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INFLUENCE OF PHYSICAL ACTIVITY ON HEALTH OUTCOMES OF HIV/AIDS PATIENTS

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ABSTRACT

Human Immunodeficiency Virus (HIV) infection remains a significant global health issue, despite antiretroviral therapy (ART) having improved patients' life expectancy. This study is a systematic review aimed at evaluating the impact of physical activity on the health outcomes of HIV/AIDS patients. This systematic search was conducted on seven databases for publications from 2018 to 2025. The keywords in the search are "physical activity" AND "HIV/AIDS patient" AND "biomedical sign" OR CD4 OR "health outcomes and five studies met the inclusion criteria. The results show that physical activity with moderate to high intensity consistently increases the number of CD4 cells, improves the CD4/CD8 ratio, and reduces immune activation, as well as decreases the risk of comorbidities. The main conclusion states that physical activity is an effective non-pharmacological intervention and needs to be integrated into HIV care services continuously. These findings encourage the development of health policies that support community-based and digital physical interventions to improve the well-being of HIV/AIDS patients.
Keywords: "Physical Activity; HIV/AIDS patients; Health Outcomes"

INTRODUCTION

Human Immunodeficiency Virus (HIV) continues to represent a major global public health challenge, with an estimated 39 million individuals living with HIV and approximately 630,000 AIDS-related deaths recorded worldwide in 2023 (UNAIDS, 2023). In Indonesia, the prevalence of HIV infection persists at concerning rates, particularly among key high-risk populations such as men who have sex with men, intravenous drug users, and commercial sex workers (Kementerian Kesehatan Republik Indonesia, 2023). The advent of antiretroviral therapy (ART) has markedly improved survival rates and reduced morbidity in people living with HIV/AIDS (PLWHA). Nonetheless, long-term ART use is associated with adverse side effects, chronic inflammation, and the emergence of non-communicable comorbidities, which collectively undermine the quality of life in this population.

In response, physical activity has been widely acknowledged as a valuable non-pharmacological intervention in the management of chronic diseases, including HIV/AIDS. Accumulating evidence over the past five years has demonstrated that consistent engagement in physical activity can enhance immunological function, increase CD4+ T-cell counts, alleviate fatigue, improve psychological health, and mitigate the risk of cardiometabolic comorbidities in PLWHA (Davy et al., 2022; O'Brien et al., 2019). Furthermore, physical activity has been associated with better ART adherence, improved functional capacity, and enhanced overall quality of life, and increase immunological markers. First, immunological markers are CD4 and CD8 are subtypes of white blood cells that play crucial roles in the immune system. CD4 cells function as "guides" or "coordinators" of the immune response, while CD8 cells act as "killers" that eliminate infected or abnormal cells. Second, The CD4/CD8 ratio reflects the balance between these key immune cell populations and serves as an indicator of immune system health. The CD4/CD8 ratio typically ranges from 1 to 3, meaning there are approximately one to three CD4 cells for every CD8 cell. (Vancampfort et al., 2021).

Despite its well-documented benefits, the integration of physical activity interventions into the routine care of PLWHA remains suboptimal, hindered by persistent social stigma, health limitations, and inadequate access to structured exercise programs (Berger et al., 2023). These barriers underscore the necessity for an updated, comprehensive synthesis of contemporary research exploring the effects of physical activity on both biomedical outcomes, such as CD4 counts and viral suppression, and psychosocial health indicators in PLWHA.

While several systematic reviews and meta-analyses have previously addressed this topic (O'Brien et al., 2019; Davy et al., 2022), the majority of these were conducted prior to the COVID-19 pandemic — a global crisis that significantly altered healthcare accessibility, physical activity patterns, and the mental health landscape among PLWHA (Berger et al., 2023). Given these profound shifts, it is imperative to reevaluate the existing evidence base in the post-pandemic context to inform contemporary clinical and public health practice.

This systematic review aims to identify, evaluate, and synthesize empirical findings from various primary research studies related to physical activity interventions on health outcomes among HIV/AIDS patients. The novelty of this study lies in its emphasis on post-pandemic evidence synthesis and its dual focus on both biomedical and psychosocial health parameters, addressing research gaps that remain insufficiently explored in the current literature.

MATERIALS AND METHODS

This research is a systematic review using quantitative testing methods. This research was conducted on databases from Scopus, Science Direct, PubMed, ProQuest, Ebscohost, and Sage to identify articles published from 2018 to 2025. The keywords in the search are "physical activity" AND “HIV/AIDS patient” AND “biomedical sign” OR CD4 OR “health outcomes”. The exclusion criteria are articles that are not full papers, conference proceedings, and publications that are not in English. The study's eligibility was assessed using the PICOT framework. Articles with the same title were excluded in the first stage, then titles and abstracts were screened to identify and eliminate irrelevant articles. The inclusion criteria are (i) full paper articles (ii) open access (iii) using quantitative research methods (iv) physical activity therapy. Quality assessment is based on the PRISMA checklist (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to enhance reporting.

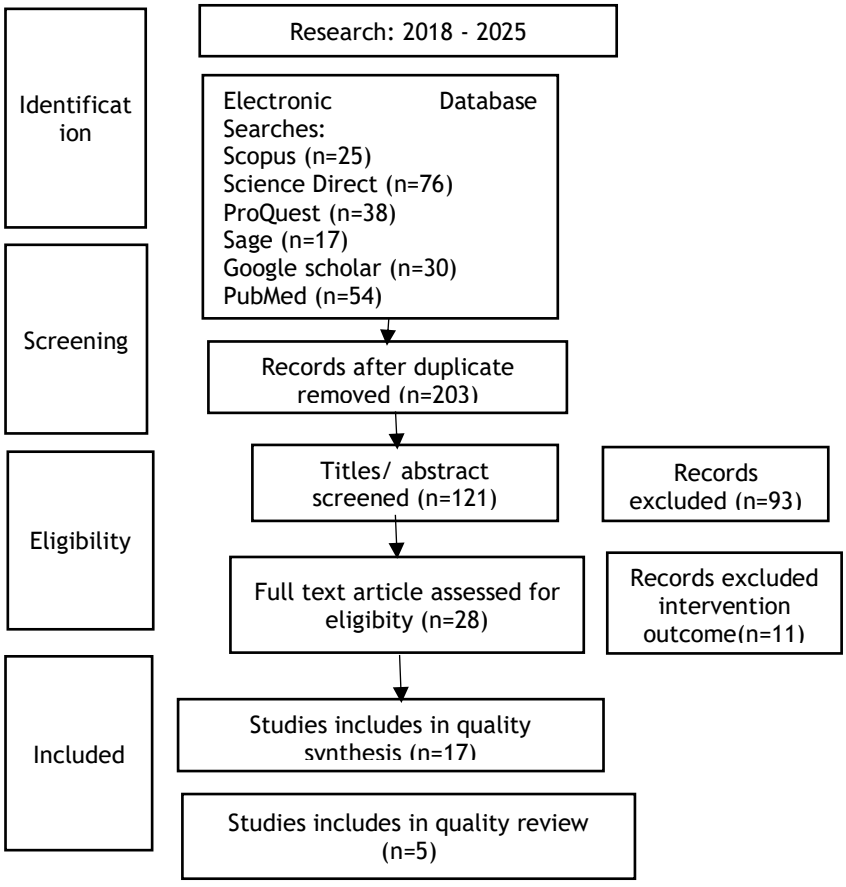


Figure 1. Prism Diagram

RESULTS AND DISCUSSION

A total of 249 references were identified in the database search, 121 of which were deemed eligible for inclusion based on title and abstract assessment. After a complete review of the articles, five research articles were selected and included for the study. The number of articles in this review is five, with respondents and types of interventions that meet the inclusion criteria. The research was conducted mostly on adult participants. This systematic review discusses the peer-reviewed literature on the benefits of physical activity for HIV/AIDS patients.

Table 1. Risk of bias

Author	D1	D2	D3	D4	D5	Overall
Bernal Enrique et.al., 2022,	🟢	🟡	🟢	🟢	🟢	🟢
Dang K.A et.al., 2018	🟢	🟡	🟢	🟡	🟢	🟢
Alinaghi S.A.S et.al., 2025	🟢	🟡	🟢	🟡	🟢	🟢
Zou Youqing et.al., 2022	🟢	🟢	🟢	🟡	🟢	🟢
Nicholas Mwebaze et.al., 2025	🟡	🟡	🟢	🟡	🟢	🟡

Domain	**Judgement**
D1: Bias arising from the randomization process	🟢 : Low risk
D2: Bias due to deviations from intended interventions	🟡 : Moderate
D3: Bias due to missing outcome data	🔴 : High risk
D4: Bias in measurement of the outcome	
D5: Bias in selection of the reported result	

Table 2. Summary of selected study

No	Author(s), year, title	Methode Design, respondent	Intervention	Outcomes
1	Bernal Enrique et.al., 2022, Moderate to Intense Physical Activity Is Associated With Improved Clinical, CD4/CD8 Ratio, and Immune Activation Status in HIV-Infected Patients on ART	Cross-sectional study / 155 HIV-infected patients	Moderate to intense physical activity : assessed via the International Physical Activity Questionnaire (iPAQ) over a 2-year period	Patients who engaged in moderate to intense physical activity had better metabolic profiles (lower BMI, glucose, triglycerides), improved CD4/CD8 ratios, and reduced immune activation markers compared to those with sedentary or low physical activity levels. Physical activity was an independent factor associated with improved CD4/CD8 ratio recovery and lower chronic inflammation among HIV patients on antiretroviral therapy (ART). The study recommends incorporating at least moderate physical activity into care plans for HIV patients.
2	Dang K.A et.al., 2018, Physical activity among HIV-positive patients receiving antiretroviral therapy	Cross-sectional study/ 1,133 HIV-positive patients	The study analyzed the level of physical activity and associated factors among HIV-positive patients undergoing	16% of participants were physically inactive. 68% achieved health-enhancing physical activity (HEPA) levels.

	in Hanoi and Nam Dinh, Vietnam: a cross-sectional study		antiretroviral therapy (ART) in urban and rural Vietnam.	Higher physical activity was associated with living in rural areas, being female, being self-employed, having a higher CD4 count > 200, better quality of life (EQ-5D-5L/EQ-VAS), and peer support. Lower activity levels were linked to urban residence, symptomatic HIV stage, longer ART duration, and poor adherence.
3	Alinaghi S.A.S et.al., 2025, Effectiveness of Exercise on Sarcopenia in HIV Patients	Systematic review/ Ten included studies	resistance training, cardiorespiratory training,	Regular exercise, especially moderate-to-high intensity resistance and cardiorespiratory training, was shown to increase muscle mass, improve physical performance, and reduce the risk of sarcopenia in PLWH. Exercise was recommended as a preventive and therapeutic strategy, with benefits extending to longevity and better quality of life.
4	Zou Youqing et.al., 2022, Physical Activities and Associated Factors Among HIV/AIDS Patients: A Questionnaire Survey	Cross-sectional/ 377 patients were initially recruited; 370 were included in the final analysis	- This was a cross-sectional survey using self-reported questionnaires, including: - International Physical Activity Questionnaire (IPAQ) - Self-Rating Depression Scale (SDS) - Self-Rating Anxiety Scale (SAS) - Social Support Scale (SSRS) - Health Belief Model (HBM)	- The average physical activity level was 1007.15±868.63 MET-min/week. - 53.8% of patients engaged in moderate physical activity, and 46.2% had low physical activity levels. - Factors significantly associated with physical activity levels were: 1. Gender 2. Latest T-CD4+ count > 200 3. Self-efficacy 4. Perceived barriers
5	Nicholas Mwebaze et.al., 2025, Effects of Aerobic Exercise on Health Outcomes and Quality of Health in People Living with HIV on Antiretroviral Therapy	Literature review/ Nine included studies	Aerobic exercise — including activities such as brisk walking, jogging, cycling, swimming, and light resistance training tailored to individual health conditions	The literature review found that aerobic exercise significantly improves cardiovascular health, metabolic function, psychological well-being, and overall quality of life in people

	living with HIV on antiretroviral therapy (ART). It also helps increase CD4 cell counts. Structured, supervised exercise programs led by clinical exercise professionals were shown to be safe, effective, and essential in managing non-communicable diseases and improving health outcomes for this population, especially in resource-limited settings.

As the life expectancy of HIV/AIDS patients increases due to the availability of effective antiretroviral therapy (ART), attention to quality of life and long-term complications becomes increasingly important. One of the strategies that has garnered attention in the scientific literature is physical activity as an adjunct approach in the management of HIV patients. Several studies have shown that physical activity not only has a positive impact on physical fitness but also benefits the immunological, metabolic, and psychological aspects of HIV patients (Nicholas et al., 2025; Dang et al., 2018).

Nicholas et al. (2025) in their literature review state that aerobic exercises such as walking, cycling, swimming, and jogging have been proven to increase CD4 cell counts, improve cardiovascular health, and reduce the risk of non-communicable diseases (NCDs) such as diabetes, hypertension, and dyslipidaemia in HIV patients undergoing ART. Additionally, physical activity also helps reduce the long-term side effects of ART such as lipodystrophy and overweight, which can worsen the patients' condition. This study emphasises the importance of exercise-based interventions in improving long-term clinical outcomes in HIV patients.

In line with these findings, a study by Bernal et al. (2022) shows that HIV patients who regularly engage in moderate to high-intensity physical activity have a better CD4/CD8 ratio and lower immune activation levels. Physical activity correlates with a decrease in the expression of inflammatory biomarkers such as HLA-DR and CD38 on T cells, as well as an increase in the proportion of CD4+ cells. A higher CD4/CD8 ratio indicates a more optimal immune system recovery and reduces the risk of non-AIDS-related diseases. These results reinforce the evidence that exercise can help control chronic inflammation commonly seen in HIV patients (Bernal et al., 2022).

Research by Dang et al. (2018) conducted in Vietnam provides important insights into the sociodemographic factors affecting the physical activity levels of HIV patients. The study results show that HIV patients living in rural areas are more physically active compared to those living in urban areas. Factors such as the type of work (e.g., labourers or farmers), openness about HIV status, and support from fellow patients encourage increased physical activity. Interestingly, the longer patients undergo ART, the less likely they are to engage in physical activity. These findings indicate the need for interventions tailored to geographic location and treatment phase (Dang et al., 2018).

In addition to physiological benefits, physical activity also has a positive impact on the mental health of HIV patients. Nicholas et al. (2025) mention that exercise can reduce levels of depression and anxiety, and improve overall quality of life. This is important because psychological disorders are often not optimally addressed, especially in developing countries. Patients who are more physically active also show higher adherence to ART treatment and have a more positive perception of their health condition (Nicholas et al., 2025).

However, various obstacles are still faced in integrating physical activity into HIV management, especially in developing countries. The lack of sports facilities, the scarcity of professionals such as exercise physiologists, and the low level of public awareness pose significant challenges. Nicholas et al. (2025) suggest that structured exercise programs supervised by healthcare professionals can overcome these barriers. Community-based approaches tailored to the local culture and the patient's socioeconomic conditions are also necessary to enhance the success of the intervention.

Overall, the literature shows that physical activity plays an important role in a holistic approach to HIV/AIDS management. Physical activity has been proven to provide benefits in terms of immunology, metabolism, mental health, and the overall quality of life of patients. Thus, the integration of physical activity into HIV care programs should be a priority in the healthcare system, especially in areas with a high HIV burden and limited resources (Nicholas et al., 2025; Bernal et al., 2022; Dang et al., 2018). "Physical activity influences the CD4 count in patients with HIV/AIDS. Patients with CD4 levels below 200 are at higher risk of developing opportunistic infections. Even among HIV/AIDS patients receiving antiretroviral therapy (ART), a significant number still have a history of opportunistic infections. The most common infection is related to nutritional problem (Hanim., R.Z, 2025)

The COVID-19 pandemic profoundly disrupted healthcare systems, altered physical activity patterns, and reshaped the management of chronic diseases, including HIV/AIDS. In this context, the influence of physical activity on health outcomes among HIV/AIDS patients warrants renewed examination, particularly in the post-pandemic era. Before the pandemic, numerous studies documented the beneficial effects of physical activity on immune function, quality of life, cardiovascular health, and mental well-being in people living with HIV (PLWH). Regular exercise was associated with increased CD4 cell counts, reduced fatigue, and improved mood and body composition (Vancampfort et al., 2018; O'Brien et al., 2016). Exercise was also promoted as an adjunct therapy to antiretroviral treatment (ART), enhancing adherence and reducing comorbid risks (Jabbour & Iancu, 2021).

However, the post-pandemic landscape introduces new variables and unique challenges. Lockdowns, social isolation, and health service disruptions led to sedentary behaviors, weight gain, and mental health deterioration among PLWH (Soares et al., 2023; Giano et al., 2022). Furthermore, the long-term immunological effects of SARS-CoV-2 infection or vaccination on PLWH remain areas of active inquiry. Given these factors, investigating how physical activity mitigates post-pandemic vulnerabilities among HIV/AIDS patients is both novel and urgent.

This study contributes to the current literature by focusing on the intersection of physical rehabilitation, immune resilience, and psychosocial recovery in PLWH during the post-pandemic phase. Unlike pre-pandemic studies that evaluated physical activity under stable healthcare access, this research reflects the dynamic realities of PLWH navigating health maintenance amid a global health crisis aftermath (Cunha et al., 2020; Soares et al., 2023).

CONCLUSION

Physical activity interventions provide significant benefits to the biomedical and psychosocial aspects of HIV/AIDS patients. Physical activity, especially when performed regularly with moderate to high intensity, has been proven to increase the number of CD4 cells, improve the CD4/CD8 ratio, and reduce immune activation, which is characteristic of chronic inflammation in people with HIV. Additionally, physical activity also contributes to a reduced risk of non-communicable comorbidities, improves mental health, and enhances overall quality of life. These findings address the research objective, which is to evaluate the impact of physical activity on various health indicators in HIV/AIDS patients in the post-pandemic era. Existing evidence shows that physical activity is not only a complementary strategy but also an important part of a sustainable holistic HIV management approach

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