

Published: June 30, 2023

**Citation:** Vasco Barreira J, Barreira P, et al., 2023. The Role of Nutritional Modulation of Immune Function in Cancer – What About It?, Medical Research Archives, [online] 11(6).  
<https://doi.org/10.18103/mra.v11i6.4038>

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DOI  
<https://doi.org/10.18103/mra.v11i6.4038>

ISSN: 2375-1924

## RESEARCH ARTICLE

### The Role of Nutritional Modulation of Immune Function in Cancer – What About It?

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**Conflict of interest:** none

**Financial support:** none

#### ABSTRACT:

In recent years there has been an increase in the number of new cases of cancer. Malnutrition in cancer patients is a consequence of the increase in inflammatory cytokines associated with cancer, metabolic alterations, and concomitant inadequate availability of nutrients, due to anorexia caused by the disease and systemic treatments. Nutrition can guide both the growth and progress of inflammatory disorders and their prevention and treatment. Irrevocably, it is indispensable to pair the diet with physical activity, balance nutritional status and prime a healthy lifestyle. An increased understanding of the instruments linked to nutrients and the immune system is a breathtaking and exceptional field for the future. The gut microbiota is now known as a fundamental factor disturbing the host's anti-cancer immunosurveillance and capacity to respond to immunotherapy. Diet is one of the most powerful modulators of microbiota, and therefore nutritional intervention could be used to increase host anti-cancer immunity. A rising body of data has also highlighted that the gut microbiota may have a constructive impact on cancer prevention or treatment, particularly via improved host immunosurveillance of cancer as well as patients' capacity to respond to chemotherapy or immunotherapy. The sway of nutrition on the immune system is a territory that remains under investigation. Nutrition and immunity are closely related. An expanded understanding of the mechanisms connected to nutrients and the immune system is a breathtaking and gifted field for the future.

## Introduction

In recent years there has been an increase in cancer incidence. This increase, in part, is closely related to the increase in average life expectancy, as well as more accurate diagnostic techniques and due to boosting screening awareness. However, to these aspects are added other factors, namely behavioral / modifiable risk factors, which refer to modifiable lifestyle factors that can help us prevent cancer, such as tobacco exposure and diet. According to the data revealed by the Organization for Economic Cooperation and Development (OECD) at the end of 2018, although Portugal has one of the lowest incidences of cancer in the European Union, the numbers are still unsettling. For every 100,000 Portuguese, more than 490 developed a tumor. Colorectal cancer was the tumor with the highest incidence in our country, having been responsible for more than 10,000 new cases of cancer, and is a type of cancer in which dietary and exercise habits play a significant role.<sup>1,2</sup>

The optimum function of the immune system is fundamental for health in general, for the prevention and elimination of infections and self-regulation disturbance, and also in immune surveillance against tumor cells. Nutrition is one of the leading factors that modulate different features of immune function.

The key function of the body's immune system is to shield the host against infection from pathological microorganisms to clear injured tissues, and to deliver constant surveillance of malignant cells that grow within the body. Furthermore, the immune system matures appropriate tolerance to evade unsolicited response to healthy tissues of self or harmless foreign substances.

There is substantial heterogeneity among individuals in the stamina of their immunological function, mainly owing to elements such as genetics, environment, lifestyle, nutrition, and the interface of these factors. Nutrition as a modifiable factor in touching immune function has been studied for numerous years. It is well-documented that nutritional status is attentively connected with immunity and host resistance to infection.

While it is established that nutritional deficit or inadequacy needs to be corrected to safeguard that the immune system functions accurately, rising evidence advocates that for certain nutrients, increased intake above presently recommended levels may help optimize immune function including enlightening defense function and resistance to infection, while upholding tolerance.

## The Role of Nutritional Modulation of Immune Function in Cancer – WhatAbout It?

Cellular stress may be of pathogenic, nutritional, oncogenic, or physical origin. The body is well armed to center a powerful set of biological processes and agents on assaulting organisms. Reference to a standard immunology text gives details of the diversity of these happenings. Nevertheless, amongst them, three vital processes occur which effect patient outcome. These processes are originated by secretion of the pro-inflammatory cytokines interleukin (IL) 1, IL-6 and tumor necrosis factor (TNF)  $\alpha$ . These processes are: (1) conception of an antagonistic setting for pathogens; (2) establishment of nutrients for the immune system from endogenous bases;<sup>3</sup> consolidation of the shielding and regulator systems against injury to healthy tissue by the immune reaction. Inhibitory systems arise into performance, with the objective of ceasing the reply once its primary purpose of defeating pathogens has been attained.<sup>3</sup>

During the last decades, the velocity of progress of immunomodulatory medicinal foods and intravenous solutions has fast-tracked. Various meta-analyses have been conducted on the efficacy of these products. It is well-established that nutritional insufficiency prominently injures the functioning of the immune system. In addition, it is progressively acknowledged that nutrient consumption, above what is currently recommended, may constructively affect immune function, regulate chronic inflammatory and autoimmune environments, and lessening infection risk.<sup>4</sup> Nutritional deficiencies may be present in different ways: it may be a suboptimal body composition (with low skeletal muscle mass and higher body fat percentage), low body weight in general, low ingestion of certain macronutrients or low levels of certain micronutrient intake.

Nutrition topics such as specific nutrient deficiencies, less archetype diet configuration, and excess calorie ingesting are still a defiant realm. This situation is predominantly meaningful in the elderly population due to a variety of factors more common in this population including disability, disease, disease-associated and medicine-induced anorexia, poor food mixture, and inferior socio-economic status.

Do wisely directed randomized double-blind placebo-controlled clinical trials support this broad conclusion? The answer to this subject is a competent **yes!** But the key factor here, which is also a limitation of the way clinical trials are designed and planned, refers to personalization of the diet to individual needs. Ensuring this possibility on

dietary interventions certainly will lead to even more robust and significant clinical impact.

Nutritional immunology was recognized for the first time in the 19th century by the documentation of an atrophy of the thymus in a malnourished patient. Increasing developments in molecular studies in the arena of nutritional immunity or immunonutritional discipline have been witnessed during the last decade.<sup>5,6,7</sup>

Nonetheless there is not profusely evidence to divulge the benefits of supplementary care with minerals, vitamins, proteins, and others no critical side effects were narrated linked with the use of such supplementary care. However, thousands of other compounds in vegetables and fruits have been and are currently being studied for their potential role as treatment adjuvants. Knowing the clinical impact, patients receiving cancer treatment and bearing a risk of malnutrition and cachexia must be evaluated for their blood levels of certain micronutrients. In cases where it is unmanageable to deliver the patient an adequate dose through food, clinicians should consider supplementation of vitamins and/or minerals and administer them according to each patient's individual needs.<sup>8,9,10,11</sup>

**Immunonutrition** is a discipline that studies the connections between nutrition, immunity, infection, inflammation, injury, and healing. With nutrition, it is possible to prevent disease in healthy individuals and to treat disorder in compromised individuals. The impact of nutrition on the modulation of the innate and adaptive immune responses are also being further explored.<sup>12,13,14</sup>

**Nutrition** is a formative factor in immune system responses, with malnutrition being the most common cause of immunodeficiency worldwide. Protein deficiency malnutrition has been linked with a meaningful reduction in cell-mediated immunity, phagocytic role, the complementsystem, secretion of immunoglobulin A antibodies, and cytokine assembly. The diet will impact the microbial community of the gut, a multifarious and vibrant system, fundamental for the maturity and growth of both systemic and gut mucosal immune responses, and plays a key role in metabolism, nutrition, and physiological characteristics. The complex interaction between available nutrients, the bacterial community, and the immune system is the

main regulator preserving homeostasis. It establishes an effector response against pathogen aggressors and maintains immune surveillance for the elimination of malignant cells.<sup>15,16,17</sup>

The connection amongst chronic inflammation and cancer has been sustained by epidemiological and experimental studies in humans and animals. Chronic inflammation plays a protagonist role in all cancer phases, increasing the rate of genetic mutations, and epigenetic mechanisms that lead to the onset of cancer, upholding tumor progression, and stimulating a metastatic spread.<sup>18,19,20</sup> This pathological state is highly driven and perpetuated by one's diet and lifestyle.

### Conclusion:

The power of the immune system to recognize and react against cancer is unwavering by numerous aspects, including the host's genetic personality, the somatic shape of cancer cells and the atmosphere. Nutrition is a central environmental aspect that acts through systemic or local outcomes within the tumor microenvironment, by regulating cell metabolism pathways through precise nutrients, such as antioxidants, by immune system modulation, and intestinal microbiota regulation.

The sway of nutrition on the immune system is a territory that remains under investigation. Nutrition and immunity are closely related. Of course, no food alone has properties capable of preventing or treat a tumor. Adopting a complete, varied, and balanced diet, namely avoiding processed foods, with high caloric density and high sugar content and limiting salt consumption, can play a determining role in this dynamic interaction between genetic and environmental factors.

Nutrition can guide both the growth and progress of inflammatory disorders and their prevention and treatment. Irrevocably, it is indispensable to pair the diet with physical activity, balance nutritional status and prime a healthy lifestyle.

An expanded understanding of the mechanisms connected to nutrients and the immune system is a breathtaking and gifted field for the future.

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