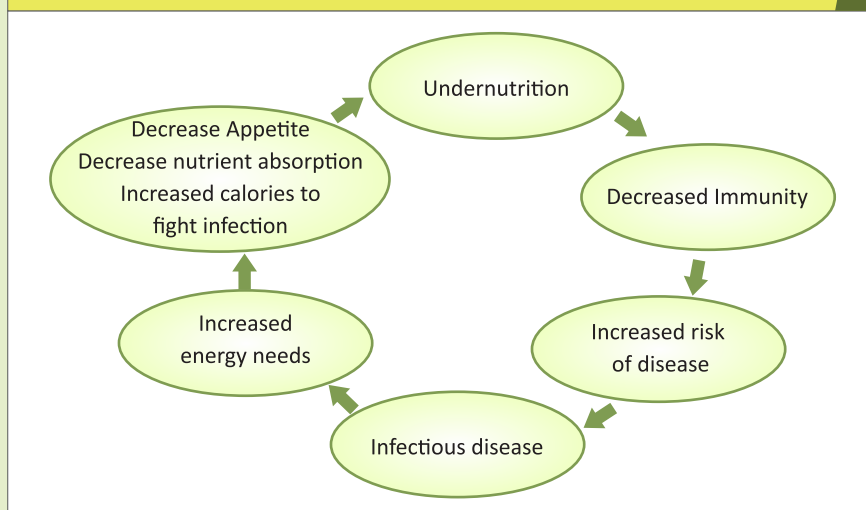
### Undernutrition – A Global Problem

- World Health Organization (WHO) states undernutrition as wasted (low weight-for-height), stunted (low height-for-age), underweight (low weight-for-age) and deficiencies in vitamins and minerals.<sup>1</sup>
- According to WHO, 149 million children fewer than 5 years were estimated to be stunted and 45 million were estimated to be wasted, globally in 2020.<sup>1</sup> It mostly occurs in low- and middle-income countries.<sup>2</sup>
- About 14% of India's population is undernourished, according to 'The State of Food Security and Nutrition in the World, 2020' report says 189.2 million people are undernourished in India & 34.7% of the children aged under five in India are stunted.<sup>2</sup>

### Undernutrition to frequent illness or infections

With poor nutrition, some parts of the immune system do not function properly. The skin and gut cannot effectively block disease-causing pathogens from entering the body and thymus, which affects the function of immune system.<sup>3</sup>

Figure 1: Process of Undernutrition to frequent infections



Infection and nutritional deficiencies can induce immunodeficiency and increases susceptibility to other infections. It can lead to a vicious cycle of recurrent infections, reduced immunity, and worsening nutritional status.<sup>4</sup>

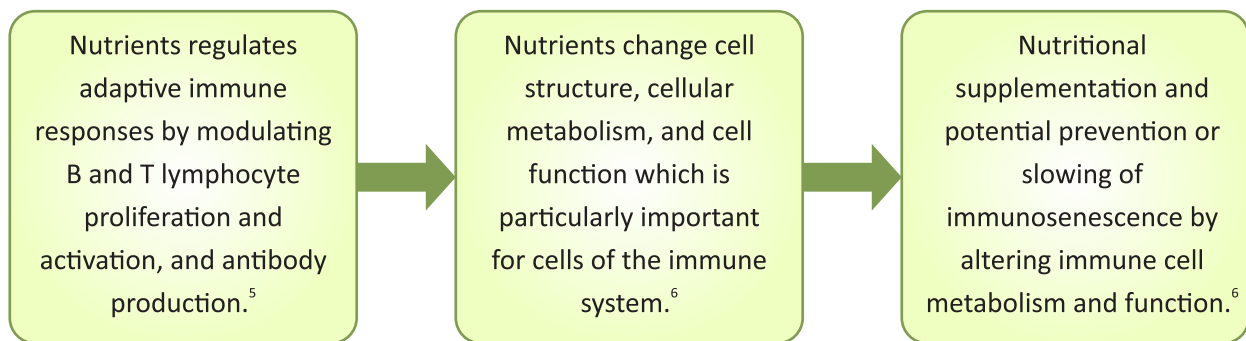
## Link between Immune Cell Function, Metabolism and Nutrition

Immune cell function and metabolism are closely linked. Alterations in cellular metabolism influence immune cell function and it determines the cellular metabolic state.<sup>7</sup>

Immune cell function influenced by nutrients that form parts of the cell membrane structure and are involved in energy production and prevention of cytotoxicity.<sup>5</sup>

Alterations in cellular metabolism influence immune cell function and that, conversely, immune cell function determines the cellular metabolic state.<sup>6</sup>

**Figure 2: Role of nutrition in immune cell function.**



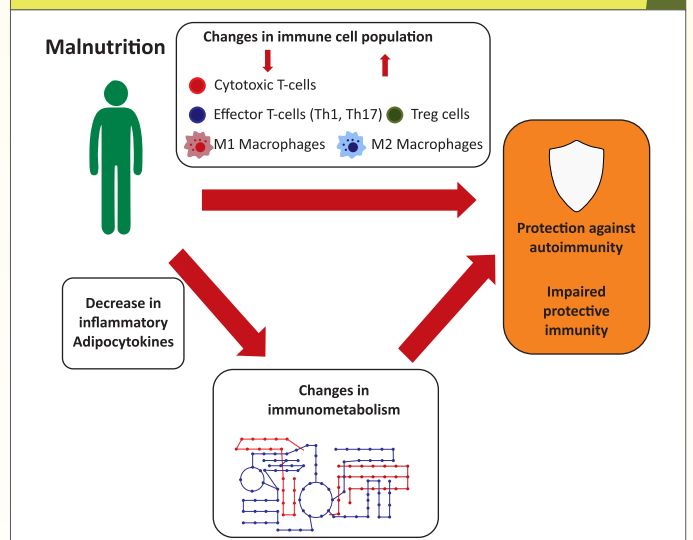
Influence of nutrition on immunological outcomes has an important role of macronutrient proteins in modulating immune homeostasis.<sup>6</sup>

## Changes in Nutritional status and Immunity<sup>7</sup>

Changes in nutritional status influence organ size, hormones, and cytokine levels, and immune cell population and function. Other cytokines and hormones likely play a similar key role in linking nutrition and immunity.

This link between nutrition and immunity is mediated, by a select group of adipocytokines, such as leptin, which can influence immune cell number and function through its effects on cellular metabolism.

**Figure 3: Changes in Nutritional status and Immunity**



## Role of Dietary Protein in Immunity<sup>8</sup>

Increasing protein intake is a priority in order to reduce catabolism due to inflammatory mediators. It is believed that insufficient protein intake causes a decrease in the amount of immunoglobulins involved in the gut-mucosal defense and the amount of gut-associated lymphoid tissue (GALT).

Protein deficiency is related to changes in antibody production that cause decreased immunoglobulin synthesis and thymus and lymphocyte dysfunction. In addition, a decrease in the rate of CD4+/CD8+ was observed in the case of protein malnutrition, accompanied by micronutrient deficiency.

Recommended Dietary Allowance (RDA) suggests 0.8 g/kg/day of protein intake, to prevent the risk of infection. High-quality proteins are important component of an anti-inflammatory, cardioprotective diet.

## Casein: the Immunomodulator Protein<sup>9</sup>

**Figure 4: Immune activity of Casein and its function**

### Casein is the main protein in milk

Nutrients regulates adaptive immune responses by modulating B and T-lymphocyte proliferation and activation, and antibody production.<sup>5</sup>

### Casein involvement

Production of cytokines and the development of the mucosal immune system.

### Main function

Casein, enhances different aspects of the immune system, such as the proliferation of lymphocytes and generation of antibodies.

Immune activities of casein are enlisted in the table below:

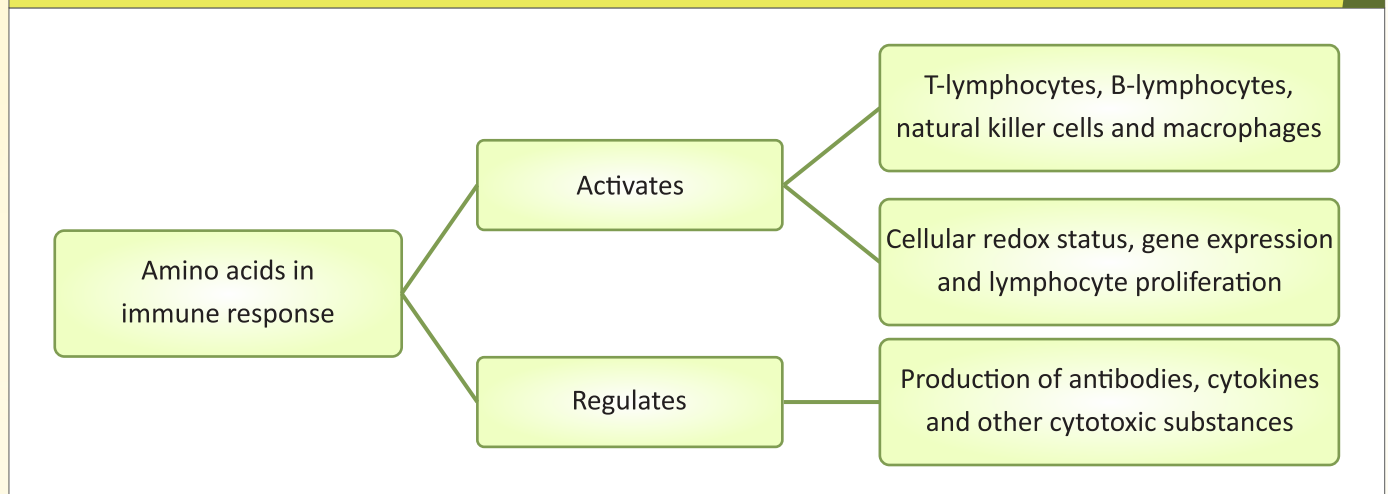
Casein	Biological functions
αs1-Casein	Promotes antibody formation and accelerated phagocytosis
κ-Casein	Promotes antibody formation and accelerated phagocytic activity of human macrophages
β-Casein	Immunomodulatory activity that might be related to interactions with monocytes-macrophages and T-helper cells
α-Casein	Decreases the production of IL-2 in activated T-lymphocytes



## Beneficial Effects of Amino Acid & Better Immunity<sup>8</sup>

Amino acids are essential for the synthesis of a variety of specific proteins and it regulates key metabolic pathways of the immune response against infectious pathogens. In order to maintain a normal immune response and protect the host from various diseases, it is necessary to provide adequate amount of all amino acids in the diet.

**Figure 5: Role of Amino acids in immunity**



Amino acids and their functions in immunity are shown below in the table:

Amino Acids	Function
Alanine <sup>10</sup>	Essential amino acid for T-cells Extracellular alanine supports protein synthesis
Arginine <sup>8</sup>	Essential for T-cell proliferation and function Reduces the inflammatory response and rate of infection
Asparagine	Required for T cell activation <sup>11</sup>
Aspartate and Glutamate	Regulates the secretion and expression of inflammatory cytokines <sup>12</sup>
Glutamine <sup>8</sup>	Successful T-cells activation. Precursor for the nucleotide synthesis required for rapidly dividing cells such as immune cells.
Tryptophan	Required for T-lymphocytes effector functions <sup>13</sup>

The morbidity and mortality of disease is higher, especially in low immune function people. It is known that increasing protein intake is a priority in order to reduce catabolism due to inflammatory mediators.<sup>8</sup>

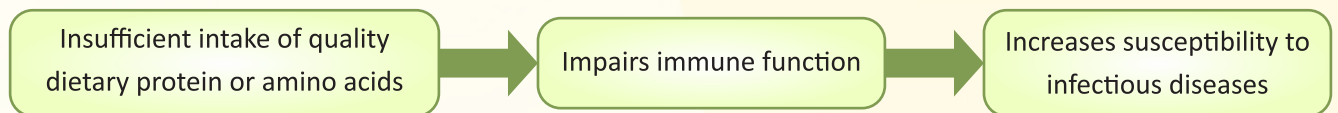




## Protein Enhances Antibody Production<sup>14</sup>

With exposure to a specific antigen or transfer of antibodies against the antigen, active /acquired immunity occurs over the lifetime of an individual. Whenever the same agent is encountered again, immune system reacts within hours because of B and T-cells.

Studies showed that protein play a crucial role in immunity and prevent infections. The effect of protein deficiency is depicted below:

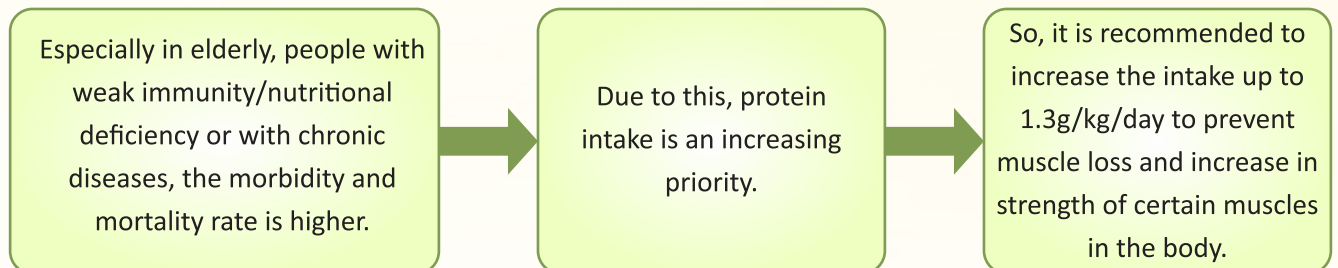


Reduced immunity also seen in case of protein deficiency which leads to decrease in anti-body production, immunoglobulin synthesis and thymus and lymphocyte dysfunction.

Findings obtained from recent studies show that amino acids play an important role in immune response as follows:

- Activation of T-lymphocytes, B-lymphocytes, natural killer cells and macrophages.
- Plays an important role by regulating the production of antibodies, cytokines and other cytotoxic substances.

During infectious disease outbreak:



In people with malnutrition or the elderly, there is a higher need for protein due to enhanced antibody production for immunity and to prevent susceptibility to infections. In order to alleviate these reasons, augmentation of protein and branched chain amino acid intake would be a wise decision.

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