v. 5, n. 24, 2025

International Journal of Health Science

Acceptance date: 11/06/2025

MYTHS AND TRUTHS ABOUT BOOSTING IMMUNITY: A SCIENTIFIC REVIEW OF THE ROLE OF VITAMINS AND MINERALS

Brayann Quadros de Souza
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0009-0003-4398-4476

Hicler Jessica dos Santos Araújo Cândido
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0009-0001-8732-2816

Paloma Iracema Banak Zilch
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0003-2713-1505

Adriano de Maman Oldra
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0009-0009-7101-0808

Clarear Figueiredo Telles
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0001-9406-0263

Douglas de Oliveira Subrinho
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0003-4597-2818

Lívia Cavalcanti Moret
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0002-6636-1621

Moisés Silva Campos
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0001-8531-2895

Wilgner Itiel Teixeira Souza
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0002-9297-6427

José Herssem Loureto Abrantes Sousa
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0002-7475-0950

Nicodemos Pereira de Queiroz Gomes de Araujo
Medical students
Central University of Paraguay (UCP)
Ciudad Del Este - Alto Paraná
Orcid 0000-0002-8619-7179

Lilian Raquel Ramírez Barúa
Dr. Guiding Physician, Professor at the Universidad Central del Paraguay - Orcid: 0009-0009-2053-9760

Abstract: This study discussed the misconception of "boosting immunity" and the real importance of balancing the immune system. Discussions on this topic are justified due to the population's lack of knowledge about the real benefits of vitamin and mineral supplementation and the indiscriminate consumption of food supplements, often encouraged by marketing strategies, especially in the post-Covid-19 pandemic context. Therefore, the general objective of this study was to clarify the myth of increased immunity and, to this end, it was necessary to review the scientific literature on the functioning of the immune system and the influence of nutrients and supplements on the immune response, analyze clinical studies that evaluated the effectiveness of supplements in immune modulation and identify myths and truths about the role of diet and supplementation in maintaining immunity. A literature review was carried out, based on a selection of articles published between 2010 and 2024 in the PubMed, Scielo and VHL databases, using specific keywords related to the topic, with the aim of gathering up-to-date scientific evidence on the relationship between supplementation and immunity. The results showed that immunity is a complex system that must be kept in balance through healthy habits, that vitamin and mineral supplementation is only indicated in cases of diagnosed deficiency and that excessive consumption can generate health risks, which imposes the observation that there is no scientific support for the idea of "boosting immunity" indiscriminately, and that evidence-based guidance for the population is essential.

Keywords: Immune system; Food supplementation; Myths about immunity; Vitamins and minerals; Public health.

INTRODUCTION

This research deals with the concept of "boosting immunity". The topic is particularly relevant as it significantly affects the Brazilian and global population, which adopts measures such as the consumption of supplements in order to "strengthen" the immune system. This behavior is encouraged by the attractiveness of the supplement market and the lack of scientific knowledge on the part of the population. Market research published by institutions such as Statista and Euromonitor International indicates significant growth in the sales of food supplements, with annual growth rates of between 8% and 12% in some markets over the last five years. Although this data does not reveal the precise number of consumers or their motives, it does point to a significant increase in interest in and consumption of these products.[1]

In the current scenario, marked by an emphasis on disease prevention and the search for quality of life, the concept of "boosting immunity" has gained notoriety. This idea is commonly associated with products marketed as "immune boosters", which promise to boost the immune system beyond its natural capacity, creating a more efficient barrier against disease. However, this idea is not supported by the scientific literature, which reveals the complexity and balance required for the immune system to function properly.[2]

Although food supplements can be important allies for health, their effectiveness is limited to specific situations in which there is a diagnosed lack of vitamins or minerals. For example, vitamin A is essential for vision, skin integrity and immunity, and its deficiency is common in diets low in carotenoids. On the other hand, excessive consumption can cause nausea, vomiting, headaches and liver toxicity.[3]

Vitamin D also stands out for its fundamental role in the absorption of calcium and phosphorus, and is widely indicated for the elderly due to reduced skin synthesis as a result of ageing. Its deficiency can result in osteoporosis and a greater propensity to fractures, while its excess is related to hypercalcemia and kidney and cardiovascular damage.[4]Folic acid (vitamin B9), which is essential during pregnancy, prevents neural tube defects such as spina bifida and anencephaly.[5]

It should be noted that vitamins such as C, D and E, and minerals such as zinc and selenium, are indeed fundamental for the immune system, but their use must be justified by clinical need. Too much can cause serious side effects. Institutions such as the World Health Organization (WHO) and the National Institutes of Health (NIH) reinforce that, for most people, a varied and balanced diet is sufficient to meet all nutritional needs.[6]

The dissemination of information, especially on social media, has contributed to the spread of misconceptions about health, reinforcing the idea that products sold as "boosters" are effective in strengthening immunity. This phenomenon intensified during the Covid-19 pandemic, a period in which concern about health and immunity was heightened, encouraging the consumption of supplements, often without professional guidance.[7]

Given this context, it is essential to critically analyze this phenomenon. The indiscriminate consumption of supplements, without proper medical advice, is still present and represents a challenge for public health. There is a false perception that these products can improve physical performance, aesthetics or even mental health, even in the absence of proven nutritional deficiencies.[7]

Scientific evidence shows that, in the absence of nutritional deficiencies, supplementation offers no additional benefits and, in some cases, may even pose health risks. In

this context, widely recognized strategies - such as a balanced diet, the regular practice of physical activities and quality sleep - are proving to be more effective and safer for maintaining the proper functioning of the immune system[7].

Based on this panorama, this study is based on the premise that a proper understanding of the functioning of the immune system, combined with the demystification of the idea that supplements alone strengthen immunity, can significantly contribute to the prevention of potentially harmful practices, such as the excessive or unnecessary consumption of supplements.[6]The central hypothesis is that scientific knowledge and informing the population about the real effects of supplementation can not only reduce the risks of intoxication, but also promote more conscious and healthy choices. This hypothesis is based on four main foundations: (i) the scientific evidence that evaluates the relationship between supplementation and immune response; (ii) the risks associated with toxicity due to the abusive use of vitamins and minerals; (iii) the appreciation of healthy eating habits as a basis for immunity; and (iv) the guidelines of national and international health institutions that guide the rational use of supplements.

Therefore, this research is based on a critical analysis of the indiscriminate consumption of supplements and proposes to discuss the extent to which this practice is safe and really necessary. Health professionals, especially doctors, play an essential role in guiding the population, demystifying misconceptions about the immune system and promoting evidence-based information. Such actions should be incorporated into both clinical practice and health professional training programs.

METHODOLOGY

The method used in this study was an exploratory literature review with a qualitative approach. The choice of this type of study is justified by the need to consolidate accumulated theoretical and scientific knowledge on the subject of food supplementation related to the concept of "boosting immunity". The literature review not only identifies the academic contributions already produced, but also maps gaps, contradictions and trends in the field under investigation, favoring a critical and grounded analysis.

Data was collected from databases recognized for their relevance in the field of health and biological sciences: Google Scholar, SciELO, PubMed and Statista. Searches were conducted using descriptors strategically combined using the Boolean operator AND, allowing the results to be refined. The keywords used included: "Immune System", "Supplement", "Food Supplementation", "Increased Immunity", "Immune Boosters" and "Myths about Supplementation".

In order to ensure the quality and relevance of the studies included, inclusion criteria were established: (1) complete articles published between 2010 and 2025; (2) written in Portuguese, English or Spanish; and (3) which addressed food supplementation from the perspective of strengthening the immune system. On the other hand, the exclusion criteria involved: (1) incomplete studies; (2) publications prior to 2010; and (3) texts in languages other than those mentioned.

The article selection process followed systematized stages, illustrated in Figure 1, which shows the flowchart of identification, screening, eligibility and inclusion of studies in the review. Initially, the articles found were assessed by reading the titles and abstracts in order to check that they adhered to the established criteria. The selected texts were then read in full and the most relevant information was listed and categorized.

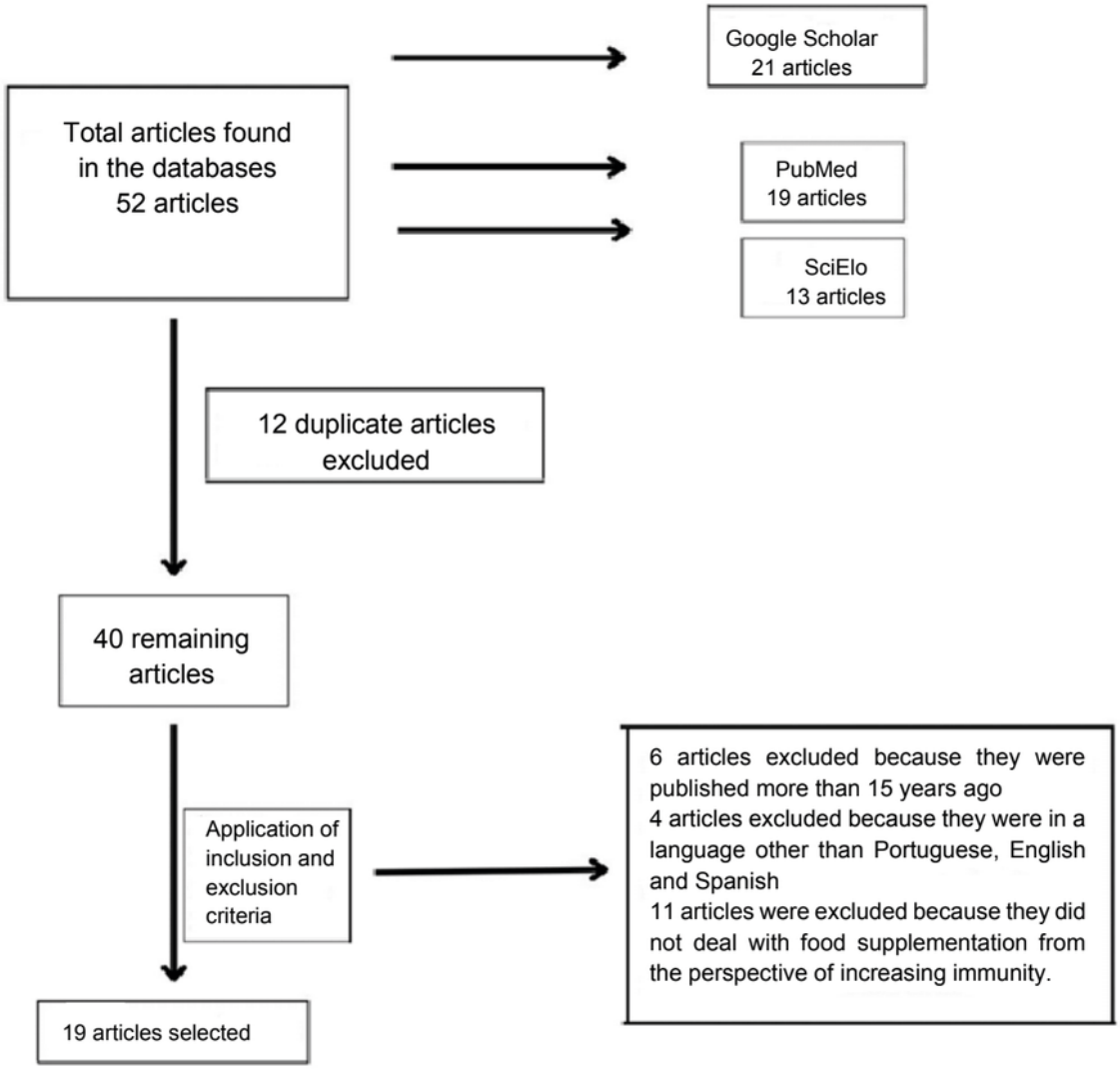

Figure 1 - Flowchart for selecting the articles used in the literature review.

Source: Prepared by the author (2025).

The data collected was analyzed qualitatively, taking into account the identification of convergent content between the studies and grouping them into thematic categories. This procedure enabled a deeper understanding of the main arguments, scientific evidence, controversies and myths related to the relationship between supplementation and immunity, helping to achieve the objectives set out in this research.

RESULTS AND DISCUSSION

The immune system is a complex network of organs, cells and molecules whose main function is to preserve the body's homeostasis, defending it against aggressive agents. In order to understand how it works and the influence of food and supplements on its activity, it is essential to analyze its main components, the types of immune response and the mechanisms that regulate its balance. Initially, the immune system is classified into two broad categories: innate immunity and adaptive immunity.[8]

Innate immunity is the body's first line of defence, characterized by a rapid and standardized response to various stimuli, although limited in specificity. This protection is exercised through physical barriers (skin and mucous membranes), expulsion mechanisms (coughing, sneezing, ciliary movement), chemical barriers (gastric acid, tears, sweat, digestive enzymes) and biological barriers. The effector cells include macrophages, neutrophils, dendritic cells and Natural Killer (NK) cells. The response involves mechanisms such as phagocytosis, release of inflammatory mediators, activation of the complement system and production of acute phase proteins, cytokines and chemokines.[9]

Complementing this defense system, adaptive immunity acts with greater specificity and memory. Unlike the innate response, adaptive immunity depends on the activation of specialized cells - B and T lymphocytes - which, once stimulated, produce antibodies and coordinate the elimination of pathogens in a precise and lasting manner. Its components include immunoglobulins (IgA, IgG, IgM, IgE and IgD), CD4+ and CD8+ T lymphocytes, and the formation of memory cells, which ensure protection in future exposures. It is worth noting that adaptive immunity is triggered after the recognition of antigens by specific receptors, and is the basis of the effectiveness of vaccines and prolonged immunization.[8]

This integration between innate and adaptive immunity is mediated by various mechanisms, including the recognition of Pathogen-Associated Molecular Patterns (PAMPs) by Pattern Recognition Receptors (PRRs), especially Toll-like Receptors (TLRs). These processes ensure a coordinated and effective response against infections.[9]

However, the optimal functioning of the immune system depends on its ability to be regulated according to the body's needs. In this context, immunomodulators have emerged, substances capable of stimulating or suppressing the immune response in a controlled manner, with important therapeutic applications in various diseases.

Immunomodulators can be classified as agents that stimulate the immune response - aimed at correcting immunodeficiencies - or as immunosuppressants, used to control processes of immunological hyperactivity, such as in autoimmune diseases. The first immunomodulators were discovered empirically, but with scientific advances it was possible to develop more specific agents, such as cytokines and monoclonal antibodies, consolidating immunomodulation as a pillar of modern medicine.[10]

Among the therapeutic options is intravenous immunoglobulin (IgEV), obtained from the plasma of thousands of donors and rich in IgG antibodies. Used as an immunomodulator, IgEV acts by modulating the activity of T lymphocytes, inhibiting leukocyte activation and blocking FcγR receptors. It is important to note that its indication is not intended for general immunoglobulin replacement, but is reserved for specific situations of diagnosed immunodeficiency.[10]

Alongside immunomodulators, nutritional status has a decisive influence on the immune system. In this scenario, food supplements are gaining relevance as auxiliary agents, designed to complement the diet of healthy individuals, providing vitamins, minerals, amino acids, enzymes or probiotics. However, unlike drug immunomodulators, supplements do not have therapeutic claims recognized by legislation.[11]

Vitamins and minerals are essential for cell activation, antibody production and the modulation of inflammatory processes. Micronutrients such as vitamins C and D, and minerals such as zinc, are widely studied in this context. Despite this, indiscriminate su-

pplementation can pose health risks, making it essential to prioritize a balanced diet as the main source of nutrients.[11]

The relationship between nutrition and immunity is particularly evident in vulnerable populations. Individuals with nutritional deficiencies are more susceptible to infections and recover more slowly. In these cases, supplementation can be a valid strategy for restoring immune balance and improving clinical prognosis.[11]

In Brazil, the regulation of dietary supplements is defined by Anvisa Resolution RDC No. 243/2018, establishing criteria for their composition and labeling. Although they can be described as aids to immune function , supplements are not a substitute for healthy lifestyle practices, such as a balanced diet and regular physical activity.[11]

In addition, Anvisa's Normative Instruction No. 28/2018 defines limits for nutrient intake in supplements, differentiating them from medicines and herbal medicines. The lack of scientific consensus on the efficacy of supplements, at the permitted doses, for preventing viral infections or optimizing the immune response reinforces the need for caution in their prescription.[11]

Among the supplements commonly associated with immune support are vitamin A, vitamin C, vitamin D and zinc. Each of these nutrients plays specific and important roles in the functioning of the body's defence system, although their supplementary use should be individualized.

Vitamin A, which is essential for the integrity of mucous membranes and the function of phagocytic cells, also acts on the proliferation of T lymphocytes. Studies point to its effectiveness in reducing morbidity from infections in malnourished populations, but with no clear benefit for well-nourished individuals.[12],[13]

Vitamin C, historically linked to the prevention of colds, shows modest effects in reducing the duration of symptoms in individuals who consume it regularly. However, there is no robust evidence to support its prophylactic use in the general population.[14],[15],[16]

In addition to its classic role in bone metabolism, vitamin D influences the gene expression of immune cells. Vitamin D deficiency is associated with increased susceptibility to infections, justifying supplementation only in cases of insufficient serum levels.[4]

Zinc, in turn, is a cofactor for numerous enzymes and performs antioxidant and immunomodulatory functions. Despite the recognition of its importance for the immune system, the evidence on the efficacy of its supplementation in preventing infections is still inconclusive, due to the heterogeneity of the studies. [17],[18]

Adequate nutrition plays an essential role in maintaining immune health, ensuring an efficient response against pathogens. However, nutrient supplementation must be carried out carefully, taking into account individual needs and based on scientific evidence. To make it easier to understand the specific role of each vitamin and mineral in immune support, as well as the strength of the evidence and recommendations for supplementation, the following is a comparative table drawn up from recent scientific literature.

Data from the US National Health Interview reveals that the most consumed food supplements among adults include probiotics, vitamins and minerals. It is estimated that the global market for these products will exceed US$73 billion by 2024, reflecting consumers' growing interest in health-promoting strategies. This increase highlights not only the popularity of traditional supplements, but also the significant expansion of the probiotics market. .[19]

NUTRIENT	FUNCTION IN THE IMMUNE SYSTEM	SCIENTIFIC EVIDENCE
VITAMIN A	Modulates the response of phagocytic cells, facilitates phagocytosis and regulates the activity of cells in the innate immune system.	Important in the formation of epithelial tissues and mucous membranes, however studies indicate that its effectiveness in preventing respiratory infections is limited, being more effective in cases of malnutrition.
VITAMIN C	Essential nutrient, related to immunity and the prevention of acute infections such as colds.	Not proven effective in preventing colds. May reduce the duration of the illness in some cases.
VITAMIN D	Regulates the concentration of calcium and phosphorus, essential for immune function and bone health.	Benefits from supplementation in the event of low sun exposure. Its effectiveness is restricted to individuals with a deficiency.
ZINC	Essential for more than 300 enzymes, influences growth, development and immune system function.	Supplementation can be effective in people with a deficit, but the evidence for its effectiveness in infections is inconclusive.

Table 1: Function and Scientific Evidence of Nutrients in the Immune System

Source: Prepared by the author (2025).

Compared to other supplements, probiotic preparations have a distinct characteristic: they contain live microorganisms which, when administered in adequate quantities, confer health benefits on the host. In recent decades, understanding of the effects of probiotics has advanced significantly, making it possible to select and characterize specific cultures. Currently, probiotics are commercially available in various forms, such as capsules, powders and fermented foods, including fermented milk and yogurts. Although research in humans has demonstrated beneficial effects on health outcomes, most of these studies have been conducted in clinical populations, and evidence of benefits in healthy adults remains limited and often inconsistent.[19]

Even so, probiotic products are widely promoted as agents capable of strengthening the immune system. Many advertising campaigns suggest that their consumption can improve the immune response and reduce the risk of common infections such as colds and flu. This prospect generates a growing expectation among consumers and reinforces the need for rigorous scientific evaluations of the real effectiveness of these products in healthy individuals.[19]

In order to elucidate this issue, Basile et al. carried out a systematic review to investigate whether oral supplementation of probiotics could significantly influence circulating immunological and inflammatory markers in healthy adults, compared to placebo. This approach aims to provide information for clinicians, consumers, industry and regulatory bodies to inform decisions regarding the use of probiotics by individuals without a diagnosis of disease.

The study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. For the inclusion of studies in the review, strict eligibility criteria were defined: only randomized (or crossover) clinical trials that evaluated the oral administration of probiotics in healthy adults without acute or chronic diseases (such as diabetes, cardiovascular, gastrointestinal, autoimmune diseases, obesity [BMI ≥ 30], cancer or liver/renal diseases). Pregnant women, nursing mothers, individuals with mental disorders, drug users and those practicing intense physical activity were excluded.[19]

The inclusion and exclusion criteria for the studies analyzed were organized as follows:

DOMAIN	INCLUSION CRITERIA
Population	Healthy adults (18-65 years) with no reported acute or chronic diseases (e.g. diabetes, cardiovascular, gastrointestinal, autoimmune diseases, obesity [BMI ≥ 30], cancer, liver/renal diseases). Pregnant or breastfeeding women and individuals with mental disorders or drug use were excluded.
Intervention	Oral probiotic supplementation (live cells).
Comparator	Control group receiving placebo.
Results	Circulating immunological and inflammatory markers, including (but not limited to): monocytes, macrophages, immunoglobulins, lymphocytes, phagocytic activity, interferons, interleukins, C-reactive protein, TNF-α, prostaglandins.
Design	Randomized clinical trials or crossover randomized clinical trials.

Table 2: Eligibility criteria (Adapted from Basile et al., 2020)

Source: Prepared by the author (2025).

Among the 18 studies included in the review, eight demonstrated positive immunological and/or inflammatory effects with probiotic supplementation compared to placebo ($P < 0.05$). The most notable results include an increase in NK cell and monocyte activity after 8 weeks of supplementation, followed by a 4-week washout period, as well as an increase in subsets of effector T cells, such as Th1 and cytotoxic T cells. However, there are also studies that found no significant differences in phagocytic activity or leukocyte count between the probiotic and placebo groups, which highlights the variability of the results obtained.[19]

Although the immunomodulatory effects of probiotics show a possible influence on the release of cytokines and chemokines, affecting both the innate and adaptive immune systems, these effects seem to be more pronounced in individuals with compromised immune systems. In healthy adults, who generally have an already functional immune system, these alterations may not be evident enough to generate clinically significant changes. In addition, variables such as diet, levels of physical activity, medication use, age, environment and ethnic origin may be determining factors in the discrepancy of findings between studies.[19]

Therefore, the results of the review suggest that although probiotic supplementation has the potential to modulate immunity, its effects in healthy adults are limited and variable. The heterogeneity between probiotic strains and the methodologies adopted by the studies analyzed require caution when interpreting the results. It is therefore imperative that future research investigates more specifically the effects of different probiotic strains in particular clinical conditions, in order to elucidate the mechanisms underlying these immune responses and improve the clinical use of probiotics.[19]

CONCLUSION

The aim of this study was to demystify the concept of "boosting immunity" and highlight the importance of balancing the immune system. The initial proposal was to analyze, on a scientific basis, the functioning of the immune system and deconstruct the simplistic idea that it is possible to "boost" immunity through supplements and vitamins. The study proved relevant in clarifying concepts that are often distorted by society, contributing to the dissemination of information based on scientific evidence.

With regard to the general objective, which aimed to understand and clarify the regulation of the immune system and the role of supplements and vitamins in this context, the results showed that immunity cannot be "boosted" indiscriminately, but rather maintained in balance through healthy habits. This balance, far from being a simple matter of "strengthening" the immune system, involves daily practices that favor the proper functioning of the immune system.

With regard to the specific objectives, it was possible to conclude that: The review of how the immune system works revealed that it is a complex and regulated system that cannot be "strengthened" beyond its natural capacity; The analysis on the use of vitamins and supplements highlighted that their benefits apply mainly in cases of diagnosed nutritional deficiencies, and not as a generic "boost" to immunity; The study on the dissemination of misinformation pointed out that many claims about "boosting immunity" lack scientific basis and may encourage the indiscriminate use of products without due need.

The initial hypothesis, that the concept of "boosting immunity" is mistaken and that immunity should be seen as a regulated and balanced system, was confirmed. The analysis of the studies reviewed showed that there are no ways to boost immunity indefinitely, but rather to keep it functioning properly.

With regard to the central problem of the research, which sought to understand whether the concept of "boosting immunity" has scientific backing or is a popular distortion, the answer found is clear: it is a misconception, widely exploited by marketing strategies and a lack of scientific knowledge. The answer reached, within the scope of this study, was considered robust, although there is room for further research, especially into the relationship between eating habits and immunity in different populations.

In view of the arguments presented, it is suggested that, in order to combat the spread of this misconception, greater dissemination of scientific information accessible to the general public should be promoted. In addition, it is essential to establish stricter control over advertising claims related to immunity, in order to avoid misleading practices.

Finally, throughout the research, some limitations were identified, such as the difficulty in finding studies directly related to the misperception of immunity among the population and the need for more experimental investigations into the impacts of indiscriminate consumption of supplements. Based on these limitations, future research is recommended: studies on the influence of the media in spreading myths about immunity; clinical investigations into the effects of excessive use of vitamin supplements without a doctor's prescription; and analysis of effective strategies for educating the population about the true function of the immune system.

REFERENCES

1. Statista. Global dietary supplements and functional foods market [Internet]. 2024. Disponível em: https://www.statista.com/topics/8402/global-dietary-supplements-and-functional-food-market/

2. Crawford C, Brown LL, Costello RB, Deuster PA. Select dietary supplement ingredients for preserving and protecting the immune system in healthy individuals: A systematic review. Nutrients. 2022;14(21):4604. doi:10.3390/nu14214604.

3. Beltrán B, Estévez R, Cuadrado C, Jiménez S, Olmedilla B. Carotenoid database to assess dietary intake of carotenes, xanthophylls and vitamin A; its use in a comparative study of vitamin A nutritional status in young adults. Nutr Hosp. 2012;27(4):1334-43. Disponível em: http://scielo.isciii.es/pdf/nh/v27n4/55_original44.pdf

4. Ismailova A, White JH. Vitamin D, infections and immunity. Rev Endocr Metab Disord. 2022;23(2):265-77. doi:10.1007/s11154-021-09679-5.

5. Hernández Ugalde F, Martínez Leyva G, Rodríguez Acosta Y, Hernández Suárez D, Pérez García A, Almeida Campos S. Folic acid and pregnancy, benefit or risk? Rev Med Electron. 2019;41(1):142-55. Disponível em: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1684-18242019000100142&lng=es.

6. Nogueira I, Alves L, Lemos G, Salerno V, Barcellos L, Cocate P. Benefícios do exercício físico e da nutrição na imunidade: Possíveis estratégias para prevenção da COVID-19. JIM. 2020;1(2):043-63. Disponível em: https://revistas.ponteditora.org/index.php/jim/article/view/300

7. Institute of Medicine (US) Panel on Dietary Antioxidants and Related Compounds. Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids. Washington (DC): National Academies Press; 2000. PMID: 25077263.

8. Abbas AK, Lichtman AH, Pillai S, et al. Imunologia Básica: funções e distúrbios do sistema imunológico. 6th ed. Rio de Janeiro: Guanabara Koogan; 2021. ISBN 9788595158672.

9. Cruvinel WM, Mesquita Júnior D, Araújo JAP, Catelan TTT, Souza AWS, Silva NP, et al. Immune system: Part I. Fundamentals of innate immunity with emphasis on molecular and cellular mechanisms of inflammatory response. Rev Bras Reumatol. 2010;50(4):434-47. Disponível em: https://www.scielo.br/j/rbr/a/QdW9KFBP3XsLvCYRJ8Q7SRb/?lang=en

10. Lima HC. Fatos e mitos sobre imunomoduladores. An Bras Dermatol. 2007;82(3):207-21. Disponível em: https://www.scielo.br/j/abd/a/xT7yWxJyWsj5xQvkwp36C5q/abstract/?lang=en

11. Bomfim JHGG, Gonçalves J da S. Suplementos alimentares, imunidade e COVID-19: qual a evidência? VITTALLE - Rev Ciênc Saúde. 2020 Jul 21;32(1):10-21. Disponível em: https://www.rbhcs.com/vittalle/article/view/11282

12. Huang Z, Liu Y, Qi G, Brand D, Zheng SG. Role of vitamin A in the immune system. J Clin Med. 2018;7(9):258. doi:10.3390/jcm7090258.

13. Chen H, Zhuo Q, Yuan W, Wang J, Wu T. Vitamin A for preventing acute lower respiratory tract infections in children up to seven years of age. Cochrane Database Syst Rev. 2008;2011(1):CD006090. doi:10.1002/14651858.CD006090.pub2.

14. San Mauro-Martín I, Garicano Vilar E. Papel de la vitamina C y los β-glucanos sobre el sistema inmunitario: revisión. Rev Esp Nutr Humana Diet. 2015;19(4):238-45. Disponível em: https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S2174-51452015000400008

15. Hemilä H, Louhiala P. Vitamin C for preventing and treating pneumonia. Cochrane Database Syst Rev. 2013;2013(8):CD005532. doi:10.1002/14651858.CD005532.pub3.

16. Hemilä H, Chalker E. Vitamin C for preventing and treating the common cold. Cochrane Database Syst Rev. 2013;2013(1):CD000980. doi:10.1002/14651858.CD000980.pub4.

17. Sena KCM de, Pedrosa L de FC. Efeitos da suplementação com zinco sobre o crescimento, sistema imunológico e diabetes. Rev Nutr. 2005;18(2):251-9. Disponível em: https://www.scielo.br/j/rn/a/8LjWK9MWZ3X8dVtrmmNxvbJ/

18. Saigal P, Hanekom D. Does zinc improve symptoms of viral upper respiratory tract infection? Evidence-Based Practice. 2020;23(1):37-39.

19. Mohr AE, Basile AJ, Crawford MS, Sweazea KL, Carpenter KC. Probiotic supplementation has a limited effect on circulating immune and inflammatory markers in healthy adults: A systematic review of randomized controlled trials. [Journal name]. [Year];[Volume]([Issue]):[Page numbers]. (In press).