

# Hypothetical Function of Influent Nutrients for the Immunological System in the Aspect of the Treatment of Patients with Visceral Leishmaniasis

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**Abstract**— The advances in studies related to serious diseases constitute new paradigms to understand the processes of illness and seek other ways to reduce the morbidity and mortality of people affected, so this study proposes to seek new knowledge about the relationship between nutrients as an influent factor in the immune system related to the treatment of patients with visceral leishmaniasis. The nutritional factor can act effectively in the treatment during the infectious diseases, improving the recovery and the healing process. Of the various existing nutrients we searched for vitamin A, zinc and protein. Of the various functions of these nutrients it is pointed out: vitamin A - strengthening of the immune system and antioxidant defense, is fundamental for T cell growth and function, important for lymphocyte secretion and proliferation, cell differentiation, immunity mechanisms, hematopoiesis and coagulation system. Zinc, which regulates the function and expression of transporters of divalent metal-1-DMT1 and iron-IREG23-regulated mRNA, required for cell reproduction, differentiation and growth, tissue repair and immune defense, plays an important role in process of DNA transcription, translation and replication. Proteins present immunological protection, recognize and bind with antigens, such as viruses and bacteria, are enzyme catalysts, carriers of hemoglobin and myoglobin, protective of antibodies, fibrinogen and cytokines.

**Index Terms**— Immune system, Malnutrition, Nutrients, Visceral leishmaniasis.

## I. INTRODUCTION

Visceral leishmaniasis (LV), or kala-azar, is caused by Leishmania species belonging to the Leishmania donovani group, is a serious disease, potentially fatal to humans when the appropriate treatment is not instituted, the etiological agent in Brazil is the L. chagasi, a species similar to L. infantum found in some countries of the Mediterranean and Asia.[1]

Considered to be one of the neglected diseases, which not only prevail in poverty, according to the World Health Organization (WHO), more than one billion people are infected with one or more neglected diseases, which represents a significant part of the world population.[2]

Zoonosis characterized by systemic involvement, visceral leishmaniasis (LV) is a disease that affects millions of people

in various tropical and subtropical regions of the world, its clinical presentation varies from the asymptomatic forms to the classic picture of parasitosis, with fever, anemia, hepatosplenomegaly, leucopenia, and may also present diarrhea, asthenia, haemorrhagic phenomena, icterus and vomiting.[3]

Patients with visceral leishmaniasis may present with malnutrition, which may affect the host's immune system, making people vulnerable to infections.[4] An aggravating factor is that malnutrition is associated with poor patient prognosis, such as an increased risk of infections, longer hospitalization and increased morbidity and mortality.[5]

A study by Werneck[6], identified that nutritional status is one of the main modulators of the immune response, definitive for the risk and prognosis of infectious diseases, as well as, it can be influenced by the infectious condition of the disease, evidencing a poor nutritional status contributing to the development and evolution of the infection.

Nutrients can influence the immune system so that the immune response can act effectively in treatment during infectious diseases, improving recovery. A study by Maciel [7], emphasizes the importance of vitamin A as a regulating factor in the immune system that can positively influence the outcome of the treatment of infections. In case of malnutrition it increases the risk of developing diseases such as visceral leishmaniasis.

Vitamin A is essential for immunity and its deficiency is related to an increase in morbidity and mortality from infectious diseases. This vitamin is essential for the development and function of the T cell and its supplementation is related to a decrease in the morbidity and mortality of patients who after a supplementation of this nutrient presents a better clinical prognosis. [8]

In developing countries, vitamin A deficiency and parasitic infections are common and pose serious problems for public health[9]. The nutritional status of zinc is related to the direct modulating mechanisms of gene expression, from the modulation of enzymatic activity or signaling molecules that depend on the binding of zinc, which is also essential for the normal function of the immune system; in a way that the deficiency can occur, thymic atrophy, lymphopenia, decreased mitosis, immunoglobulin. In zinc deficiency, the

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activity of Natural killer (NK), phagocytosis by macrophages and leukocytes, occurs in the generation of oxidative damage, decreasing the number of granulocytes.[10]

The insufficient daily intake of zinc affects the subgroups of children, young women, the elderly or people on a restricted diet, and may develop a subclinical deficiency and cause immunological dysfunction, since zinc is related to the activity of T- helper cells, development of T - cytotoxic lymphocytes, proliferation of T lymphocytes, production of Interleukin - 2 and programmed death of cells of myeloid and lymphoid origin.[11]

A study by Freire [12] reveals that zinc plays a fundamental role in the defense of the organism, influencing the proliferation and maturation of the defense cells, so that individuals with zinc deficiency are susceptible to infections, altered natural killer cell (NK) activity that are important for immunity against infections.

In the case of protein is an essential macronutrient, consumption is necessary by the human being to stay healthy. Proteins are part of the biological structure, so the construction and maintenance of the human organism depends on the supply of this macronutrient. Among the various functions of proteins, they also act to prevent and fight important infections and infectious diseases.[13]

## II. HYPOTHESIS

The terminology malnutrition (or malnutrition) refers to a pathological state motivated by the absence of intake or absorption of nutrients, according to the severity of the clinical picture, malnutrition can be divided into first, second and third degree. Sometimes this nutritional disorder can be mild and translate, without any record of symptoms, into an inadequate or unbalanced diet, however, there are more serious cases whose consequences may be irreversible.

The nutritional factor and the various functions of nutrients involving the immunological system related to the treatment of visceral leishmaniasis need further studies to evaluate its effects on the healing process of patients with leishmania as well as the various functions of the nutrients related to the system immunological.

Studies related to the field of knowledge of malnutrition seek to evaluate the factors associated with food consumption and methodological aspects of dietary intake as well as the combination of the consumption of basic foods of good nutritional quality with foods of low nutritional quality and high energy density, characteristics that result in high prevalence of food inadequacy correlated with increased rates of chronic diseases that indicate the national context of morbidity and mortality. [14] Among the various nutrients, Vitamin A, zinc and protein are considered as influencers in the immune system for the treatment and cure of visceral leishmaniasis.

## III. FUNCTIONS OF VITAMIN 'A'

Vitamin A has several functions, such as immune system strengthening and antioxidant defense, is critical for T cell growth and function and its supplementation is associated with a drop in morbidity and mortality in infectious diseases [8].

It acts on the maintenance of epithelial tissue, protein synthesis, differentiation of bone cells, adequate functioning of the immune system, important for the secretion and proliferation of lymphocytes [15].

Vitamin A acts against oxidative stress for individuals with infectious processes and has anti-inflammatory action.[16] Vitamin A deficiency may affect cell differentiation, immunity mechanisms, hematopoiesis and coagulation system, these abnormalities can aggravate infections and anemia by significantly increasing morbidity and mortality from infectious diseases[17].

## IV. ZINC FUNCTIONS

Zinc acts on the hematological conditions by the participation of the nutrient in the iron metabolism, acting on the regulation of the function and expression of the transporters of divalent metal 1-DMT1 and mRNA regulated by iron-IREG23. Promotes a significant increase in the variation of hemoglobin levels and hematocrit levels [18].

Zinc provides several functions in the human body is important for the proper functioning of metabolism, necessary for cell reproduction, differentiation and growth, tissue repair and immune defense. In the immune system, it plays a key role in the process of DNA transcription, translation and replication. It consists of more than 300 enzymes that participate in the metabolism of carbohydrates, lipids and proteins and the synthesis and degradation of nucleic acids [19].

It influences the hormonal regulation of cell division, especially via growth hormone (GH) and insulin-dependent growth factor I (IGF-I), besides interfering with mitogenic hormones, acting on cell proliferation [20].

Zinc plays an important role in various physiological processes, acting in intracellular signaling, repair of DNA damage, cell proliferation, maintenance of immune and anti-inflammatory systems [21].

## V. PROTEIN FUNCTIONS

Genetic information in humans is contained in the structure of DNA, which determines the type and amount of proteins synthesized in each cell of the organism, so the proteins are responsible for the synthesis of all other cellular components, are the most abundant macromolecules biological and represent the main structural and functional component of all cells of the organism, have several functions, including immunological protection, antibodies are highly specific

proteins that recognize and bind with antigens such as viruses and bacteria.[22]

Proteins are organic compounds most common in an organism, are present in all cellular structures composing intercellular substances, hormones and antibodies, stand out for their diversity of functions in the body, as main actions are evidenced, as enzyme catalysts, carriers of hemoglobin and myoglobin, protective of antibodies, fibrinogen and cytokines.[23]

Because it is an essential macronutrient, the consumption of the protein is necessary for the human being to remain healthy, since they are part of the biological structure, so that the construction and maintenance of the human organism depend on the supply of this macronutrient, among its various functions proteins, also act to prevent and combat major infections and infectious diseases.[23]

Protein-caloric malnutrition depresses the humoral and cellular immune function, reducing fractions of the complement system, number, proliferation and function of the circulating T lymphocytes (consequently the production of cytokines), and altering the recognition of antigens.[24].

## VI. CONCLUSION

The data present the various functions of vitamin A and zinc, such as the strengthening of the immune system and related association with decreased morbidity and mortality in infectious diseases. The inclusion of immune system enhancement is related to the systemic inflammatory response to visceral leishmaniasis. It is related to the proper functioning of the immune system, important for the secretion and proliferation of lymphocytes, as well as, it promotes a significant increase in the variation of hemoglobin levels and hematocrit levels.

Related to zinc constitutes more than 300 enzymes that participate in the metabolism of carbohydrates, lipids and proteins and the synthesis and degradation of nucleic acids, it participates in various functions in the human body in the immune system, plays a fundamental role in the process of transcription, translation and replication of the DNA. It is important for reproduction, differentiation and cell growth and immune defense.

The study indicates that hospitalized patients with severe diseases may present malnutrition due to the disease itself or due to reduced food intake, malabsorption and increased energy expenditure, this factor can affect the host's immune system, making people vulnerable to infections, longer hospitalization time and increased morbidity and mortality.

Thus, the study points out that the nutritional factor is of fundamental importance in reducing mortality from infectious diseases, that deficiency of vitamin A, zinc and protein is related to the greater susceptibility to infections in people due to damage in the immune system.

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