

## Ceruloplasmin and HIV-Associated Malignancies: A Review

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### Abstract

HIV infection is associated with an increased risk of malignancies, ranging from AIDS-defining cancers to non-AIDS-defining malignancies. Ceruloplasmin, a multifunctional glycoprotein involved in iron metabolism, antioxidant defense, and immune regulation, has recently emerged as a potential modulator of tumorigenesis in the context of HIV infection. This review examines the role of ceruloplasmin in HIV-associated malignancies, exploring its implications for cancer development, progression, and therapeutic interventions. The paper discusses the mechanisms underlying ceruloplasmin's involvement in cancer-related processes, including oxidative stress, inflammation, and immune evasion, and evaluate the potential of targeting ceruloplasmin-mediated pathways for cancer management in HIV-infected individuals.

**Keywords:** *Ceruloplasmin, HIV, malignancies, tumorigenesis, oxidative stress, inflammation, immune evasion, therapeutic interventions.*

### Introduction

HIV infection has long been associated with an increased risk of malignancies, which encompass a diverse array of cancers spanning from AIDS-defining malignancies to non-AIDS-defining tumors. Despite significant advancements in antiretroviral therapy (ART) and HIV management, individuals living with HIV continue to face elevated rates of cancer incidence and mortality compared to the general population. This heightened susceptibility to malignancies is believed to stem from a complex interplay of factors, including immune dysregulation, chronic inflammation, viral co-infections, and lifestyle factors. Ceruloplasmin, a multifunctional glycoprotein primarily synthesized in the liver, has recently emerged as a potential modulator of tumorigenesis in the context of HIV infection. While traditionally recognized for its role in iron metabolism and antioxidant defense, ceruloplasmin exhibits diverse physiological functions, including immune

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modulation and inflammatory responses. Given its versatility, ceruloplasmin represents a compelling candidate for investigation in the context of HIV-associated malignancies, where dysregulation of immune and inflammatory pathways plays a pivotal role in cancer development and progression. The intricate relationship between HIV infection and cancer development underscores the need for comprehensive research efforts aimed at unraveling the underlying mechanisms and identifying potential interventions. Ceruloplasmin's involvement in tumorigenic processes offers a promising avenue for further exploration, with potential implications for understanding the etiology, progression, and treatment of HIV-associated malignancies. By elucidating the role of ceruloplasmin in cancer pathogenesis, we may uncover new insights into the complex interplay between HIV infection and cancer susceptibility.<sup>1-20</sup>

### **Ceruloplasmin and Tumorigenesis**

Ceruloplasmin, traditionally recognized for its role in copper metabolism and antioxidant defense, has recently emerged as a significant player in the intricate landscape of tumorigenesis. While initially studied for its ferroxidase activity and ability to regulate iron homeostasis, ceruloplasmin's multifaceted functions extend beyond metal ion transport to encompass modulation of cellular processes relevant to cancer development and progression. Recent research has highlighted ceruloplasmin's involvement in various aspects of tumorigenesis, shedding light on its potential as a novel biomarker and therapeutic target in cancer biology. Oxidative stress, characterized by an imbalance between reactive oxygen species (ROS) production and antioxidant defense mechanisms, is a hallmark feature of cancer. Ceruloplasmin's antioxidant properties make it a crucial player in mitigating oxidative damage and maintaining redox homeostasis in the tumor microenvironment. By scavenging free radicals and inhibiting lipid peroxidation, ceruloplasmin helps protect cells from DNA damage and genomic instability, thereby exerting a protective effect against tumorigenesis.<sup>21-40</sup>

In addition to its antioxidant functions, ceruloplasmin plays a role in modulating inflammatory responses, which are intricately linked to cancer development and progression. Chronic inflammation creates a pro-tumorigenic microenvironment characterized by immune cell infiltration, cytokine release, and tissue remodeling. Ceruloplasmin's immunomodulatory effects may influence the inflammatory milieu within the tumor microenvironment, impacting tumor cell proliferation, survival, and metastasis. Dysregulation of ceruloplasmin-mediated inflammatory signaling pathways may contribute to tumor-promoting inflammation and facilitate tumor progression. Moreover, ceruloplasmin's interactions with the extracellular matrix and cell surface receptors suggest its involvement in cell adhesion, migration, and invasion, critical processes in cancer metastasis. Ceruloplasmin may facilitate tumor cell dissemination by modulating cell-matrix interactions and promoting epithelial-mesenchymal transition (EMT), a key event in the acquisition of invasive and metastatic properties by cancer cells. Dysregulation of ceruloplasmin-mediated signaling pathways may enhance tumor cell motility and invasiveness, leading to metastatic spread and poor clinical outcomes. Furthermore, ceruloplasmin's role in angiogenesis, the process by which new blood vessels are formed to support tumor growth and metastasis, underscores its significance in tumor progression. Ceruloplasmin may promote angiogenesis by modulating endothelial cell function and vascular remodeling, facilitating the formation of tumor-

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associated vasculature. By promoting neovascularization, ceruloplasmin enhances nutrient and oxygen delivery to the tumor microenvironment, fueling tumor growth and metastatic dissemination.<sup>41-60</sup>

### **Implications of Ceruloplasmin in HIV-Associated Malignancies**

The implications of ceruloplasmin in HIV-associated malignancies extend beyond its traditional roles in iron metabolism and antioxidant defense to encompass its involvement in cancer-related processes, including oxidative stress modulation, inflammation, and immune evasion. HIV infection is associated with a heightened risk of malignancies, ranging from AIDS-defining cancers like Kaposi's sarcoma and non-Hodgkin lymphoma to non-AIDS-defining malignancies such as lung cancer and anal cancer. Ceruloplasmin's dysregulation in the context of HIV infection may contribute to the increased incidence and aggressiveness of these malignancies, posing significant challenges for clinical management and patient outcomes. One implication of ceruloplasmin in HIV-associated malignancies lies in its role in oxidative stress modulation. Chronic inflammation and immune dysregulation characteristic of HIV infection create a pro-tumorigenic microenvironment characterized by increased ROS production and oxidative damage. Ceruloplasmin's antioxidant properties help counteract oxidative stress and protect cells from DNA damage, thereby exerting a protective effect against tumorigenesis. Dysregulation of ceruloplasmin-mediated antioxidant defenses may exacerbate oxidative stress burden and promote cancer development and progression in HIV-infected individuals.<sup>61-80</sup>

Furthermore, ceruloplasmin's involvement in inflammatory responses may impact cancer-related inflammation and tumor microenvironment dynamics in HIV-infected individuals. Chronic inflammation promotes tumor cell proliferation, survival, and metastasis through the release of pro-inflammatory cytokines and chemokines. Ceruloplasmin's immunomodulatory effects may influence the inflammatory milieu within the tumor microenvironment, shaping immune cell infiltration, tumor-associated macrophage polarization, and cytokine production. Dysregulation of ceruloplasmin-mediated inflammatory signaling pathways may contribute to tumor-promoting inflammation and facilitate cancer progression in HIV-infected individuals. Another implication of ceruloplasmin in HIV-associated malignancies lies in its potential role in immune evasion mechanisms employed by cancer cells. Ceruloplasmin may modulate immune surveillance mechanisms and tumor immune responses through its interactions with immune cells and cytokine networks. Dysregulation of ceruloplasmin-mediated immune modulation may impair anti-tumor immune responses and promote immune escape, allowing cancer cells to evade detection and elimination by the immune system. This immune evasion mechanism may contribute to the development of aggressive and treatment-resistant malignancies in HIV-infected individuals. Moreover, ceruloplasmin's interactions with the extracellular matrix and cell surface receptors may influence cancer cell adhesion, migration, and invasion, critical processes in tumor metastasis. Ceruloplasmin may facilitate tumor cell dissemination and metastatic spread by promoting epithelial-mesenchymal transition (EMT) and enhancing cancer cell motility and invasiveness. Dysregulation of ceruloplasmin-mediated signaling pathways may enhance the metastatic potential of cancer cells, leading to widespread dissemination and poor clinical outcomes in HIV-infected individuals with malignancies.<sup>81-100</sup>

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## Therapeutic Interventions Targeting Ceruloplasmin

Therapeutic interventions targeting ceruloplasmin hold promise for managing HIV-associated malignancies by modulating oxidative stress, inflammation, immune evasion, and metastasis. These interventions aim to restore ceruloplasmin levels and activity or to target downstream pathways involved in tumorigenesis. Several potential therapeutic strategies have been proposed, including antioxidant interventions, ceruloplasmin modulation, and targeted therapies aimed at disrupting ceruloplasmin-mediated pathways. Antioxidant interventions represent a promising approach for managing HIV-associated malignancies by mitigating oxidative stress burden and preserving redox homeostasis. Antioxidants such as vitamin C, vitamin E, and N-acetylcysteine (NAC) have been shown to enhance ceruloplasmin activity and protect against oxidative damage in various disease states. By augmenting ceruloplasmin-mediated antioxidant defenses, antioxidant interventions may help alleviate oxidative stress burden and inhibit cancer development and progression in HIV-infected individuals. Ceruloplasmin modulation represents another potential therapeutic strategy for managing HIV-associated malignancies by targeting ceruloplasmin levels and activity. Strategies aimed at modulating ceruloplasmin expression or function may help restore redox balance and suppress tumor growth and metastasis. For example, small molecule inhibitors or monoclonal antibodies targeting ceruloplasmin receptors or signaling pathways may help disrupt ceruloplasmin-mediated tumor-promoting processes and improve clinical outcomes in HIV-infected individuals with malignancies.<sup>103</sup>

Furthermore, targeted therapies aimed at disrupting ceruloplasmin-mediated pathways may offer novel approaches for cancer management in HIV-infected individuals. For example, inhibitors of ceruloplasmin-associated pathways involved in inflammation, angiogenesis, and metastasis may help inhibit tumor progression and metastatic spread. By selectively targeting key regulators of ceruloplasmin-mediated tumorigenic processes, these targeted therapies may offer more precise and effective treatment options for HIV-associated malignancies. In addition to direct targeting of ceruloplasmin, combinatorial approaches combining ceruloplasmin-targeted therapies with standard cancer treatments such as chemotherapy, radiation therapy, and immunotherapy may offer synergistic effects and improved treatment outcomes. By simultaneously targeting multiple pathways involved in tumorigenesis, these combination therapies may enhance therapeutic efficacy and reduce the risk of treatment resistance in HIV-infected individuals with malignancies.<sup>104-111</sup>

## Conclusion

Ceruloplasmin emerges as a significant player in the complex landscape of HIV-associated malignancies, exerting its influence through modulation of oxidative stress, inflammation, immune evasion, and metastasis. Dysregulation of ceruloplasmin levels and activity may contribute to various aspects of cancer development and progression in HIV-infected individuals, posing challenges for clinical management and patient outcomes. Therapeutic interventions targeting ceruloplasmin offer promising avenues for managing HIV-associated malignancies by restoring redox balance, suppressing tumor growth and metastasis, and enhancing treatment efficacy. Antioxidant interventions, ceruloplasmin modulation, targeted therapies, and combinatorial

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approaches represent novel strategies for improving clinical outcomes and reducing the burden of cancer in this vulnerable population.

## References

1. World Health Organization. Global health sector response to HIV, 2000-2015: focus on innovations in Africa: progress report. World Health Organization; 2015.
2. Dieffenbach CW, Fauci AS. Thirty years of HIV and AIDS: future challenges and opportunities. *Annals of internal medicine*. 2011;154(11):766-771.
3. Waldman AJ, Balskus EP. The human microbiota, infectious disease, and global health: challenges and opportunities. *ACS infectious diseases*. 2018;4(1):14-26.
4. Chan M. Ten years in public health 2007-2017: report by dr margaret chan director-general world health organization. World Health Organization; 2018.
5. Cohen MS, Hellmann N, Levy JA, DeCock K, Lange J. The spread, treatment, and prevention of HIV-1: evolution of a global pandemic. *The Journal of clinical investigation*. 2008;118(4):1244-1254.
6. Piot P, Kazatchkine M, Dybul M, Lob-Levyt J. AIDS: lessons learnt and myths dispelled. *The Lancet*. 2009 ;374(9685):260-263.
7. Obeagu EI. Comparative Study of Serum Iron and Hemoglobin Levels of Cord Blood of Normal Neonates and that of Maternal Blood in Federal Medical Centre Owerri. *Journal of Clinical and Laboratory Research*. 2021;4(1):2768-0487.
8. Obeagu EI, Aneke J, Okafor CN, Esseini UC, Ochei KC, Obeagu GU. Assessment of Serum Iron Status of Malnourished Infants in Umuahia, Abia State, Nigeria. *Sch J App Med Sci*. 2016; 4:4384-7.
9. Obeagu EI, Eze VU, Alaebboh 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.
10. Obeagu EI, Opoku D, Obeagu GU. Burden of nutritional anaemia in Africa: A Review. *Int. J. Adv. Res. Biol. Sci*. 2023;10(2):160-163.
11. 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.
12. 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.
13. 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>.
14. 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://links/63e538ed64252375639dd0df/An-update-on-premalignant-cervical-lesions-and-cervical-cancer-screening-services-among-HIV-positive-women.pdf).

**Citation:** Obeagu EI. Ceruloplasmin and HIV-Associated Malignancies: A Review. *Elite Journal of Health Science*, 2023; 1(1):38-50



15. 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.
16. 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)
17. 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.2017.03.01.004).
18. 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.
19. Obeagu EI, Mohamod AH. An update on Iron deficiency anaemia among children with congenital heart disease. *Int. J. Curr. Res. Chem. Pharm. Sci*. 2023;10(4):45-48.
20. Obeagu EI, Oshim IO, Ochei KC, Obeagu GU. Iron and blood donation: A Review. *Int. J. Curr. Res. Med. Sci*. 2016;2(10):16-48.
21. Obeagu EI, Obeagu GU, Emeonye OP, Jakheng SP. An Upadte on Interleukin 6 And Iron Status of Volleyball Players. *Madonna University journal of Medicine and Health Sciences*. 2022;2(2):41-74.
22. Okamgba OC, Nwosu DC, Nwobodo EI, Agu GC, Ozims SJ, Obeagu EI, Ibanga IE, Obioma-Elemba IE, Ihekaire DE, Obasi CC, Amah HC. Iron Status of Pregnant and Post-Partum Women with Malaria Parasitaemia in Aba Abia State, Nigeria. *Annals of Clinical and Laboratory Research*. 2017;5(4):206.
23. Obeagu EI, Anierobi CC, Eze GC, Chukwueze CM, Makonyonga RD, Amadi NM, Hassan R. Evaluation of Plasma Levels of Interleukin 6 and Iron Status of Volleyball Players in a Nigerian University. *Journal of Advances in Medical and Pharmaceutical Sciences*. 2022;24(6):18-23.
24. Obeagu EI, Obeagu GU, Guevara ME, Okafor CJ, Bot YS, Eze GC, Amadi NM, Jakheng EW, Uwakwe OS. Evaluation of Plasma Levels of Interleukin 6 and Iron of Volleyball Players Based on Heights and Weight of a Nigerian University Students. *Asian Journal of Medicine and Health*. 2022;20(10):147-152.
25. 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.
26. 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.
27. 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).

**Citation:** Obeagu EI. Ceruloplasmin and HIV-Associated Malignancies: A Review. *Elite Journal of Health Science*, 2023; 1(1):38-50

28. 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](https://www.academia.edu/download/38320140/Obeagu_Emmanuel_Ifeanyi_and_Obeagu_Getrude_Uzoma2.EMMA1.pdf).
29. 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)
30. 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](https://www.iosrjournals.org/IOSRjournal/2017/12(4)/70-75.pdf)
31. 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.
32. 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-MDA-AND-NON-ENZYMATIC-ANTIOXIDANTS-VIT-C-E-IN-HIV-SEROPOSITIVE-CHILDREN-IN-AN-URBAN-COMMUNITY-OF-ABIA-STATE-NIGERIA.pdf](https://www.researchgate.net/publication/311111111_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).
33. 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.IJC\\_RAR.pdf](https://www.academia.edu/download/38320159/Obeagu_Emmanuel_Ifeanyi3_et_al.IJC_RAR.pdf).
34. 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/5aa2bb17a6fdcc544b7526e/Haematological-Indices-of-HIV-Seropositive-Subjects-at-Nnamdi-Azikiwe.pdf](https://www.researchgate.net/publication/325555555_Haematological-Indices-of-HIV-Seropositive-Subjects-at-Nnamdi-Azikiwe)
35. 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](https://doi.org/10.22192/ijcrms.2017.03.02.005)
36. 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.
37. Obeagu EI, Amekpor F, Scott GY. An update of human immunodeficiency virus infection: Bleeding disorders. J Pub Health Nutri. 2023; 6 (1). 2023;139.

**Citation:** Obeagu EI. Ceruloplasmin and HIV-Associated Malignancies: A Review. Elite Journal of Health Science, 2023; 1(1):38-50

[links/645b4a6c2edb8e5f094d9bd9/An-update-of-human-immunodeficiency-virus-infection-Bleeding.pdf](https://epjournals.com/journals/EJMS/links/645b4a6c2edb8e5f094d9bd9/An-update-of-human-immunodeficiency-virus-infection-Bleeding.pdf).

38. 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>.
39. Obeagu E, Felix CE, MTB O, Chikodili UM, Nchekwubedi C1S, Chinedum OK. Studies on some cytokines, CD4, iron status, hepcidin and some haematological parameters in pulmonary tuberculosis patients based on duration of treatment in Southeast, Nigeria. *African Journal of Biological Sciences*. 2021;3(1):146-156.
40. Okoroiwu IL, Chinedu-Madu JU, Obeagu EI, Vincent CC, Ochiabuto OM, Ibekwe AM, Amaechi CO, Agu CC, Anoh NV, Amadi NM. Evaluation of Iron Status, Haemoglobin and Protein Levels of Pregnant Women in Owerri Metropolis. *Journal of Pharmaceutical Research International*. 2021;33(27A):36-43.
41. Assadsangabi A, Evans CA, Corfe BM, Lobo A. Application of proteomics to inflammatory bowel disease research: current status and future perspectives. *Gastroenterology Research and Practice*. 2019.
42. Singh S, Sarma DK, Verma V, Nagpal R, Kumar M. Unveiling the future of metabolic medicine: omics technologies driving personalized solutions for precision treatment of metabolic disorders. *Biochemical and Biophysical Research Communications*. 2023.
43. Obeagu EI. Erythropoietin in Sickle Cell Anaemia: A Review. *International Journal of Research Studies in Medical and Health Sciences*. 2020;5(2):22-28.
44. Obeagu EI, Ezimah AC, Obeagu GU. Erythropoietin in the anaemias of pregnancy: a review. *Int J Curr Res Chem Pharm Sci*. 2016;3(3):10-18.
45. Obeagu EI, Agree FC. Anaemia among pregnant women: A review of African pregnant teenagers. *J Pub Health Nutri*. 2023; 6 (1). 2023;138.
46. Walter O, Anaebio 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.
47. 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.
48. 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://epjournals.com/journals/EJMS/links/6317a6b1acd814437f0ad268/Seroprevalence-of-human-immunodeficiency-virus-based-on-demographic-and-risk-factors-among-pregnant-women-attending-clinics-in-Zaria-Metropolis-Nigeria.pdf).
49. 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-](https://epjournals.com/journals/EJMS/links/6516faa61e2386049de5e828/A-Review-of-)

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[knowledge-attitudes-and-socio-demographic-factors-associated-with-non-adherence-to-antiretroviral-therapy-among-people-living-with-HIV-AIDS.pdf](#)

50. 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](#).
51. Obeagu EI, Ibeh NC, Nwobodo HA, Ochei KC, Iwegbulam CP. Haematological indices of malaria patients coinfectd 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\\_coinfectd\\_with\\_HIV.pdf](https://www.academia.edu/download/54317126/Haematological_indices_of_malaria_patients_coinfectd_with_HIV.pdf)
52. 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.
53. 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](#).
54. 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.
55. 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/>.
56. 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.
57. 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>
58. Echendu GE, Vincent CC, Ibebuikwe 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

**Citation:** Obeagu EI. Ceruloplasmin and HIV-Associated Malignancies: A Review. Elite Journal of Health Science, 2023; 1(1):38-50

59. Nwosu DC, Nwanjio 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://www.worldjournalofpharmacy.com/links/5a4fd0500f7e9bbc10526b38/BIOCHEMICAL-ALTERATIONS-IN-ADULT-HIV-PATIENTS-ON-ANTIRETROVIRAL-THERAPY.pdf).
60. 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.
61. Obeagu EI, Nwazu ME, Obeagu GU. Evaluation of plasma levels of interleukin 6 and iron status based on sleeping patterns of students in a Nigerian University. Int. J. Curr. Res. Med. Sci. 2022;8(9):1-6.
62. Edward U, Osuorji VC, Nnodim J, Obeagu EI. Evaluation of Trace Elements in Sick Cell Anaemia Patients Attending Imo State Specialist Hospital, Owerri. Madonna University journal of Medicine and Health Sciences. 2022;2(1):218-234.
63. Obeagu EI, Dahir FS, Francisca U, Vandu C, Obeagu GU. Hyperthyroidism in sickle cell anaemia. Int. J. Adv. Res. Biol. Sci. 2023;10(3):81-89.
64. Obeagu EI, Babar Q. Recent advances in understanding of Haemochromatosis: A burning issue of life. Int. J. Curr. Res. Med. Sci. 2021;7(7):23-28.
65. Obeagu EI, Okoroiwu IL, Azuonwu O. An update on hypoxic regulation of iron homeostasis and bone marrow environment. Int. J. Curr. Res. Med. Sci. 2018;4(10):42-48.
66. Edward Henry SI, Obeagu EI. Assessment of the Serum Iron Status of Preeclampsia Subjects in Aba, Abia State. Elite Journal of Haematology. 2024;2(1):10-18.
67. 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/ijcrps.2019.06.12.004  
[links/650aba1582f01628f0335795/Adverse-drug-reactions-in-HIV-AIDS-patients-on-highly-active-antiretro-viral-therapy-a-review-of-prevalence.pdf](https://www.ijcrps.com/links/650aba1582f01628f0335795/Adverse-drug-reactions-in-HIV-AIDS-patients-on-highly-active-antiretro-viral-therapy-a-review-of-prevalence.pdf).
68. 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](https://www.ijcrms.com/links/645a4a462edb8e5f094ad37c/Implications-of-CD4-CD8-ratios-in-Human-Immunodeficiency-Virus-infections.pdf).
69. 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](https://www.ijcrms.com/links/5711c47508aeebe07c02496b/Assessment-of-the-level-of-haemoglobin-and-erythropoietin-in-persons-living-with-HIV-in-Umuahia.pdf).
70. 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](https://www.academia.edu/download/38320134/Obeagu_Emanuel_Ifeanyi_and_Obeagu_Getrude_Uzoma.EMMA2.pdf).
71. 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.

72. 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>.
73. 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.
74. Obeagu EI, Obarezi TN, Ogbuabor BN, Anaebio 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 Pharma Research*. 2014; 391:186-189.
75. 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.
76. 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.
77. Nwosu DC, Obeagu EI, Nkwuocha BC, Nwanna CA, Nwanjo HU, Amadike JN, Ezemima 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.
78. 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.
79. 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.
80. 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).
81. 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.
82. 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.
83. 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.

84. 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.
85. 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.
86. 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.
87. Obeagu EI, Obeagu GU, Obiezu J, Ezeonwumelu C, Ogunnaya FU, Ngwoke AO, Emeka-Obi OR,
88. 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.
89. 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.
90. Obeagu EI, Obeagu GU. Early Infant Diagnosis: A Crucial Step in Halting HIV Transmission. *Elite Journal of Health Science*, 2023; 1(1):1-11
91. Obeagu EI, Obeagu GU. Early Infant Diagnosis: Shielding Infants from HIV Transmission. *Elite Journal of Health Science*, 2023; 1(1):12-22
92. Obeagu EI, Obeagu GU. Protecting Generations: Early Infant Diagnosis's Role in Preventing HIV Spread. *Elite Journal of Public Health*, 2023; 1 (1): 1-11
93. Obeagu EI, Obeagu GU. Securing Health: The Role of Early Infant Diagnosis in Preventing HIV in Newborns. *Elite Journal of Public Health*, 2023; 1 (1): 12-22
94. Obeagu EI, Obeagu GU. Empowering Health Systems: Early Infant Diagnosis's Impact on Preventing HIV in Newborns. *Elite Journal of Public Health*, 2023; 1 (1): 23-33
95. Obeagu EI, Obeagu GU. From Classroom to Home: Strengthening the Continuum of Sickle Cell Disease Knowledge. *Elite Journal of Health Science*, 2023; 1(1):23-29
96. Obeagu EI, Obeagu GU. Incorporating Sickle Cell Disease Curriculum in Schools: An Effective Approach. *Elite Journal of Health Science*, 2023; 1(1):30-36
97. Obeagu EI, Obeagu GU. Community Leaders as Educators: Mobilizing for Sickle Cell Disease Reduction. *Elite Journal of Health Science*, 2023; 1(1):37-43
98. Obeagu EI, Obeagu GU. Peer-to-Peer Learning Networks: Sickle Cell Disease Education Among Adolescents. *Elite Journal of Public Health*, 2023; 1 (1): 34-41
99. Obeagu EI, Obeagu GU. From Awareness to Action: Encouraging Adolescent Engagement in Sickle Cell Disease Prevention. *Elite Journal of Public Health*, 2023; 1 (1): 42-50
100. Obeagu EI, Obeagu GU. The Vital Role of Antioxidants in Enhancing Fertility and Pregnancy Success: A Review. *Elite Journal of Nursing and Health Science*, 2023; 1(1):1-12

101. Obeagu EI, Obeagu GU. Harnessing the Power of Antioxidant-Rich Diet for Preconception Health: A Review. *Elite Journal of Health Science*, 2023; 1(1):1-13
102. Obeagu EI. Unraveling Diagnostic Challenges of Aplastic Anemia in the Context of HIV: A Review. *Elite Journal of Nursing and Health Science*, 2023; 1(1):13-23
103. Obeagu EI. Immunological Insights into Aplastic Anemia within the Context of HIV: Unraveling the Complex Interplay. *Elite Journal of Health Science*, 2023; 1(1):14-24
- 104.** Obeagu EI. Treatment Strategies for Aplastic Anemia in HIV: Current Approaches and Future Directions. *Elite Journal of Laboratory Medicine*, 2023; 1(1): 1-12
105. Hackl L, Itzkowitz L, Koso-Thomas M, Moorthy D, Owino V, Pachón H, Stoffel N, Zimmerman M, Raiten D, Loechl C, Datta-Mitra A. Approaches to Address the Anemia Challenge. *The Journal of Nutrition*. 2023;153(Suppl 1).
106. Obeagu EI. Iron Overload in HIV: Implications for Disease Management. *Elite Journal of HIV*, 2023; 1(1): 15-28
107. Obeagu EI. Hemochromatosis and HIV: Two Conditions, One Challenge. *Elite Journal of Laboratory Medicine*, 2023; 1(1): 13-27
108. Obeagu EI. Iron Overload in HIV: Implications for Antiretroviral Therapy. *Elite Journal of Health Science*, 2023; 1(1):25-37
109. Obeagu EI. Hemochromatosis and HIV: Implications for Immune Reconstitution. *Elite Journal of Health Science*, 2023; 1(1):17-30
110. Obeagu EI. Ceruloplasmin and Oxidative Stress in HIV: A Review. *Elite Journal of HIV*, 2023; 1(1): 29-42
- 111.** Obeagu EI. Ceruloplasmin and HIV-Associated Coagulopathies: A Review. *Elite Journal of Laboratory Medicine*, 2023; 1(1): 28-41