BAGHDAD JOURNAL OF BIOCHEMISTRY AND APPLIED BIOLOGICAL SCIENCES
2024, VOL. 5, NO. 2, 87-91, e-ISSN: 2706-9915, p-ISSN: 2706-9907
https://doi.org/10.47419/bjbabs.v5i2.215

NARRATIVE REVIEW

Immune –enhancing role of vitamin A- Narrative review

Muna Mohammed Ibraheem[1], TafaoulJaber Hameed[2] and Maysam Adnan Mezher[2]

[1]Department of Soil and water Resources, College of Agriculture , Tikrit University, Tikrit, Iraq.
[2]Department of Clinical Laboratory Sciences, College of Pharmacy, Tikrit University, Tikrit, Iraq.

ABSTRACT

Vitamin A has been prescribed in many cases of immunodeficiency or infection, as researchers have found that vitamin A strengthens immunity and regulates immune cells such as neutrophils, macrophages and others. On the other hand, vitamin A treatment did not reduce the length of stay in the hospital or the death-rate sepsis patients. However, vitamin A plays a positive role in the treatment of COVID-19 through regulating many significant signaling pathways. In addition, it provides protection against measles and reduces mortality, and contributes in the treatment of tuberculosis through several mechanisms. In this review we aimed to explain the role of vitamin A in enhancing body immune functions and reducing inflammation in human body.

Keywords Vitamin A, Immune system, Inflammation, Anti- inflammatory, Viral infections

Received 17-04-2023
Revised 27-11-2023
Accepted 03-03-2024
Published 01-04-2024

DOI https://doi.org/10.47419/bjbabs.v5i2.215

Pages: 87-91

INTRODUCTION

Vitamin A was discovered in about 1906 and synthesized around 1947. It is a fat-soluble vitamin, belongs to the unsaturated monohydroalcohols group. It is available as retinal, retinol and retinoic acid (RA), the last one has the most significant biological activity. We can get vitamin A from animal products like cheese, eggs, liver and oily fish in form retinol, and from plants (vegetables, carrots and yellow fruit etc..) as beta-carotene and then the body can convert it to retinol. Vitamin A is called “anti-inflammation vitamin” by Green and Mellandy because it improves immune and anti-inflammatory response. In addition, it is important for many functions in the body, such as metabolism, hematopoiesis, vision, differentiation of cells, gene transcription, Integrity of epithelial and mucous membranes and immune system work [[1,2]. Iddir et al (2020) published a review in 2020 about strengthening the immune system and reducing inflammation by some agents like vitamins [3] . Other studies has been reported that VAcan improve the ability of immune cells to produce antibodies and induce T lymphocytes to release functional lymphokines through modulation of target

genes via nuclear receptors [4]. Additionally, VA is extremely important for maintaining sufficient levels of natural "killer cells" (showing antiviral activity) in circulating blood[5]. VA adjuvant therapy may enhance body immune function by increasing IgM and IgG levels and activating T lymphocytes [6] . More importantly, vitamin A was reported to play a significant role against pneumonia. It is evidenced that low VA content is linked to neonatal pneumonia [7] . Clinical data show that VA deficiency is implicated in fatal mycoplasma-induced pneumonia in children[8].

Cherukuri et al (2019) tested effects of vitamin A administration (100,000 IU in a day) on the death-rate and days length in Intensive Care Unit for sepsis patients. The study was conducted on 64 patients, 32 of them was treatment with vitamin A and the others given placebo over 7-dayes, in adults (the mean age was 51). The results showed that the number of days of stay in the intensive care unit had decreased slightly in patients treated with vitamin A compared to placebo. In addition, the study indicated there was no difference in the death rate between two groups [9].

Li *et al* (2020) identified pharmacological functions and mechanisms of vitamin A to treat COVID-19 infections. The results showed that the mechanisms of vitamin A in the treatment of COVID-19 infections involve increasing the body's immunity, reducing the inflammatory reaction. Vitamin A may play an effective role in the treatment of COVID-19 infections through its anti-inflammatory, antiviral, and immune-regulating effects. In their study, the researchers showed that vitamin A regulates many signaling pathways that are associated with COVID-19 infection such as FoxO, TNF and nuclear factor kappa B etc [10].

Other study indicated in her article that vitamin A contributes in strengthening the human immune system, particularly in innate immunity and antibody responses. He showed that Vitamin A deficiency affects the integrity of the mucous membranes that relate to the eyes, respiratory system, and the gastrointestinal tract, and it affects the susceptibility of each of them to infection with many pathogens. Treatment malnourished children with vitamin A provides protection against measles and reduces mortality. In addition, the researcher indicate that vitamin A enhances antibody concentration in humans, WBC function, and the body's resistance to carcinogens, and maintains the skin and mucous membranes which are the first line of defense against infection[11].

A study by Cantorna *et al* (2019) explained in their article the role of vitamin A in regulation the microbial complexity. The study indicated that vitamin A regulates microorganisms, as its deficiency leads to a decrease in the concentrations of beneficial bacteria important for stimulating T-cells and an increase in pathogenic bacteria in the gastrointestinal tract. The role of vitamin A in microorganism regulation is due to its indirect effects on the mucosal barrier and immune cells. An imbalance in vitamin A concentrations leads to a decreased response to gastrointestinal infections, which leads to chronic inflammation, dysbacteriosis and colitis [12].

A study conducted by Bahlool et al (2022) explained the role of vitamin A in the treatment of tuberculosis (a disease that occurs in poor countries). Tuberculosis patients showed lower levels of vitamin A compared to healthy subjects, which leads to increased oxidative stress and inflammation[13]. In addition because vitamin A is an antioxidant, it reduces free radicals which causes cell damage because the increased of radicals lead to hazardous biological reactions by withdrawing electrons from other molecules [14].

The researchers indicated through their study the mechanisms of action; 1. vitamin A affects many cells of the immune system, for example, it stimulates the production of cytokines, which promotes differentiation of T cells, and suppresses the toxicity of natural killer (NK) cells in humans. 2. Retinoic acid is important in the formation of IgA antibody by B cells, which plays an important role in immunity. 3. All trans retinoic acid (ATRA) promotes autophagy in tuberculosis-infected macrophages. 4. Vitamin A reduces the concentration of intracellular cholesterol in patients with tuberculosis, which increases the antibacterial activity. 5. ATRA decrease the expression of cellular transferrin receptors, resulting to reduce the supply of iron to the cell which promotes bacterial growth[13].

CONCLUSION

Previous studies showed the importance and role of vitamin A in anti- viral , anti-inflammatory , increasing the immunity of the body, and explained the many mechanisms of action related to it, but they did not give clinical evidence about it. Also, the studies above did not determine the administration route, the period of treatment and the exact dosage that gives the pharmacological effect without causing side effects. Therefore, we need more studies to use vitamin A clinically for treatment viral or bacterial infections and prove its effectiveness in supporting immunity in children and adults.

DECLARATIONS

1. All authors contributed equally to the paper, with tasks divided collaboratively, including research and writing. Each author shares equal responsibility for the con- tent and conclusions.

2.Conflict of interest

The authors declares no conflict of interest.

3. Ethical approval

(Institutional ethical approvals and informed consent)

This research does not conflict with our university’s ethical standards, nor with any known ethical criteria.

4. Funding resources

This research is self-funded

REFERENCES

1. 5-Lee H, Ko G. New perspectives regarding the antiviral effect of vitamin a on norovirus using modulation of gut microbiota. Gut Microbes. 2017;8:616–636.
2. 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. 10.3390/jcm7090258.
3. Iddir M, Brito A, Dingeo G, Campo SSFD, Samouda H, Frano MRL, et al. Strengthening the Immune System and Reducing Inflammation and Oxidative Stress through Diet and Nutrition: Considerations during the COVID-19 Crisis. Nutrients. 2020;12(6):1562–1562. 10.3390/nu12061562.
4. Stephensen CB. Vitamin A, infection, and immune function. Annu Rev Nutr . 2001;21:92–167. 10.1146/annurev.nutr.21.1.167.
5. Lee H, Ko G. New perspectives regarding the antiviral effect of vitamin A on norovirus using modulation of gut microbiota. Gut Microbes. 2017;8(6):616–620. 10.1080/19490976.2017.1353842.
6. Zhang P, Cui TT, Zhang ZH, Wang YQ. Low-dose vitamin A therapy on T lymphocyte function in neonatal pneumonia. Eur Rev Med Pharmacol Sci. 2018;22(13):4371–4374. 10.26355/eurrev$_2$01807$_1$5437.
7. Tian Y, Tian Q, Wu Y, Peng X, Chen Y, Li Q, et al. Vitamin A supplement after neonatal Streptococcus pneumoniae pneumonia inhibits the progression of experimental asthma by altering CD4+T cell subsets. Sci Rep. 2020;10(1):4214–4214. 10.1038/s41598-020-60665-4.
8. Xing Y, Sheng K, Xiao X, Li J, Wei H, Liu L, et al. Vitamin A deficiency is associated with severe Mycoplasma pneumoniae pneumonia in children. The role of vitamins and minerals on the immune system Home Health Care Management & Practice. 2020;8(4):120–120. 10.21037/atm.2020.02.33.
9. Cherukuri L, Gewirtz G, Osea K, Tayek JA. Vitamin A treatment for severe sepsis in humans; a prospective randomized double blind placebo-controlled clinical trial. Clin Nutr ESPEN. 2019;29:49–51. 10.1016/j.clnesp.2018.10.011.
10. Li R, Wu K, Li Y, Liang X, Tse WKF, Yang L, et al. Revealing the targets and mechanisms of vitamin A in the treatment of COVID-19. Aging (Albany NY). 2020;12(15):15784–15796. 10.18632/aging.103888.
11. Alpert PT. The Role of Vitamins and Minerals on the Immune System. Home Health Care Management & Practice. 2017;29(3). 10.1177/1084822317713300.
12. Cantorna MT, Snyder L, Arora J, Keane J, Sullivan MP. Vitamin A and vitamin D regulate the microbial complexity, barrier function, and the mucosal immune responses to ensure intestinal homeostasis. Crit Rev Biochem Mol Biol . 2019;54(2):184–192. 10.1080/10409238.2019.1611734.

13. Bahlool AZ, Grant C, Cryan SA, Keane J, c MPO. All trans retinoic acid as a host-directed immunotherapy for tuberculosis. Current Research in Immunology. 2022;22:54–72. 10.1016/j.crimmu.2022.03.003.
14. Halliwell B, JMC, Gutteridge. Free radicals in biology and medicine; 2015. .