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Optimizing Immune Health in HIV Patients through Nutrition: A Review

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Abstract

Human Immunodeficiency Virus (HIV) infection poses a continual challenge to global health, affecting the immune system and rendering individuals susceptible to opportunistic infections. With the advancements in Antiretroviral Therapy (ART), increasing attention is being directed towards holistic approaches, including nutritional interventions, to optimize immune health in people living with HIV. This review explores the intricate interplay between nutrition and immune health in the context of HIV. We examine the nutritional challenges faced by HIV patients, ranging from malabsorption to altered metabolism, and their implications for immune function. The review investigates the impact of micronutrients on immune parameters, evaluating the potential of supplementation to support immune health. Dietary patterns, including the Mediterranean and DASH diets, are scrutinized for their immunomodulatory effects in HIV-infected individuals. Furthermore, the review delves into the role of probiotics in maintaining gut health and supporting immune function in the HIV population. In conclusion, this review underscores the pivotal role of nutrition in enhancing immune health for individuals living with HIV, offering valuable insights for healthcare providers, researchers, and those navigating the complexities of HIV management.

Keywords: *HIV, Immune Health, Nutrition, Antiretroviral Therapy, Micronutrients, Probiotics, Dietary Supplements, Immunomodulation*

Introduction

Human Immunodeficiency Virus (HIV) infection continues to be a global public health challenge, affecting millions of individuals worldwide. Despite substantial advancements in Antiretroviral Therapy (ART), HIV remains a complex and dynamic virus, necessitating a multifaceted approach to its management. The primary hallmark of HIV is its profound impact on the immune system,

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leading to a gradual decline in CD4+ T cells and leaving individuals susceptible to opportunistic infections and malignancies. While ART has significantly improved life expectancy and quality of life for those living with HIV, there is an increasing recognition of the need for complementary strategies to bolster immune health.¹⁻¹⁰

Micronutrients, including vitamins and minerals, form the cornerstone of immune health, acting as essential cofactors for various immune processes. Despite the well-established importance of adequate nutrition in immune function, there is a paucity of comprehensive reviews specifically addressing the nutritional needs of individuals with HIV. This review seeks to bridge this gap by critically examining the existing literature and shedding light on the potential of targeted nutritional interventions to enhance immune health in the HIV population. Additionally, it explores the impact of dietary patterns, probiotics, and their interplay with ART, providing a nuanced understanding of how these factors collectively contribute to immune modulation.¹¹⁻²⁰

HIV-Related Nutritional Challenges

Individuals living with Human Immunodeficiency Virus (HIV) face a myriad of nutritional challenges that significantly impact their overall health and well-being. These challenges arise from the complex interplay between the virus and the host, contributing to malnutrition, altered metabolism, and compromised immune function. One primary nutritional challenge in HIV is malabsorption, driven by gastrointestinal mucosal damage caused by both the virus itself and opportunistic infections. The resulting malabsorption compromises the absorption of essential nutrients, leading to deficiencies in vital vitamins and minerals. Micronutrient deficiencies, such as those in vitamin B12, vitamin D, zinc, and selenium, are common among HIV-infected individuals and contribute to immune dysfunction and disease progression. Weight loss and wasting syndrome are prevalent nutritional challenges in HIV patients, particularly in advanced stages of the disease. HIV-associated wasting is characterized by the loss of lean body mass, muscle wasting, and unintentional weight loss, contributing to increased morbidity and mortality. The mechanisms behind wasting include elevated metabolic rates, chronic inflammation, and increased energy expenditure, further exacerbating the nutritional burden on affected individuals.²¹⁻⁴⁰

Alterations in metabolism represent another significant nutritional challenge in HIV. The virus induces changes in lipid and glucose metabolism, leading to insulin resistance and dyslipidemia. These metabolic abnormalities not only impact nutritional status but also contribute to an increased risk of cardiovascular diseases, adding an additional layer of complexity to the management of individuals with HIV. Moreover, the chronic inflammatory state associated with HIV infection places additional nutritional stress on the body. Elevated levels of pro-inflammatory cytokines, such as tumor necrosis factor-alpha (TNF- α) and interleukin-6 (IL-6), contribute to an increased metabolic rate and catabolic state, further depleting energy reserves and essential nutrients. This chronic inflammation not only exacerbates malnutrition but also plays a role in the progression of HIV-associated comorbidities. The impact of HIV-related nutritional challenges extends beyond the physical realm, influencing mental health and overall quality of life. Nutritional deficiencies

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are associated with cognitive impairment and neurocognitive disorders, adding a layer of complexity to the management of individuals living with HIV.⁴¹⁻⁶⁰

Micronutrients and Immune Health

Micronutrients, encompassing vitamins and minerals, play a pivotal role in maintaining a robust immune system, a significance accentuated in individuals living with Human Immunodeficiency Virus (HIV).⁶¹ The intricate interplay between micronutrients and immune health involves the modulation of various cellular and molecular processes essential for an effective immune response. Vitamins, such as vitamin A, C, D, E, and B-complex vitamins, act as potent antioxidants and cofactors in immune cell function. Vitamin A, for instance, supports the integrity of mucosal barriers, enhancing the first line of defense against pathogens. Vitamin C plays a vital role in the function of immune cells, including neutrophils and macrophages. Vitamin D is crucial for the regulation of immune responses, with its deficiency linked to increased susceptibility to infections. Vitamin E, known for its antioxidant properties, protects immune cells from oxidative stress. Various B vitamins contribute to cellular energy production, influencing the proliferation and activity of immune cells.

Essential minerals like zinc, selenium, iron, and copper are indispensable for immune function. Zinc is integral for the development and function of immune cells, and its deficiency is associated with impaired immune responses. Selenium acts as a cofactor for antioxidant enzymes, influencing the balance between oxidative stress and immune regulation. Iron, while essential for immune cell proliferation, requires careful management in HIV due to the risk of iron overload. Copper participates in various enzymatic reactions that support immune responses. Micronutrients exhibit immunomodulatory effects by influencing immune cell development, proliferation, and function. For example, vitamin D regulates the differentiation and activation of T cells, while vitamin E protects T cells from oxidative damage. Zinc is crucial for the development and activity of immune cells like T lymphocytes and natural killer cells. The role of micronutrients extends beyond individual immune cells, affecting cytokine production, antibody responses, and overall immune regulation. In individuals with HIV, micronutrient deficiencies are common and contribute to immunodeficiency. Deficiencies in vitamin A, C, and zinc, for instance, are associated with an increased risk of opportunistic infections. Adequate levels of micronutrients are essential for maintaining the integrity of mucosal barriers, which act as the first line of defense against infections. Moreover, micronutrient supplementation has been explored as a potential adjunctive therapy to enhance immune responses and mitigate the impact of HIV on the immune system.⁶²⁻⁷¹

Dietary Patterns and Immunomodulation

The role of dietary patterns in modulating immune function has garnered increasing attention, especially in the context of chronic infections such as Human Immunodeficiency Virus (HIV). Dietary choices profoundly influence the overall nutritional status, impacting the immune system's ability to mount an effective response against infections. The Mediterranean diet, characterized by high consumption of fruits, vegetables, whole grains, nuts, and olive oil, has emerged as a

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paradigm of a health-promoting dietary pattern. Rich in antioxidants, vitamins, and monounsaturated fats, the Mediterranean diet possesses anti-inflammatory properties that may benefit immune function. Studies suggest that adherence to the Mediterranean diet is associated with lower levels of inflammatory markers and improved immune responses. For individuals with HIV, adopting this dietary pattern may offer potential benefits in mitigating inflammation and supporting immune health.⁷²⁻⁷⁴

The Dietary Approaches to Stop Hypertension (DASH) diet, designed to manage hypertension, is rich in fruits, vegetables, whole grains, and lean proteins while limiting sodium intake. Beyond its cardiovascular benefits, the DASH diet's emphasis on nutrient-dense foods contributes to an overall anti-inflammatory environment. This anti-inflammatory effect may have implications for individuals living with HIV, where chronic inflammation is a hallmark of the condition. The DASH diet's potential to modulate immune responses warrants exploration in the context of HIV-related inflammation.⁷⁵ Protein is essential for immune cell development and function, and protein-rich dietary patterns have implications for immune modulation. Diets incorporating adequate protein from diverse sources, including lean meats, dairy, legumes, and nuts, provide essential amino acids necessary for immune cell proliferation and antibody production. Ensuring optimal protein intake is particularly relevant for individuals with HIV, where maintaining muscle mass and supporting immune function are critical components of overall health. Dietary patterns also influence the composition and diversity of the gut microbiota, which plays a crucial role in immune regulation. High-fiber diets, often associated with plant-based dietary patterns, promote the growth of beneficial gut bacteria. This, in turn, contributes to a balanced immune response. For individuals with HIV, where gut health is often compromised, dietary patterns that support a healthy gut microbiome may have implications for immune function and overall well-being.

Challenges and Opportunities: Despite the potential benefits, challenges exist in adopting specific dietary patterns, particularly in resource-limited settings where access to diverse and nutrient-rich foods may be constrained. Socioeconomic factors, cultural preferences, and individual variations also influence dietary choices. Tailoring dietary recommendations to the unique needs and preferences of individuals living with HIV is essential for the successful implementation of immunomodulatory dietary strategies.

Probiotics and Gut Health

The intricate relationship between the gut and the immune system has led to increased interest in the potential of probiotics to modulate immune responses, offering promise in the context of Human Immunodeficiency Virus (HIV) infection.⁷⁶ Probiotics, live microorganisms that confer health benefits to the host when administered in adequate amounts, have been extensively studied for their impact on gut health and immune function. Individuals with HIV often experience alterations in gut health, characterized by microbial dysbiosis, compromised gut barrier integrity, and chronic inflammation. The gut-associated lymphoid tissue (GALT), a significant component of the immune system, is profoundly impacted by HIV. Disruption of the gut-immune axis contributes to immune dysfunction, systemic inflammation, and the progression of HIV. Probiotics

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exert their immunomodulatory effects through multiple mechanisms, including the restoration of gut microbial balance, enhancement of the gut barrier, and regulation of immune responses. In the context of HIV, the potential benefits of probiotics lie in their ability to mitigate gut dysbiosis and inflammation, potentially influencing disease progression and immune function.⁷⁶⁻

HIV-related gut dysbiosis is characterized by alterations in the abundance and diversity of gut microbiota. Probiotics, through their capacity to replenish beneficial bacteria and suppress pathogenic species, contribute to the restoration of a balanced microbial environment. This rebalancing of the gut microbiota may positively impact the immune system, helping to mitigate the chronic inflammation observed in individuals with HIV. The gut epithelial barrier serves as a crucial defense against the translocation of microbial products into systemic circulation. HIV-induced damage to the gut mucosa compromises this barrier, contributing to heightened inflammation. Probiotics play a role in reinforcing gut barrier function by promoting the production of mucin, enhancing tight junction integrity, and preventing microbial translocation. These effects may be particularly relevant in the context of HIV, where maintaining gut barrier integrity is crucial for overall health. Probiotics influence immune responses through the activation of immune cells, regulation of cytokine production, and modulation of inflammation. Studies have demonstrated that specific probiotic strains can enhance antiviral immune responses and exert anti-inflammatory effects. This immunoregulatory potential is of interest in HIV, where chronic inflammation is associated with disease progression and comorbidities.⁷⁶

Interaction Between Nutrition and Antiretroviral Therapy

The intricate interplay between nutrition and Antiretroviral Therapy (ART) in the management of Human Immunodeficiency Virus (HIV) represents a crucial aspect of comprehensive care for individuals living with the virus.⁷⁷ Nutrition plays a multifaceted role in supporting overall health, influencing medication efficacy, and mitigating potential side effects associated with ART. Antiretroviral medications, while pivotal in suppressing viral replication and preserving immune function, can influence nutritional status. Certain ART drugs may contribute to metabolic changes, affecting lipid profiles, glucose metabolism, and body composition. These alterations underscore the importance of monitoring nutritional parameters and addressing potential nutrient deficiencies during ART. Initiating ART often brings about changes in metabolism and nutritional requirements. Individuals starting ART may experience weight changes, altered appetite, and gastrointestinal symptoms. A comprehensive nutritional assessment is crucial during this period to identify and address specific needs. Tailoring nutritional interventions can help alleviate side effects, enhance medication adherence, and support overall health during the critical early stages of ART.

Antiretroviral drugs may interact with nutrients, impacting their absorption, metabolism, or efficacy. For instance, certain protease inhibitors may affect vitamin D metabolism, potentially leading to deficiencies. Additionally, the management of micronutrients like calcium and magnesium may be influenced by ART. Awareness of these interactions is vital to prevent nutritional deficiencies and optimize treatment outcomes. Nutritional interventions can serve as

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adjuncts to manage specific side effects associated with ART. For instance, addressing dyslipidemia through dietary modifications, such as adopting heart-healthy eating patterns, may mitigate lipid-related side effects of certain antiretroviral drugs. Dietary strategies can also assist in managing gastrointestinal symptoms, ensuring individuals maintain adequate nutrient intake despite potential challenges. Gastrointestinal symptoms, common in individuals with HIV and exacerbated by certain ART regimens, may impact nutrient absorption. Optimizing nutrient intake and utilizing appropriate nutritional supplements can help compensate for potential malabsorption issues. Coordinating the timing of nutrient intake with ART dosages can further enhance absorption and mitigate potential nutrient deficiencies. The diverse spectrum of ART regimens, individual variations in drug responses, and the unique nutritional needs of individuals with HIV necessitate personalized nutrition plans. Tailoring dietary recommendations based on factors such as age, comorbidities, and lifestyle considerations is crucial for optimizing treatment outcomes and promoting long-term health.⁷⁷

Conclusion

The intricate relationship between nutrition and Human Immunodeficiency Virus (HIV) care is paramount for the holistic well-being of individuals living with the virus. The comprehensive exploration of nutritional challenges, micronutrient impact on immune health, dietary patterns, probiotics, and the interaction between nutrition and Antiretroviral Therapy (ART) underscores the multifaceted nature of this critical intersection. Addressing HIV-related nutritional challenges, including malabsorption, altered metabolism, and deficiencies, emerges as a key component in the management of the virus. Micronutrients, as essential contributors to immune function, offer avenues for targeted interventions to support immune health in the context of HIV. Dietary patterns, such as the Mediterranean and DASH diets, present promising strategies for immune modulation, while protein-rich diets contribute to overall health and immune cell function. Probiotics, with their potential to restore gut health and regulate immune responses, present exciting opportunities for individuals with HIV. Their role in mitigating gut dysbiosis and inflammation could have far-reaching implications for disease progression and overall health.

References

1. Obeagu EI, Okwuanaso CB, Edoho SH, Obeagu GU. Under-nutrition among HIV-exposed Uninfected Children: A Review of African Perspective. *Madonna University journal of Medicine and Health Sciences*. 2022;2(3):120-127.
2. Obeagu EI, Alum EU, Obeagu GU. Factors associated with prevalence of HIV among youths: A review of Africa perspective. *Madonna University journal of Medicine and Health Sciences*. 2023;3(1):13-18.
<https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/93>.
3. Obeagu EI. A Review of Challenges and Coping Strategies Faced by HIV/AIDS Discordant Couples. *Madonna University journal of Medicine and Health Sciences*. 2023 ;3(1):7-12.
<https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/91>.

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

4. Obeagu EI, Obeagu GU. An update on premalignant cervical lesions and cervical cancer screening services among HIV positive women. *J Pub Health Nutri.* 2023; 6 (2). 2023; 141:1-2. [links/63e538ed64252375639dd0df/An-update-on-premalignant-cervical-lesions-and-cervical-cancer-screening-services-among-HIV-positive-women.pdf](https://doi.org/10.22192/ijcrms.2017.03.01.004).
5. Ezeoru VC, Enweani IB, Ochiabuto O, Nwachukwu AC, Ogbonna US, Obeagu EI. Prevalence of Malaria with Anaemia and HIV status in women of reproductive age in Onitsha, Nigeria. *Journal of Pharmaceutical Research International.* 2021;33(4):10-19.
6. Omo-Emmanuel UK, Chinedum OK, Obeagu EI. Evaluation of laboratory logistics management information system in HIV/AIDS comprehensive health facilities in Bayelsa State, Nigeria. *Int J Curr Res Med Sci.* 2017;3(1): 21-38.DOI: [10.22192/ijcrms.2017.03.01.004](https://doi.org/10.22192/ijcrms.2017.03.01.004)
7. Obeagu EI, Obeagu GU, Musiimenta E, Bot YS, Hassan AO. Factors contributing to low utilization of HIV counseling and testing services. *Int. J. Curr. Res. Med. Sci.* 2023;9(2): 1-5.DOI: [10.22192/ijcrms.2023.09.02.001](https://doi.org/10.22192/ijcrms.2023.09.02.001)
8. Obeagu EI, Obeagu GU. An update on survival of people living with HIV in Nigeria. *J Pub Health Nutri.* 2022; 5 (6). 2022;129. [links/645b4bfcf3512f1cc5885784/An-update-on-survival-of-people-living-with-HIV-in-Nigeria.pdf](https://doi.org/10.22192/ijcrms.2023.09.02.001).
9. Offie DC, Obeagu EI, Akueshi C, Njab JE, Ekanem EE, Dike PN, Oguh DN. Facilitators and barriers to retention in HIV care among HIV infected MSM attending Community Health Center Yaba, Lagos Nigeria. *Journal of Pharmaceutical Research International.* 2021;33(52B):10-19.
10. Obeagu EI, Ogbonna US, Nwachukwu AC, Ochiabuto O, Enweani IB, Ezeoru VC. Prevalence of Malaria with Anaemia and HIV status in women of reproductive age in Onitsha, Nigeria. *Journal of Pharmaceutical Research International.* 2021;33(4):10-19.
11. Odo M, Ochei KC, Obeagu EI, Barinaadaa A, Eteng UE, Ikpeme M, Bassej JO, Paul AO. TB Infection Control in TB/HIV Settings in Cross River State, Nigeria: Policy Vs Practice. *Journal of Pharmaceutical Research International.* 2020;32(22):101-119.
12. Obeagu EI, Eze VU, Alaebob EA, Ochei KC. Determination of haematocrit level and iron profile study among persons living with HIV in Umuahia, Abia State, Nigeria. *J BioInnovation.* 2016; 5:464-471. [links/592bb4990f7e9b9979a975cf/DETERMINATION-OF-HAEMATOCRIT-LEVEL-AND-IRON-PROFILE-STUDY-AMONG-PERSONS-LIVING-WITH-HIV-IN-UMUAHIA-ABIA-STATE-NIGERIA.pdf](https://doi.org/10.22192/ijcrms.2017.03.01.004).
13. Ifeanyi OE, Obeagu GU. The values of prothrombin time among HIV positive patients in FMC owerri. *International Journal of Current Microbiology and Applied Sciences.* 2015;4(4):911-916.
https://www.academia.edu/download/38320140/Obeagu_Emanuel_Ifeanyi_and_Obeagu_Getrude_Uzoma2.EMMA1.pdf.
14. Izuchukwu IF, Ozims SJ, Agu GC, Obeagu EI, Onu I, Amah H, Nwosu DC, Nwanjo HU, Edward A, Arunsi MO. Knowledge of preventive measures and management of HIV/AIDS victims among parents in Umuna Orlu community of Imo state Nigeria. *Int. J. Adv. Res. Biol. Sci.* 2016;3(10): 55-65.DOI; [10.22192/ijarbs.2016.03.10.009](https://doi.org/10.22192/ijarbs.2016.03.10.009)
15. Chinedu K, Takim AE, Obeagu EI, Chinazor UD, Eloghosa O, Ojong OE, Odunze U. HIV and TB co-infection among patients who used Directly Observed Treatment Short-course

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

- centres in Yenagoa, Nigeria. IOSR J Pharm Biol Sci. 2017;12(4):70-75.
<links/5988ab6d0f7e9b6c8539f73d/HIV-and-TB-co-infection-among-patients-who-used-Directly-Observed-Treatment-Short-course-centres-in-Yenagoa-Nigeria.pdf>
16. Oloro OH, Oke TO, Obeagu EI. Evaluation of Coagulation Profile Patients with Pulmonary Tuberculosis and Human Immunodeficiency Virus in Owo, Ondo State, Nigeria. *Madonna University journal of Medicine and Health Sciences*. 2022;2(3):110-119.
 17. Nwosu DC, Obeagu EI, Nkwocha BC, Nwanne CA, Nwanjo HU, Amadike JN, Elendu HN, Ofoedeme CN, Ozims SJ, Nwankpa P. Change in Lipid Peroxidation Marker (MDA) and Non enzymatic Antioxidants (VIT C & E) in HIV Seropositive Children in an Urban Community of Abia State, Nigeria. *J. Bio. Innov.* 2016;5(1):24-30.
<links/5ae735e9a6fdcc5b33eb8d6a/CHANGE-IN-LIPID-PEROXIDATION-MARKER-MDAAND-NON-ENZYMATIC-ANTIOXIDANTS-VIT-C-E-IN-HIV-SEROPOSITIVE-CHILDREN-IN-AN-URBAN-COMMUNITY-OF-ABIA-STATE-NIGERIA.pdf>.
 18. Igwe CM, Obeagu IE, Ogbuabor OA. Clinical characteristics of people living with HIV/AIDS on ART in 2014 at tertiary health institutions in Enugu, Nigeria. *J Pub Health Nutri.* 2022; 5 (6). 2022;130. <links/645a166f5762c95ac3817d32/Clinical-characteristics-of-people-living-with-HIV-AIDS-on-ART-in-2014-at-tertiary-health-institutions-in-Enugu.pdf>.
 19. Ifeanyi OE, Obeagu GU, Ijeoma FO, Chioma UI. The values of activated partial thromboplastin time (APTT) among HIV positive patients in FMC Owerri. *Int J Curr Res Aca Rev.* 2015; 3:139-144.
https://www.academia.edu/download/38320159/Obeagu_Emanuel_Ifeanyi3_et_al.IJC_RAR.pdf.
 20. Obiomah CF, Obeagu EI, Ochei KC, Swem CA, Amachukwu BO. Hematological indices o HIV seropositive subjects in Nnamdi Azikiwe University teaching hospital (NAUTH), Nnewi. *Ann Clin Lab Res.* 2018;6(1):1-4.
<links/5aa2bb17a6fdccd544b7526e/Haematological-Indices-of-HIV-Seropositive-Subjects-at-Nnamdi-Azikiwe.pdf>
 21. Omo-Emmanuel UK, Ochei KC, Osuala EO, Obeagu EI, Onwuasoanya UF. Impact of prevention of mother to child transmission (PMTCT) of HIV on positivity rate in Kafanchan, Nigeria. *Int. J. Curr. Res. Med. Sci.* 2017;3(2): 28-34.DOI: 10.22192/ijcrms.2017.03.02.005
 22. Aizaz M, Abbas FA, Abbas A, Tabassum S, Obeagu EI. Alarming rise in HIV cases in Pakistan: Challenges and future recommendations at hand. *Health Science Reports.* 2023;6(8):e1450.
 23. Obeagu EI, Amekpor F, Scott GY. An update of human immunodeficiency virus infection: Bleeding disorders. *J Pub Health Nutri.* 2023; 6 (1). 2023;139.
<links/645b4a6c2edb8e5f094d9bd9/An-update-of-human-immunodeficiency-virus-infection-Bleeding.pdf>.
 24. Obeagu EI, Scott GY, Amekpor F, Ofodile AC, Edoho SH, Ahamefula C. Prevention of New Cases of Human Immunodeficiency Virus: Pragmatic Approaches of Saving Life in Developing Countries. *Madonna University journal of Medicine and Health Sciences*.

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

2022;2(3):128-134.

<https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/86>.

25. Walter O, Anaebo QB, Obeagu EI, Okoroiwu IL. Evaluation of Activated Partial Thromboplastin Time and Prothrombin Time in HIV and TB Patients in Owerri Metropolis. *Journal of Pharmaceutical Research International*. 2022;29-34.
26. Odo M, Ochei KC, Obeagu EI, Barinaadaa A, Eteng EU, Ikpeme M, Bassey JO, Paul AO. Cascade variabilities in TB case finding among people living with HIV and the use of IPT: assessment in three levels of care in cross River State, Nigeria. *Journal of Pharmaceutical Research International*. 2020;32(24):9-18.
27. Jakheng SP, Obeagu EI. Seroprevalence of human immunodeficiency virus based on demographic and risk factors among pregnant women attending clinics in Zaria Metropolis, Nigeria. *J Pub Health Nutri*. 2022; 5 (8). 2022;137. [links/6317a6b1acd814437f0ad268/Seroprevalence-of-human-immunodeficiency-virus-based-on-demographic-and-risk-factors-among-pregnant-women-attending-clinics-in-Zaria-Metropolis-Nigeria.pdf](https://doi.org/10.22192/ijarbs.2023.10.09.015).
28. Obeagu EI, Obeagu GU. A Review of knowledge, attitudes and socio-demographic factors associated with non-adherence to antiretroviral therapy among people living with HIV/AIDS. *Int. J. Adv. Res. Biol. Sci*. 2023;10(9):135-142.DOI: 10.22192/ijarbs.2023.10.09.015 [links/6516faa61e2386049de5e828/A-Review-of-knowledge-attitudes-and-socio-demographic-factors-associated-with-non-adherence-to-antiretroviral-therapy-among-people-living-with-HIV-AIDS.pdf](https://doi.org/10.22192/ijarbs.2023.10.09.015)
29. Obeagu EI, Onuoha EC. Tuberculosis among HIV Patients: A review of Prevalence and Associated Factors. *Int. J. Adv. Res. Biol. Sci*. 2023;10(9):128-134.DOI: 10.22192/ijarbs.2023.10.09.014 [links/6516f938b0df2f20a2f8b0e0/Tuberculosis-among-HIV-Patients-A-review-of-Prevalence-and-Associated-Factors.pdf](https://doi.org/10.22192/ijarbs.2023.10.09.014).
30. Obeagu EI, Ibeh NC, Nwobodo HA, Ochei KC, Iwegbulam CP. Haematological indices of malaria patients coinfecting with HIV in Umuahia. *Int. J. Curr. Res. Med. Sci*. 2017;3(5):100-104.DOI: 10.22192/ijcrms.2017.03.05.014 https://www.academia.edu/download/54317126/Haematological_indices_of_malaria_patients_coinfected_with_HIV.pdf
31. Jakheng SP, Obeagu EI, Abdullahi IO, Jakheng EW, Chukwueze CM, Eze GC, Essien UC, Madekwe CC, Madekwe CC, Vidya S, Kumar S. Distribution Rate of Chlamydial Infection According to Demographic Factors among Pregnant Women Attending Clinics in Zaria Metropolis, Kaduna State, Nigeria. *South Asian Journal of Research in Microbiology*. 2022;13(2):26-31.
32. Viola N, Kimono E, Nuruh N, Obeagu EI. Factors Hindering Elimination of Mother to Child Transmission of HIV Service Uptake among HIV Positive Women at Comboni Hospital Kyamuhunga Bushenyi District. *Asian Journal of Dental and Health Sciences*. 2023;3(2):7-14. <http://ajdhs.com/index.php/journal/article/view/39>.
33. Okorie HM, Obeagu Emmanuel I, Okpoli Henry CH, Chukwu Stella N. Comparative study of enzyme linked immunosorbent assay (Elisa) and rapid test screening methods on HIV, Hbsag, Hcv and Syphilis among voluntary donors in. Owerri, Nigeria. *J Clin Commun Med*. 2020;2(3):180-183.DOI: DOI: [10.32474/JCCM.2020.02.000137](https://doi.org/10.32474/JCCM.2020.02.000137)

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

[links/5f344530458515b7291bd95f/Comparative-Study-of-Enzyme-Linked-Immunosorbent-Assay-EIISA-and-Rapid-Test-Screening-Methods-on-HIV-HBsAg-HCV-and-Syphilis-among-Voluntary-Donors-in-Owerri-Nigeria.pdf](https://epjournals.com/journals/EJI/links/5f344530458515b7291bd95f/Comparative-Study-of-Enzyme-Linked-Immunosorbent-Assay-EIISA-and-Rapid-Test-Screening-Methods-on-HIV-HBsAg-HCV-and-Syphilis-among-Voluntary-Donors-in-Owerri-Nigeria.pdf).

34. Ezugwu UM, Onyenekwe CC, Ukibe NR, Ahaneku JE, Onah CE, Obeagu EI, Emeje PI, Awalu JC, Igbokwe GE. Use of ATP, GTP, ADP and AMP as an Index of Energy Utilization and Storage in HIV Infected Individuals at NAUTH, Nigeria: A Longitudinal, Prospective, Case-Controlled Study. *Journal of Pharmaceutical Research International*. 2021;33(47A):78-84.
35. Emmanuel G, Martin O, Peter OS, Obeagu EI, Daniel K. Factors Influencing Early Neonatal Adverse Outcomes among Women with HIV with Post Dated Pregnancies Delivering at Kampala International University Teaching Hospital, Uganda. *Asian Journal of Pregnancy and Childbirth*. 2023 Jul 29;6(1):203-211. <http://research.sdpublishers.net/id/eprint/2819/>.
36. Igwe MC, Obeagu EI, Ogbuabor AO, Eze GC, Ikpenwa JN, Eze-Stephen PE. Socio-Demographic Variables of People Living with HIV/AIDS Initiated on ART in 2014 at Tertiary Health Institution in Enugu State. *Asian Journal of Research in Infectious Diseases*. 2022;10(4):1-7.
37. Vincent CC, Obeagu EI, Agu IS, Ukeagu NC, Onyekachi-Chigbu AC. Adherence to Antiretroviral Therapy among HIV/AIDS in Federal Medical Centre, Owerri. *Journal of Pharmaceutical Research International*. 2021;33(57A):360-368.
38. Igwe MC, Obeagu EI, Ogbuabor AO. ANALYSIS OF THE FACTORS AND PREDICTORS OF ADHERENCE TO HEALTHCARE OF PEOPLE LIVING WITH HIV/AIDS IN TERTIARY HEALTH INSTITUTIONS IN ENUGU STATE. *Madonna University journal of Medicine and Health Sciences*. 2022;2(3):42-57. <https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/75>.
39. Madekwe CC, Madekwe CC, Obeagu EI. Inequality of monitoring in Human Immunodeficiency Virus, Tuberculosis and Malaria: A Review. *Madonna University journal of Medicine and Health Sciences*. 2022;2(3):6-15. <https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/69>
40. Echendu GE, Vincent CC, Ibebuike J, Asodike M, Naze N, Chinedu EP, Ohale B, Obeagu EI. WEIGHTS OF INFANTS BORN TO HIV INFECTED MOTHERS: A PROSPECTIVE COHORT STUDY IN FEDERAL MEDICAL CENTRE, OWERRI, IMO STATE. *European Journal of Pharmaceutical and Medical Research*, 2023; 10(8): 564-568
41. Nwosu DC, Nwanjo HU, Okolie NJ, Ikeh K, Ajero CM, Dike J, Ojiegbe GC, Oze GO, Obeagu EI, Nnatunanya I, Azuonwu O. BIOCHEMICAL ALTERATIONS IN ADULT HIV PATIENTS ON ANTIRETROVIRAL THERAPY. *World Journal of Pharmacy and Pharmaceutical Sciences*, 2015; 4(3): 153-160. [links/5a4fd0500f7e9bbc10526b38/BIOCHEMICAL-ALTERATIONS-IN-ADULT-HIV-PATIENTS-ON-ANTIRETROVIRAL-THERAPY.pdf](https://epjournals.com/journals/EJI/links/5a4fd0500f7e9bbc10526b38/BIOCHEMICAL-ALTERATIONS-IN-ADULT-HIV-PATIENTS-ON-ANTIRETROVIRAL-THERAPY.pdf).
42. Obeagu EI, Obeagu GU. Effect of CD4 Counts on Coagulation Parameters among HIV Positive Patients in Federal Medical Centre, Owerri, Nigeria. *Int. J. Curr. Res. Biosci. Plant Biol*. 2015;2(4):45-49.

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

43. Obeagu EI, Nwosu DC. Adverse drug reactions in HIV/AIDS patients on highly active antiretroviral therapy: a review of prevalence. *Int. J. Curr. Res. Chem. Pharm. Sci.* 2019;6(12):45-8. DOI: [10.22192/ijcreps.2019.06.12.004](https://doi.org/10.22192/ijcreps.2019.06.12.004)
[links/650aba1582f01628f0335795/Adverse-drug-reactions-in-HIV-AIDS-patients-on-highly-active-antiretroviral-therapy-a-review-of-prevalence.pdf](https://www.ijcreps.com/links/650aba1582f01628f0335795/Adverse-drug-reactions-in-HIV-AIDS-patients-on-highly-active-antiretroviral-therapy-a-review-of-prevalence.pdf).
44. Obeagu EI, Scott GY, Amekpor F, Obeagu GU. Implications of CD4/CD8 ratios in Human Immunodeficiency Virus infections. *Int. J. Curr. Res. Med. Sci.* 2023;9(2):6-13. DOI: [10.22192/ijcrms.2023.09.02.002](https://doi.org/10.22192/ijcrms.2023.09.02.002)
[links/645a4a462edb8e5f094ad37c/Implications-of-CD4-CD8-ratios-in-Human-Immunodeficiency-Virus-infections.pdf](https://www.ijcrms.com/links/645a4a462edb8e5f094ad37c/Implications-of-CD4-CD8-ratios-in-Human-Immunodeficiency-Virus-infections.pdf).
45. Obeagu EI, Ochei KC, Okeke EI, Anode AC. Assessment of the level of haemoglobin and erythropoietin in persons living with HIV in Umuahia. *Int. J. Curr. Res. Med. Sci.* 2016;2(4):29-33. [links/5711c47508aebe07c02496b/Assessment-of-the-level-of-haemoglobin-and-erythropoietin-in-persons-living-with-HIV-in-Umuahia.pdf](https://www.ijcrms.com/links/5711c47508aebe07c02496b/Assessment-of-the-level-of-haemoglobin-and-erythropoietin-in-persons-living-with-HIV-in-Umuahia.pdf).
46. Ifeanyi OE, Obeagu GU. The Values of CD4 Count, among HIV Positive Patients in FMC Owerri. *Int. J. Curr. Microbiol. App. Sci.* 2015;4(4):906-910. https://www.academia.edu/download/38320134/Obeagu_Emanuel_Ifeanyi_and_Obeagu_Getrude_Uzoma.EMMA2.pdf.
47. Obeagu EI, Okeke EI, Anonde Andrew C. Evaluation of haemoglobin and iron profile study among persons living with HIV in Umuahia, Abia state, Nigeria. *Int. J. Curr. Res. Biol. Med.* 2016;1(2):1-5.
48. Alum EU, Ugwu OP, Obeagu EI, Okon MB. Curtailing HIV/AIDS Spread: Impact of Religious Leaders. *Newport International Journal of Research in Medical Sciences (NIJ RMS)*. 2023;3(2):28-31.
49. Obeagu EI, Obeagu GU, Paul-Chima UO. Stigma Associated With HIV. *AIDS: A Review. Newport International Journal of Public Health and Pharmacy (NIJPP)*. 2023;3(2):64-67.
50. Alum EU, Obeagu EI, Ugwu OP, Aja PM, Okon MB. HIV Infection and Cardiovascular diseases: The obnoxious Duos. *Newport International Journal of Research in Medical Sciences (NIJ RMS)*. 2023;3(2):95-99.
51. Ibebuikwe JE, Nwokike GI, Nwosu DC, Obeagu EI. A Retrospective Study on Human Immune Deficiency Virus among Pregnant Women Attending Antenatal Clinic in Imo State University Teaching Hospital. *International Journal of Medical Science and Dental Research*, 2018; 1 (2):08-14. <https://www.ijmsdr.org/published%20paper/li1i2/A%20Retrospective%20Study%20on%20Human%20Immune%20Deficiency%20Virus%20among%20Pregnant%20Women%20Attending%20Antenatal%20Clinic%20in%20Imo%20State%20University%20Teaching%20Hospital.pdf>.
52. Obeagu EI, Obarezi TN, Omeh YN, Okoro NK, Eze OB. Assessment of some haematological and biochemical parameters in HIV patients before receiving treatment in Aba, Abia State, Nigeria. *Res J Pharma Biol Chem Sci.* 2014; 5:825-830.
53. Obeagu EI, Obarezi TN, Ogbuabor BN, Anaebo QB, Eze GC. Pattern of total white blood cell and differential count values in HIV positive patients receiving treatment in Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria. *International Journal of Life Science, Biotechnology and Pharama Research.* 2014; 391:186-189.

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

54. Obeagu EI. A Review of Challenges and Coping Strategies Faced by HIV/AIDS Discordant Couples. *Madonna University journal of Medicine and Health Sciences*. 2023; 3 (1): 7-12.
55. Oloro OH, Obeagu EI. A Systematic Review on Some Coagulation Profile in HIV Infection. *International Journal of Innovative and Applied Research*. 2022;10(5):1-11.
56. Nwosu DC, Obeagu EI, Nkwuocha BC, Nwanjo CA, Nwanjo HU, Amadike JN, Ezemma MC, Okpomeshine EA, Ozims SJ, Agu GC. Alterations in superoxide dismutase, vitamins C and E in HIV infected children in Umuahia, Abia state. *International Journal of Advanced Research in Biological Sciences*. 2015;2(11):268-271.
57. Obeagu EI, Malot S, Obeagu GU, Ugwu OP. HIV resistance in patients with Sick Cell Anaemia. *Newport International Journal of Scientific and Experimental Sciences (NIJSES)*. 2023;3(2):56-59.
58. Ifeanyi OE, Uzoma OG, Stella EI, Chinedum OK, Abum SC. Vitamin D and insulin resistance in HIV sero positive individuals in Umudike. *Int. J. Curr. Res. Med. Sci*. 2018;4(2):104-108.
59. Ifeanyi OE, Leticia OI, Nwosu D, Chinedum OK. A Review on blood borne viral infections: universal precautions. *Int. J. Adv. Res. Biol. Sci*. 2018;5(6):60-66.
60. Nwovu AI, Ifeanyi OE, Uzoma OG, Nwebonyi NS. Occurrence of Some Blood Borne Viral Infection and Adherence to Universal Precautions among Laboratory Staff in Federal Teaching Hospital Abakaliki Ebonyi State. *Arch Blood Transfus Disord*. 2018;1(2).
61. Cantani A. Malnutrition and the Immune System. *Pediatric Allergy, Asthma and Immunology*. 2008:1243-64.
62. Chinedu K, Takim AE, Obeagu EI, Chinazor UD, Eloghosa O, Ojong OE, Odunze U. HIV and TB co-infection among patients who used Directly Observed Treatment Short-course centres in Yenagoa, Nigeria. *IOSR J Pharm Biol Sci*. 2017;12(4):70-75.
63. Offie DC, Obeagu EI, Akueshi C, Njab JE, Ekanem EE, Dike PN, Oguh DN. Facilitators and barriers to retention in HIV care among HIV infected MSM attending Community Health Center Yaba, Lagos Nigeria. *Journal of Pharmaceutical Research International*. 2021;33(52B):10-19.
64. Obeagu EI, Obeagu GU, Ede MO, Odo EO, Buhari HA. Translation of HIV/AIDS knowledge into behavior change among secondary school adolescents in Uganda: A review. *Medicine (Baltimore)*. 2023;102(49): e36599. doi: 10.1097/MD.00000000000036599. PMID: 38065920; PMCID: PMC10713174.
65. Anyiam AF, Arinze-Anyiam OC, Ironi EA, Obeagu EI. Distribution of ABO and rhesus blood grouping with HIV infection among blood donors in Ekiti State Nigeria. *Medicine (Baltimore)*. 2023;102(47): e36342. doi: 10.1097/MD.00000000000036342. PMID: 38013335; PMCID: PMC10681551.
66. Echefu SN, Udosen JE, Akwiwu EC, Akpotuzor JO, Obeagu EI. Effect of Dolutegravir regimen against other regimens on some hematological parameters, CD4 count and viral load of people living with HIV infection in South Eastern Nigeria. *Medicine (Baltimore)*. 2023;102(47): e35910. doi: 10.1097/MD.00000000000035910. PMID: 38013350; PMCID: PMC10681510.

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33

67. Opeyemi AA, Obeagu EI. Regulations of malaria in children with human immunodeficiency virus infection: A review. *Medicine (Baltimore)*. 2023;102(46): e36166. doi: 10.1097/MD.00000000000036166. PMID: 37986340; PMCID: PMC10659731.
68. Alum EU, Obeagu EI, Ugwu OPC, Samson AO, Adepoju AO, Amusa MO. Inclusion of nutritional counseling and mental health services in HIV/AIDS management: A paradigm shift. *Medicine (Baltimore)*. 2023;102(41): e35673. doi: 10.1097/MD.00000000000035673. PMID: 37832059; PMCID: PMC10578718.
69. Aizaz M, Abbas FA, Abbas A, Tabassum S, Obeagu EI. Alarming rise in HIV cases in Pakistan: Challenges and future recommendations at hand. *Health Sci Rep*. 2023;6(8): e1450. doi: 10.1002/hsr2.1450. PMID: 37520460; PMCID: PMC10375546.
70. Obeagu EI, Obeagu GU, Obiezu J, Ezeonwumelu C, Ogunnaya FU, Ngwoke AO, Emeka-Obi OR, Ugwu OP. Hematologic Support in HIV Patients: Blood Transfusion Strategies and Immunological Considerations. *APPLIED SCIENCES (NIJBAS)*. 2023;3(3).
71. Obeagu EI, Ubosi NI, Uzoma G. Storms and Struggles: Managing HIV Amid Natural Disasters. *Int. J. Curr. Res. Chem. Pharm. Sci*. 2023;10(11):14-25.
72. Obeagu EI, Obeagu GU. Human Immunodeficiency Virus and tuberculosis infection: A review of prevalence of associated factors. *Int. J. Adv. Multidiscip. Res*. 2023;10(10):56-62.
73. Obeagu EI, Malot S, Obeagu GU, Ugwu OP. HIV resistance in patients with Sickle Cell Anaemia. *Newport International Journal of Scientific and Experimental Sciences (NIJSES)*. 2023;3(2):56-9.
74. Alum EU, Ugwu OP, Obeagu EI, Aja PM, Okon MB, Uti DE. Reducing HIV Infection Rate in Women: A Catalyst to reducing HIV Infection pervasiveness in Africa. *International Journal of Innovative and Applied Research*. 2023;11(10):01-6.
75. Saloner R, Fields JA, Marcondes MC, Iudicello JE, von Känel S, Cherner M, Letendre SL, Kaul M, Grant I, Translational Methamphetamine AIDS Research Center (TMARC) Group. Methamphetamine and cannabis: a tale of two drugs and their effects on HIV, brain, and behavior. *Journal of Neuroimmune Pharmacology*. 2020; 15:743-764.
76. Harper A, Vijayakumar V, Ouwehand AC, Ter Haar J, Obis D, Espadaler J, Binda S, Desiraju S, Day R. Viral infections, the microbiome, and probiotics. *Frontiers in Cellular and Infection Microbiology*. 2021; 10:596166.
77. Thapa R, Amatya A, Pahari DP, Bam K, Newman MS. Nutritional status and its association with quality of life among people living with HIV attending public anti-retroviral therapy sites of Kathmandu Valley, Nepal. *AIDS research and therapy*. 2015; 12:1-0.

Citation: Obeagu EI, Obeagu GU, Okwuanaso CB. Optimizing Immune Health in HIV Patients through Nutrition: A Review. *Elite Journal of Immunology*, 2024; 2(1): 14-33