Elite Journal of Immunology. Volume 2 issue 3(2024), Pp. 19-32
https://epjournals.com/journals/EJI

Immunological Currency: Evaluating CD4/CD8 Ratios in HIV

*Emmanuel Ifeanyi Obeagu[1] and Getrude Uzoma Obeagu[2]

[1]Department of Medical Laboratory Science, Kampala International University, Uganda

[3]School of Nursing Science, Kampala International University, Uganda

*Corresponding authour: Emmanuel Ifeanyi Obeagu, Department of Medical Laboratory Science, Kampala International University, Uganda, emmanuelobeagu@yahoo.com, ORCID: 0000-0002-4538-0161

Abstract

The CD4/CD8 ratio is a pivotal marker in evaluating immune health, particularly in the context of Human Immunodeficiency Virus (HIV) infection. This review elucidates the significance of CD4/CD8 ratios as immunological currency in HIV, emphasizing their role in immune monitoring and therapy evaluation. We explore the dynamic interplay between CD4+ and CD8+ T cells, their alteration during HIV infection, and the implications for disease progression and treatment outcomes. Furthermore, we discuss the clinical relevance of CD4/CD8 ratios as prognostic indicators and predictors of therapeutic response. Understanding the nuances of CD4/CD8 ratios provides valuable insights into HIV pathogenesis, guiding clinical decision-making, and advancing strategies for immune-based therapies. Through a comprehensive examination of CD4/CD8 ratios, this review aims to enhance our understanding of HIV immunopathogenesis and contribute to the optimization of patient care and outcomes.

Keywords: *Immunological currency, CD4/CD8 ratios, HIV, immune system, viral infection, immune monitoring, therapy response*

Introduction

Human Immunodeficiency Virus (HIV) remains a significant global health challenge, with approximately 38 million people living with the virus worldwide. HIV infection leads to progressive depletion of the immune system, ultimately resulting in acquired immunodeficiency syndrome (AIDS) if left untreated. Central to the immunopathogenesis of HIV is the dysregulation

Citation: Obeagu EI, Obeagu GU. Immunological Currency: Evaluating CD4/CD8 Ratios in HIV. Elite Journal of Immunology, 2024; 2(3): 19-32

of T lymphocytes, particularly the CD4+ and CD8+ T cell subsets, which play crucial roles in orchestrating the immune response against viral pathogens. The CD4/CD8 ratio, defined as the ratio of CD4+ T cells to CD8+ T cells, serves as a cornerstone in assessing immune health and function. In the context of HIV infection, monitoring CD4/CD8 ratios provides valuable insights into the status of the immune system, disease progression, and response to therapy. The alterations in CD4/CD8 ratios during HIV infection reflect the dynamic interplay between viral replication, immune activation, and immune evasion mechanisms employed by the virus.[1-20]

CD4+ T cells, often referred to as helper T cells, are essential for coordinating various immune responses, including activation of cytotoxic CD8+ T cells, B cell-mediated antibody production, and immune memory. HIV preferentially targets and depletes CD4+ T cells, leading to impaired immune function and increased susceptibility to opportunistic infections and malignancies. Conversely, CD8+ T cells, known as cytotoxic T cells, play a crucial role in recognizing and eliminating virus-infected cells. However, chronic HIV infection is characterized by the functional exhaustion of CD8+ T cells, compromising their antiviral effector functions. Understanding the dynamics of CD4/CD8 ratios during HIV infection is paramount for prognostication and clinical decision-making. Lower CD4/CD8 ratios are associated with increased risk of disease progression, development of AIDS-defining illnesses, and mortality. Conversely, restoration of CD4/CD8 ratios, particularly in response to antiretroviral therapy (ART), correlates with improved immune function and reduced morbidity and mortality. Therefore, CD4/CD8 ratios serve as crucial biomarkers for monitoring disease progression, immune reconstitution, and therapeutic efficacy in individuals living with HIV.[21-40]

CD4/CD8 Ratio: The Immunological Currency

The CD4/CD8 ratio stands as a fundamental metric in the evaluation of immune competence and function, serving as a barometer of immunological currency in various clinical contexts, particularly in the realm of Human Immunodeficiency Virus (HIV) infection. This ratio, defined as the proportion of CD4+ T cells to CD8+ T cells, reflects the dynamic interplay between different arms of the adaptive immune response. In the context of HIV, where the virus intricately manipulates the host immune system, the CD4/CD8 ratio assumes a central role in gauging disease progression, immune reconstitution, and therapeutic efficacy. CD4+ T cells, often termed helper T cells, play a critical role in orchestrating immune responses by facilitating the activation of other immune cells, including CD8+ T cells, B cells, and macrophages. In HIV infection, the virus targets CD4+ T cells through direct infection and bystander effects, leading to their progressive depletion. This loss of CD4+ T cells compromises immune function, resulting in increased susceptibility to opportunistic infections and malignancies, hallmark features of AIDS.[41-56]

Conversely, CD8+ T cells, or cytotoxic T cells, serve as the primary effectors of antiviral immunity by recognizing and eliminating virus-infected cells. Despite their crucial role, chronic HIV infection is characterized by the functional exhaustion of CD8+ T cells, rendering them less effective in controlling viral replication. The dysregulation of CD4/CD8 ratios during HIV infection reflects the imbalance between CD4+ T cell depletion and CD8+ T cell activation,

providing insights into the dynamic nature of host-virus interactions. Monitoring CD4/CD8 ratios holds profound prognostic implications in HIV management. Lower CD4/CD8 ratios are associated with increased risk of disease progression, AIDS-defining illnesses, and mortality, serving as predictors of poor clinical outcomes. Conversely, the restoration of CD4/CD8 ratios, particularly in response to antiretroviral therapy (ART), signifies immune reconstitution and correlates with improved prognosis. Therefore, CD4/CD8 ratios serve as indispensable biomarkers for guiding clinical decision-making, optimizing treatment strategies, and assessing therapeutic efficacy in individuals living with HIV.[57-71]

Dynamic Interplay of CD4+ and CD8+ T Cells in HIV

The immune response to Human Immunodeficiency Virus (HIV) infection is characterized by a complex interplay between CD4+ and CD8+ T cells, two key subsets of T lymphocytes with distinct yet complementary roles in orchestrating antiviral immunity. Understanding the dynamic interactions between these T cell subsets is essential for elucidating the immunopathogenesis of HIV and developing effective therapeutic strategies. CD4+ T cells, often referred to as helper T cells, play a central role in coordinating immune responses by secreting cytokines and providing help to other immune cells. In the context of HIV, these cells are the primary targets of viral infection, leading to their progressive depletion over the course of infection. The loss of CD4+ T cells compromises immune function, impairing the ability of the host to mount effective immune responses against HIV and other pathogens. Furthermore, the decline in CD4+ T cells is closely associated with the development of AIDS-defining illnesses and increased mortality in individuals with HIV.[72-81]

In contrast, CD8+ T cells, or cytotoxic T cells, are specialized in recognizing and eliminating virus-infected cells. Upon encountering infected cells presenting viral antigens, CD8+ T cells become activated and exert their effector functions, including the secretion of cytotoxic molecules and the induction of apoptosis in target cells. During acute HIV infection, CD8+ T cells play a critical role in controlling viral replication and limiting the spread of the virus. However, chronic HIV infection is characterized by the functional exhaustion of CD8+ T cells, marked by reduced proliferative capacity and cytokine production, as well as the upregulation of inhibitory receptors such as PD-1 and CTLA-4. The dynamic interplay between CD4+ and CD8+ T cells in HIV is further influenced by various factors, including viral load, host genetic factors, and immune activation. Elevated levels of viral replication drive continuous immune activation, leading to T cell exhaustion, dysfunction, and senescence. Moreover, chronic immune activation contributes to the depletion of CD4+ T cells and the perturbation of CD4/CD8 ratios, which serve as markers of disease progression and prognosis in individuals with HIV.[82-91]

Clinical Relevance of CD4/CD8 Ratios

The CD4/CD8 ratio serves as a crucial biomarker with significant clinical relevance in the management of Human Immunodeficiency Virus (HIV) infection. This ratio, reflecting the balance between CD4+ and CD8+ T cell subsets, provides valuable insights into immune health, disease

progression, and therapeutic response in individuals living with HIV. One of the primary clinical applications of CD4/CD8 ratios lies in prognostication. Lower CD4/CD8 ratios are associated with increased risk of disease progression and development of AIDS-defining illnesses, serving as prognostic indicators of poor clinical outcomes. Individuals with HIV who have persistently low CD4/CD8 ratios are more susceptible to opportunistic infections and malignancies, highlighting the importance of CD4/CD8 ratios in risk stratification and patient management. Moreover, CD4/CD8 ratios play a pivotal role in monitoring immune reconstitution during antiretroviral therapy (ART). ART effectively suppresses viral replication, leading to increases in CD4+ T cell counts and restoration of immune function. Monitoring CD4/CD8 ratios alongside CD4+ T cell counts provides a more comprehensive assessment of immune recovery. A rise in CD4/CD8 ratios following initiation of ART signifies successful immune reconstitution and correlates with improved clinical outcomes, including reduced risk of opportunistic infections and mortality. Additionally, CD4/CD8 ratios serve as predictive markers for therapy response and treatment outcomes in individuals receiving ART. Therefore, monitoring changes in CD4/CD8 ratios over time can aid clinicians in evaluating the effectiveness of ART regimens and optimizing treatment strategies for individual patients.[92-97]

Evaluating CD4/CD8 Ratios in Therapy Response

Assessing CD4/CD8 ratios holds paramount importance in understanding therapy response and guiding clinical decisions in Human Immunodeficiency Virus (HIV) management. These ratios, reflecting the balance between CD4+ and CD8+ T cell populations, offer valuable insights into the dynamics of immune reconstitution and the efficacy of antiretroviral therapy (ART) in controlling viral replication and restoring immune function. One of the primary objectives of ART in HIV management is to suppress viral replication and facilitate immune reconstitution by increasing CD4+ T cell counts. Monitoring changes in CD4/CD8 ratios following initiation of ART provides a comprehensive assessment of treatment response. Successful therapy typically results in a gradual normalization of CD4/CD8 ratios, reflecting the restoration of immune homeostasis and the reduction of immune activation. Conversely, persistent abnormalities in CD4/CD8 ratios may indicate suboptimal therapy response, treatment failure, or ongoing immune dysfunction.[98-102]

Furthermore, CD4/CD8 ratios serve as predictive markers for long-term clinical outcomes in individuals receiving ART. Studies have demonstrated that individuals with HIV who achieve normalization or restoration of CD4/CD8 ratios on ART have better virologic suppression, reduced risk of AIDS-defining illnesses, and improved overall survival compared to those with persistently low CD4/CD8 ratios. Therefore, monitoring CD4/CD8 ratios longitudinally allows clinicians to assess the durability of treatment response and identify patients at higher risk of disease progression or complications. In addition to their prognostic value, CD4/CD8 ratios offer insights into the immunological mechanisms underlying therapy response. ART-induced viral suppression leads to decreased immune activation and inflammation, which contribute to the restoration of CD4/CD8 ratios. Conversely, inadequate suppression of viral replication may result in persistent immune activation, leading to abnormal CD4/CD8 ratios despite apparent virologic control. Understanding the relationship between CD4/CD8 ratios and immune activation provides

opportunities for optimizing therapeutic interventions and developing adjunctive therapies aimed at modulating immune function. Moreover, evaluating changes in CD4/CD8 ratios over time allows for the identification of individuals with suboptimal treatment responses who may benefit from therapeutic intensification or regimen switches. Clinicians can utilize CD4/CD8 ratios as dynamic markers to tailor treatment strategies based on individual patient responses and evolving clinical circumstances. Additionally, incorporating CD4/CD8 ratios into treatment algorithms enables proactive management of immune dysfunction and minimizes the risk of disease progression and treatment failure.[103-105]

Conclusion

The evaluation of CD4/CD8 ratios stands as a cornerstone in the comprehensive management of Human Immunodeficiency Virus (HIV) infection. These ratios serve as dynamic biomarkers, providing critical insights into immune health, disease progression, and therapeutic response in individuals living with HIV. The normalization or restoration of CD4/CD8 ratios following initiation of antiretroviral therapy (ART) signifies successful immune reconstitution and correlates with better virologic control, reduced risk of opportunistic infections, and improved survival. Monitoring changes in CD4/CD8 ratios longitudinally enables clinicians to assess treatment response, identify individuals at higher risk of disease progression, and tailor therapeutic interventions accordingly.

Furthermore, CD4/CD8 ratios provide insights into the immunological mechanisms underlying HIV pathogenesis and therapy response. The dynamic interplay between CD4+ and CD8+ T cells reflects the intricate balance between viral replication, immune activation, and immune reconstitution, offering opportunities for optimizing therapeutic strategies and developing adjunctive immunomodulatory therapies. Incorporating CD4/CD8 ratios into routine clinical practice enhances the comprehensive evaluation of immune status and facilitates personalized management approaches for individuals living with HIV. By leveraging CD4/CD8 ratios as dynamic biomarkers, clinicians can optimize treatment strategies, minimize the risk of disease progression and treatment failure, and improve long-term clinical outcomes for individuals living with HIV.

References

1. Gayle HD, Hill GL. Global impact of human immunodeficiency virus and AIDS. Clinical microbiology reviews. 2001;14(2):327-335.
2. Younai FS. Thirty years of the human immunodeficiency virus epidemic and beyond. International journal of oral science. 2013;5(4):191-199.
3. Ndjoyi-Mbiguino A, Zoa-Assoumou S, Mourembou G, Ennaji MM. Human immunodeficiency virus: a brief review. Emerging and Reemerging Viral Pathogens. 2020:183-200.

Citation: Obeagu EI, Obeagu GU. Immunological Currency: Evaluating CD4/CD8 Ratios in HIV**.** Elite Journal of Immunology, 2024; 2(3): 19-32

4. Parekh BS, Ou CY, Fonjungo PN, Kalou MB, Rottinghaus E, Puren A, Alexander H, Hurlston Cox M, Nkengasong JN. Diagnosis of human immunodeficiency virus infection. Clinical microbiology reviews. 2018;32(1):10-128.
5. Salehi B, Kumar NV, Şener B, Sharifi-Rad M, Kılıç M, Mahady GB, Vlaisavljevic S, Iriti M, Kobarfard F, Setzer WN, Ayatollahi SA. Medicinal plants used in the treatment of human immunodeficiency virus. International journal of molecular sciences. 2018;19(5):1459.
6. 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.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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
12. 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
13. 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.
14. 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.
15. 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.

16. Odo M, Ochei KC, Obeagu EI, Barinaadaa A, Eteng UE, Ikpeme M, Bassey 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.
17. Obeagu EI, Eze VU, Alaeboh 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.
18. 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_Emmanuel_Ifeanyi_and_Obeagu__Getrude_Uzoma2.EMMA1.pdf.
19. 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
20. 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. links/5988ab6d0f7e9b6c8539f73d/HIV-and-TB-co-infection-among-patients-who-used-Directly-Observed-Treatment-Short-course-centres-in-Yenagoa-Nigeria.pdf
21. 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.
22. Nwosu DC, Obeagu EI, Nkwocha BC, Nwanna 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.
23. 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.
24. 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_Emmanuel_Ifeanyi3__et_al.IJCRAR.pdf.

25. 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
26. 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
27. 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.
28. 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.
29. 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. 2022;2(3):128-134. https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/86.
30. 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.
31. 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.
32. 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.
33. 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
34. 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.

35. Obeagu EI, Ibeh NC, Nwobodo HA, Ochei KC, Iwegbulam CP. Haematological indices of malaria patients coinfected 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
36. 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.
37. 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.
38. 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 links/5f344530458515b7291bd95f/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.pdf.
39. 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.
40. Emannuel 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/.
41. Igwe MC, Obeagu EI, Ogbuabor AO, Eze GC, Ikpenwa JN, Eze-Steven 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.
42. 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.
43. 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.

44. 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
45. 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
46. 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 ANTIRETRQVIRAL THERAPY. World Journal of Pharmacy and Pharmaceutical Sciences, 2015; 4(3): 153-160**.** links/5a4fd0500f7e9bbc10526b38/BIOCHEMICAL-ALTERATIONS-IN-ADULT-HIV-PATIENTS-ON-ANTIRETRQVIRAL-THERAPY.pdf.
47. 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.
48. Obeagu EI, Nwosu DC. Adverse drug reactions in HIV/AIDS patients on highly active antiretro viral therapy: a review of prevalence. Int. J. Curr. Res. Chem. Pharm. Sci. 2019;6(12):45-8.DOI: 10.22192/ijcrcps.2019.06.12.004 links/650aba1582f01628f0335795/Adverse-drug-reactions-in-HIV-AIDS-patients-on-highly-active-antiretro-viral-therapy-a-review-of-prevalence.pdf.
49. 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 links/645a4a462edb8e5f094ad37c/Implications-of-CD4-CD8-ratios-in-Human-Immunodeficiency-Virus-infections.pdf.
50. 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/5711c47508aeebe07c02496b/Assessment-of-the-level-of-haemoglobin-and-erythropoietin-in-persons-living-with-HIV-in-Umuahia.pdf.
51. 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_Emmanuel_Ifeanyi_and_Obeagu__Getrude_Uzoma.EMMA2.pdf.
52. 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.
53. 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.

54. 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 (NIJRMS). 2023;3(2):95-99.
55. Ibebuike 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.
56. Obeagu EI, Obarezi TN, Omeh YN, Okoro NK, Eze OB. Assessment of some haematological and biochemical parametrs in HIV patients before receiving treatment in Aba, Abia State, Nigeria. Res J Pharma Biol Chem Sci. 2014; 5:825-830.
57. 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.
58. 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.
59. 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.
60. Nwosu DC, Obeagu EI, Nkwuocha BC, Nwanna CA, Nwanjo HU, Amadike JN, Ezemma MC, Okpomeshine EA, Ozims SJ, Agu GC. Alterations in superoxide dismutiase, 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.
61. 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):56-59.
62. 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.
63. 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.
64. 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).
65. 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.
66. 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.
67. 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.0000000000036599. PMID: 38065920; PMCID: PMC10713174.
68. Anyiam AF, Arinze-Anyiam OC, Irondi 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.0000000000036342. PMID: 38013335; PMCID: PMC10681551.
69. 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.0000000000035910. PMID: 38013350; PMCID: PMC10681510.
70. 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.0000000000036166. PMID: 37986340; PMCID: PMC10659731.
71. 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.
72. 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.
73. 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.
74. Obeagu EI, Obeagu GU. Unmasking the Truth: Addressing Stigma in the Fight Against HIV. Elite Journal of Public Health. 2024;2(1):8-22.
75. 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.
76. Obeagu EI, Obeagu GU. Utilization of immunological ratios in HIV: Implications for monitoring and therapeutic strategies. Medicine. 2024;103(9):e37354.
77. Obeagu EI, Obeagu GU. CD8 Dynamics in HIV Infection: A Synoptic Review. Elite Journal of Immunology. 2024;2(1):1-3.
78. Obeagu EI, Obeagu GU. Implications of B Lymphocyte Dysfunction in HIV/AIDS. Elite Journal of Immunology. 2024;2(1):34-46.
79. Obeagu EI, Obeagu GU. Maternal Influence on Infant Immunological Responses to HIV: A Review. Elite Journal of Laboratory Medicine. 2024;2(1):46-58.
80. Obeagu EI, Obeagu GU. Understanding B Lymphocyte Functions in HIV Infection: Implications for Immune Dysfunction and Therapeutic Strategies. Elite Journal of Medicine. 2024;2(1):35-46.

81. Obeagu EI, Obeagu GU. Platelet-Driven Modulation of HIV: Unraveling Interactions and Implications. Journal home page: http://www. journalijiar. com.;12(01).
82. Obeagu EI, Anyiam AF, Obeagu GU. Managing Hematological Complications in HIV: Erythropoietin Considerations. Elite Journal of HIV. 2024;2(1):65-78.
83. Obeagu EI, Obeagu GU, Hauwa BA, Umar AI. Hematocrit Variations in HIV Patients Co-infected with Malaria: A Comprehensive Review. Journal home page: http://www. journalijiar. com.;12(01).
84. ObeaguEI AA, Obeagu GU. Synergistic Effects of Blood Transfusion and HIV in Children Under 5 Years with Severe Malaria: A Review. Elite Journal of HIV. 2024;2(1):31-50.
85. Obeagu EI, Anyiam AF, Obeagu GU. Unveiling B Cell Mediated Immunity in HIV Infection: Insights, Challenges, and Potential Therapeutic Avenues. Elite Journal of HIV. 2024;2(1):1-5.
86. Obeagu EI, Obeagu GU. Hematocrit Fluctuations in HIV Patients Co-infected with Malaria Parasites: A Comprehensive Review. Int. J. Curr. Res. Med. Sci. 2024;10(1):25-36.
87. Obeagu EI, Obeagu GU. Transfusion Therapy in HIV: Risk Mitigation and Benefits for Improved Patient Outcomes. Sciences. 2024;4(1):32-7.
88. Obeagu EI, Obeagu GU. Mental Health and Psychosocial Effects of natural disaster on HIV Patients. Sciences. 2024;4(1):38-44.
89. Obeagu EI, Obeagu GU. Eosinophil-Associated Changes in Neonatal Thymic T Regulatory Cell Populations in HIV-Infected Pregnancies. Elite Journal of Health Science. 2024;2(1):33-42.
90. Obeagu EI, Obeagu GU. Advances in Understanding the Impact of Blood Transfusion on Anemia Resolution in HIV-Positive Children with Severe Malaria: A Comprehensive Review. Elite Journal of Haematology. 2024;2(1):26-41.
91. Obeagu EI, Ayogu EE, Obeagu GU. Interactions between Blood Transfusion and Antiretroviral Medications: Implications for Patient Care. Elite Journal of Medicine. 2024;2(2):104-15.
92. Obeagu EI, Obeagu GU. Maternal Eosinophilic Responses in HIV-Positive Pregnant Women: Unraveling Immunological Dynamics for Improved Maternal-Fetal Health. Elite Journal of Immunology. 2024;2(1):47-64.
93. Obeagu EI, Anyanwu CN, Obeagu GU. Challenges and Considerations in Managing Blood Transfusion for Individuals with HIV. Elite Journal of HIV. 2024;2(2):1-7.
94. Obeagu EI, Ubosi NI, Obeagu GU, Akram M. Early Infant Diagnosis: Key to Breaking the Chain of HIV Transmission. Elite Journal of Public Health. 2024;2(1):52-61.
95. Obeagu EI, Obeagu GU. Understanding Hematocrit Fluctuations in HIV-Malaria Coinfection for Improved Management. Elite Journal of Public Health. 2024;2(1):22-34.
96. Obeagu EI, Obeagu GU. The Impact of Erythropoietin on Preeclampsia in HIV-Positive Women: A Review. Elite Journal of Nursing and Health Science. 2024;2(1):21-31.
97. Obeagu EI, Obeagu GU. Platelet Distribution Width (PDW) as a Prognostic Marker for Anemia Severity in HIV Patients: A Comprehensive Review. Journal home page: http://www. journalijiar. com.;12(01).

98. Ron R, Moreno E, Martínez-Sanz J, Brañas F, Sainz T, Moreno S, Serrano-Villar S. CD4/CD8 ratio during human immunodeficiency virus treatment: time for routine monitoring? Clinical Infectious Diseases. 2023 May 1;76(9):1688-96.
99. Obeagu EI, Obeagu GU. Utilization of immunological ratios in HIV: Implications for monitoring and therapeutic strategies. Medicine. 2024 Mar 1;103(9):e37354.
100. Obeagu EI, Obeagu GU. CD4/CD8 Ratios: The Immunological Barometer in HIV. Elite Journal of Laboratory Medicine. 2024;2(2):8-20.
101. Obeagu EI, Obeagu GU. Counting Cells, Shaping Fates: CD4/CD8 Ratios in HIV. Elite Journal of Scientific Research and Review. 2024;2(1):37-50.
102. Lee SS, Wong NS, Wong BC, Wong KH, Chan KC. Combining CD4 recovery and CD4: CD8 ratio restoration as an indicator for evaluating the outcome of continued antiretroviral therapy: an observational cohort study. BMJ open. 2017 Sep 1;7(9):e016886.
103. 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.
104. Belaunzarán-Zamudio PF, Naranjo L, Caro-Vega Y, Castillo-Mancilla JR, Camiro-Zuñiga A, Fuentes-García R, Crabtree-Ramírez BE, Sierra-Madero JG. Incomplete Antiretroviral Therapy Adherence Is Associated with Lower CD4-CD8 Ratio in Virally Suppressed Patients with HIV Infection in Mexico. AIDS Research and Human Retroviruses. 2023;39(3):136-144.
105. Monsalvo M, Vallejo A, Fontecha M, Vivancos MJ, Vizcarra P, Casado JL. CD4/CD8 ratio improvement in HIV-1-infected patients receiving dual antiretroviral treatment. International journal of STD & AIDS. 201930(7):656-662.