The Influence of Psychological Stress on HIV Progression and Evolution: A Systematic Review

A Influência do Estresse Psicológico na Progressão e Evolução do HIV: Uma Revisão Sistemática
La Influencia del Estrés Psicológico en la Progresión y Evolución del VIH: Una Revisión Sistemática

RESUMO
A pesquisa foi realizada através de uma revisão sistemática de estudos publicados entre 1990 e 2024, utilizando as bases de dados Pubmed, Science Direct e Scopus, com os termos de busca "HIV/AIDS" AND "stress" AND "immune system". Os critérios de inclusão foram: estudos em seres humanos e que avaliaram marcadores imunológicos e parâmetros de estresse, ansiedade e depressão. Após a triagem, 15 artigos foram incluídos nesta revisão. Os resultados mostram que o estresse psicológico, principalmente quando relacionado à ansiedade e depressão, afeta negativamente o sistema imunológico, acelerando a progressão da infecção por HIV. Todavia, intervenções como terapia emocional e prática regular de atividades físicas demonstraram ser eficazes na homeostase do sistema imunológico. Conclui-se que o estresse tem uma influência direta na progressão da infecção por prejudicar a resposta imune, a inclusão de intervenções psicossociais é fundamental para melhorar a qualidade de vida e retardar a evolução da doença
DESCRITORES: HIV/AIDS. Estresse. Sistema imune. Revisão sistemática.

ABSTRACT
The research was carried out through a systematic review of studies published between 1990 and 2024, using the Pubmed, Science Direct and Scopus databases, with the search terms "HIV/AIDS" AND "stress" AND "immune system". The inclusion criteria were: studies in humans and that evaluated immunological markers and parameters of stress, anxiety and depression. After screening, 15 articles were included in this review. The results show that psychological stress, especially when related to anxiety and depression, negatively affects the immune system, accelerating the progression of HIV infection. However, interventions such as emotional therapy and regular physical activity have been shown to be effective in the homeostasis of the immune system. It is concluded that stress has a direct influence on the progression of the infection by impairing the immune response, the inclusion of psychosocial interventions is essential to improve quality of life and delay the progression of the disease.
DESCRITORS: HIV/AIDS. Stress. Immune system. Systematic review.

RESUMEN
La investigación se llevó a cabo mediante una revisión sistemática de estudios publicados entre 1990 y 2024, utilizando las bases de datos Pubmed, Science Direct y Scopus, con los términos de búsqueda "VIH/SIDA", "estrés" y "sistema inmunitario". Los criterios de inclusión fueron: estudios en humanos que evaluaran marcadores inmunológicos y parámetros de estrés, ansiedad y depresión. Tras la selección, se incluyeron 15 artículos en esta revisión. Los resultados muestran que el estrés psicológico, especialmente cuando se relaciona con la ansiedad y la depresión, afecta negativamente al sistema inmunitario, acelerando la progresión de la infección por VIH. Sin embargo, intervenciones como la terapia emocional y la actividad física regular han demostrado ser eficaces para la homeostasis del sistema inmunitario. Se concluye que el estrés influye directamente en la progresión de la infección al deteriorar la respuesta inmunitaria; la inclusión de intervenciones psicosociales es esencial para mejorar la calidad de vida y retrasar la progresión de la enfermedad.
DESCRIPTORES: HIV/AIDS. Estrés. Sistema inmunitario. Revisión sistemática.

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731

RECEBIDO EM: 01/06/2025 **APROVADO EM:** 20/06/2025

Como citar este artigo: Silva CF, Anklam CFV, Kirsten K. A Influência do Estresse Psicológico na Progressão e Evolução do HIV: Uma Revisão Sistemática. Saúde Coletiva (Edição Brasileira) [Internet]. 2025 [acesso ano mês dia];15(98):16716-16731. Disponível em: DOI: 10.36489/saudecoletiva.2025v15i98p16716-16731

Carolina Fioravanço da Silva
Biomedicine student at Atitus Educação
ORCID: https://orcid.org/0009-0000-1369-9437

Carolain Felipin Vincensi Anklam
Professor on the Biomedicine course at Atitus Educação
ORCID: https://orcid.org/0000-0001-6984-7136

Karina Kirsten
Professor on the Biomedicine course at Atitus.
ORCID: https://orcid.org/0000-0002-1686-3033

INTRODUCTION

The Human Immunodeficiency Virus (HIV) is a retrovirus whose main target is CD4+ T cells, which are essential for coordinating the immune response[1]. As the virus replicates, these cells are progressively destroyed, weakening the immune system and increasing susceptibility to opportunistic infections. A marked reduction in the CD4+ T-cell count and an increase in viral load mark the progression of the infection to Acquired Immune Deficiency Syndrome (AIDS)[2].

Since HIV was identified, the CD4+ T-cell count has been used as one of the main parameters to monitor the progression of the infection, along with viral load3. However, more recent studies indicate that the impact of the virus on the immune system cannot be understood solely by the presence and replication of the virus. Factors such as psychosocial aspects also have an important influence on the progression of the infection, affecting both the immune response and the quality of life of infected people[4]. These factors are associated with the constant activation of the hypothalamic-pituitary-adrenal (HPA) axis, which raises cortisol levels and stimulates the production of pro-inflammatory cytokines such as IL-6 and TNF-α, promoting inflammation and compromising immunity[5].

Maintaining a healthy lifestyle, with exercise and emotional support, can help slow down the progression of HIV by strengthening the immune system[6]. On the other hand, prolonged exposure to psychosocial stress, such as emotional losses, financial difficulties and discrimination, can damage the immunocompetence of people living with HIV. Several studies have shown that these psychosocial factors can accelerate the progression of the infection to AIDS[7,8].

Differences in impact between men and women have also been highlighted. Studies indicate that women, in particular, may have more unstable immune responses to stress, being more susceptible to inflammatory changes intensified by factors such as social stigma[9,10]. This vulnerability highlights the importance of personalized strategies for managing stress in people living with HIV.

With advances in antiretroviral therapy (ART), which has led to greater longevity and quality of life, attention to psychosocial factors is becoming increasingly necessary. These factors not only directly influence the progression of the infection, but also play a fundamental role in treatment adherence and patients' quality of life[11]. Thus, integrating psychosocial interventions into clinical treatment is indispensable to address the biological, emotional and behavioral aspects of this condition.

Understanding how the immune system interacts with behavioral factors is essential for improving the treatment of people living with HIV. Research suggests that by combining conventional medical interventions with stress management strategies, it is possible to improve patients' quality of life. Therefore, the aim of this study was to investigate, through a systematic review of the literature, the influence of psychosocial factors on biomarkers related to HIV infection, including CD4 cell count, viral load and inflammatory markers.

METHOD

A systematic peer review was carried out to identify studies that address the relationship between stress and the immune system in HIV patients. To this end, this study was developed in four main stages: identification, selection, evaluation and synthesis of the studies, in accordance with the Preferred Reporting Items for Systematic Reviews and Me-

ta-analysis Protocols (PRISMA-P) guidelines. Therefore, the review included the following characteristics: a set of clearly defined objectives with an explicit and reproducible methodology; a systematic search to identify all studies meeting the eligibility criteria; an assessment of the validity of the results of the included studies; systematic presentation and synthesis of the characteristics and findings of the included studies.

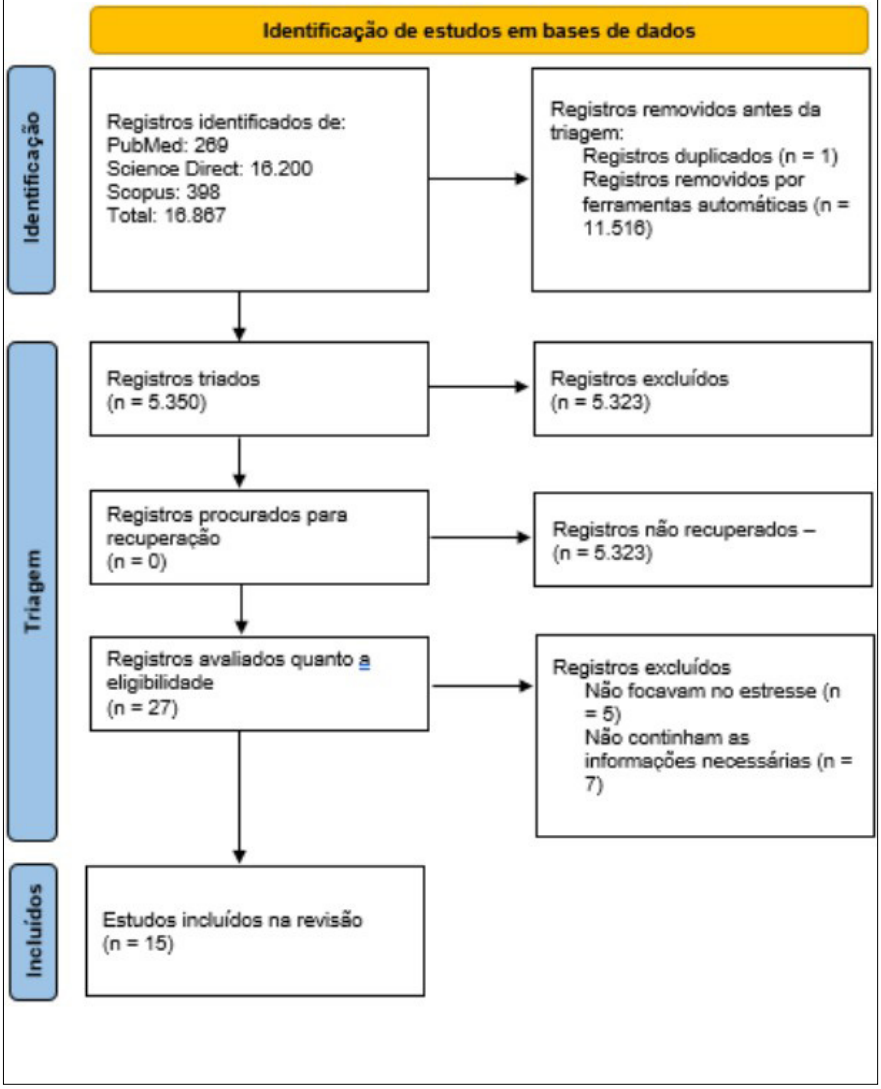
The search covered studies published between 1990 and 2024 in scientific journals in the databases: National Library of Medicine (Pubmed), Science Direct and Scopus. The Health Sciences Descriptors (DeCS) and Medical Subject Headings (MESH) terms used in English were used to collect the information: HIV/AIDS, stress and immune system. The search terms were combined using Boolean operators (NOT, AND and OR).

The studies included had the following eligibility criteria: studies on human beings; studies that assessed immunological markers and psychosocial parameters in HIV patients. The information compiled for each article was: Author and year, number of participants, average age, gender, parameters assessed, intervention, conclusions. The data will then be tabulated and analyzed. Literature review and meta-analysis articles, case studies and studies with qualitative data were excluded. In addition, the selection of studies was demonstrated using a flowchart in accordance with PRISMA 2020[12].

RESULTS

The initial search found 16,867 articles. Literature reviews and studies with qualitative data were excluded, totaling 5,350 articles. The titles and abstracts of these 5,350 articles were read, applying the eligibility criteria, which required the presence of results related to immunological markers. After this analysis, a total of 27 articles were obtained. These 27 articles were read in their entirety and the eligibility criteria applied once again, excluding those that did not focus on the relationship with stress. The final result was 15 articles. The details of the search, screening and selection of articles are shown in Flowchart 1 (Figure 1).

Figure 1. Flow diagram of the studies selected for the systematic review.



Source: Authors.

Of the 15 articles analyzed, 6 dealt with interventions aimed at reducing stress, while in 9 there was no intervention. In order to present the results, the studies were divided according to whether or not interventions were used to minimize stress. Table 1 shows the articles that did not involve interventions and the results obtained (Table 1).

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731

Table 1. Results of articles without interventions.

Author and year	Participants, average age and gender	Parameters assessed	Results
Kessler *et al.* (1991)[13]	1,001 35-year-old men	Stressful life events; Percentage reduction in CD4 lymphocytes; New symptoms such as oral candidiasis and fever	The study found no evidence that severe stressful events have a significant effect on the onset of symptoms and progression of HIV.
Roger McIntosh *et al.* (2024)[1]	54 participants aged 58.5 years - HIV+ participants and 56.2 years - HIV- participants; Postmenopausal women	Perception of stress; Resting-state functional connectivity between medial prefrontal cortex and nucleus accumbens and amygdala; TNF-αexpression in monocytes.	HIV infection moderates the effect of TNF-α expression in monocytes and mPFC-NAcc connectivity on levels of perceived stress. Reduced connectivity between these brain regions was associated with higher levels of stress.
Julnes *et al.* (2016)[14]	114 individuals aged 50; 68 men and 46 women	Post-traumatic stress disorder (PTSD) symptoms; markers of inflammation and immune activation	Individuals with PTSD had higher total leukocyte counts (p = 0.03), neutrophils, CD8+ percentage, and increased C-reactive protein (>3 mg/L).
Solomon *et al.* (2002)[15]	231 men and 77 women, Age not specified	Psychosocial behavior; CD4 cell count, NK cell cytotoxicity, viral load	Long-term HIV survivors showed preserved levels of NK cell cytotoxicity despite low CD4 counts.
Fumaz *et al.* (2012)[16]	39 years; 44 men and 6 women	Psychological stress, anxiety, depression, healthy diet, sleep quality, CD4 and CD8 cell counts, CD4/CD8 ratio, IL-6 plasma levels, HIV-1 viral load	There was a strong correlation between psychological stress and high IL-6 levels ($r = 0.81$, $p < 0.001$), as well as with anxiety ($r = 0.59$) and depression ($r = 0.41$). Levels of CD4 ($r = 0.11$) and CD8 ($r = 0.04$) showed no significant changes.
Leserman *et al.* (2002)[17]	30 years; 96 homosexual men. 13 men aged 25 to 54	Stressful life events; Depressive symptoms; Anger; Serum cortisol; Lymphocytes CD4, CD8 and NK cells	Stress, anger, depressive symptoms and high levels of cortisol and CD8 T cells are linked to the accelerated progression of AIDS.
Cole *et al.* (2002)[18]	133 men and 67 women aged 41.2 ± 6.9 years.	Autonomic nervous system activity; Viral load; CD4 T-cell count; Efficacy of antiretroviral drugs	Men with higher autonomic nervous system (ANS) activity responded less well to antiretroviral drugs, with a lower reduction in viral load and CD4 cell recovery.
Greeson *et al.* (2008)[19]	54.6 years; 52 homosexual men, 29 heterosexual men and 39 women	Levels of psychological stress, number of NK and cytotoxic T cells, T cell activation, HIV-1 viral load, CD4+ cell count	Psychological stress is associated with a decrease in both the number and cytotoxic function of NK cells and increased activation of cytotoxic T cells, which has been linked to greater disease severity.
Rendina *et al.* (2019)[20]	54,6 anos; 52 homens homossexuais, 29 homens heterosexuais e 39 mulheres	HIV stigma, depression, loneliness, alcohol and drug problems, adherence to antiretroviral therapy (ART), viral load (VL), and CD4 cell count	HIV stigma was positively associated with depressive symptoms, loneliness, alcohol and drug problems, and was negatively associated with CD4 count.

Source: Authors.

Table 2 shows the articles that involved interventions and the results obtained in these studies (Table 2).

Tabela 2. Resultados de artigos com intervenções.

Author and year	Participants, mean age and gender	Parameters assessed	Intervention	Conclusions
Birk *et al.* (2000[21]	36.7 years; 40 men and 2 women	CD4+, CD8+ lymphocyte count; CD4+/CD8+ ratio; NK cells; Quality of life assessment	Massage alone and in combination with other therapies	There were no changes in immunological parameters.
LaPerriere *et al.* (1990)[22]	Between 18 and 40 years old, average age 31; 50 homosexual men	Measures of emotional stress: anxiety and depression; immunological parameters: CD4 and NK cell counts and NK cell cytotoxicity	Aerobic exercise	Participants who did not exercise showed increased levels of anxiety (from 11.3 to 16.3) and depression (from 10.0 to 23.8) after notification of serological status, as well as a significant decrease in the number of NK cells (from 473 to 294 cells/mm^3). Participants who practiced physical exercise did not show these changes, showing similar levels to the seronegative group

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731

Corroon *et al.* (2017)[23]	Between 37 and 57 years old, with an average of 57 years; 1 woman and 14 men	Inflammatory markers; CD4+ count; Viral load; Body fat percentage; Quality of life	Hydrotherapy	There were no changes in CD4+ count or viral load.
Mustafa *et al.* (1999)[24]	35 years for the HIV+ group and 37 years for the HIV- group; 415 homosexual men	Physical exercise; Progression to AIDS; Death from AIDS; Decline in CD4 lymphocytes	Physical exercise	There was an increase (7.5%) or smaller decline in CD4 count among HIV+ participants who exercised
Ghayomzadeh *et al.* (2019)[25]	38 years; 11 women and 19 men	Quality of life; Body composition; CD4+ cell count	Recreational activities	The lifestyle modification group had a significant increase in CD4+ count
O'Cleirigh *et al.* (2008)[26]	37 years; 92 men and 45 women	Emotional expression, emotional disclosure, emotional/cognitive processing, NK cell count, CD4 count, viral load	Emotional expression through writing	The "Healthy Survivors" group, with less than 50 CD4 cells/mm³ for more than 9 months, had a higher NK cell count.

Source: Authors.

DISCUSSION

Psychological stress has a negative impact on the immune system. Several studies have shown that chronic stress causes a reduction in CD4 lymphocytes and an increase in inflammatory markers such as IL-6 and TNF-α[27]. In HIV-infected people, stress has a direct effect on the cells and molecules of the immune system and can accelerate the progression of the disease[28].

Studies included in this review, such as that by Leserman et al.[17], have shown that high levels of stress and depressive symptoms are associated with a reduction in CD4 lymphocytes and increased activation of CD8 lymphocytes, which weakens the immune response and favors viral replication. Similarly, Julnes et al.[14] identified that Post-Traumatic Stress Disorder (PTSD) increases inflammatory markers, making it more difficult to control HIV infection. Stress also compromises the function of natural killer (NK) cells, as observed in the study by Greeson et al.[19], making it difficult to control viral load and opportunistic infections.

Positive coping strategies, such as social support and religious coping, have shown beneficial effects, preserving immunity and slowing down the progression of HIV, which reinforces the importance of psychosocial interventions. In addition, physical exercise, writing and recreational activities show significant benefits on quality of life and preservation of immunity. These interventions help to reduce the progression of the disease and promote psychosocial benefits[22, 24, 25,26,29]. On the other hand, interventions such as hydrotherapy and massage did not show significant direct effects on immunological parameters, although they did contribute to improving other aspects, such as physical and emotional well-being[21,23].

Even though social support has not been directly investigated as an intervention, it plays a crucial role in stress management. Individuals with greater social support cope better with stress, preventing its negative effects on the immune system[30]. In contrast, those with less social support show a faster progression to AIDS[17].

It is important to note that the regulation of stress in individuals living with HIV can vary between men and women. Men tend to have a more intense stress response, characterized by high levels of cortisol, indicating greater activation of the HPA axis. Although this response is harmful in the long term, it is more stable and direct. On the other hand, women have a less intense but more unstable stress response, which can make it more difficult to control the inflammation associated with stress[9]. This instability, combined with psychosocial factors and the social stigmas that often fall on women, can result in more serious consequences for their health. This impact is highlighted by Gonzalez et al.[31], who point out how these differences make women more susceptible to the negative effects of chronic stress.

Global data from 2023 shows that of the 39.9 million people living with HIV, 53% are women and girls. These differences in stress response have important implications. A study focused on women showed that the presence of HIV affects communication be-

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731

tween the medial prefrontal cortex (mPFC) and the nucleus accumbens (NAcc), which increases vulnerability to perceived stress10. This finding reinforces the fact that HIV has a different impact on stress regulation mechanisms between the sexes, making women more susceptible to adverse consequences.

When comparing research carried out over the years, it is possible to observe significant differences in the findings. Studies from the 1990s and 2000s focused mainly on classic immunological parameters, such as CD4 and CD8 cell counts, viral load, as well as clinical symptoms associated with HIV, such as fever and oral candidiasis. In general, these studies did not find a significant association between emotional stress and the progression of HIV infection.

On the other hand, more recent research, from 2010 onwards, has adopted broader and more detailed approaches, incorporating inflammatory markers such as TNF-α and IL-6, as well as investigations into brain connectivity and gender aspects. These studies indicate that HIV-related psychological stress has a direct impact on the immune response, including a reduction in brain connectivity, associated with higher levels of perceived stress and a more intense inflammatory response.

With the advance of ART, which has become more effective and accessible throughout the 21st century, patients are living longer and with a better quality of life. Evidence indicates that early ART not only prevents AIDS-related events, but also other diseases such as cancer and cardiovascular conditions, highlighting the importance of early treatment[32]. This has allowed researchers to broaden their focus to more complex issues, including the impact of psychological stress, inflammatory markers and even the functional connectivity of the brain.

Although several studies have shown the relationship between psychological stress and HIV progression, some limitations need to be considered. Firstly, the studies analyzed different types of stress, such as acute stress, chronic stress and trauma, and each individual reacts differently to these situations, which can influence the results. In addition, the laboratory methods used to assess immunological parameters varied greatly, with some focusing on inflammatory cytokines, while others assessed CD4 and CD8 cell counts. These methodological differences may explain why some studies found significant immune alterations and others did not. These contrasts reflect the complexity of the impact of stress on the immune system and show the importance of more standardized analyses to better understand these interactions.

CONCLUSION

Psychological stress stands out as a central factor in the progression of HIV, affecting the immune system by reducing CD4 cells, activating CD8 cells and increasing inflammatory markers such as IL-6. These processes contribute to worsening health status and increased viral replication in people living with HIV. However, psychosocial interventions and positive coping strategies, such as social support and physical exercise, have had a positive impact on preserving immunity and improving quality of life. With the advance of antiretroviral therapy, the field of research has broadened its focus to include both emotional aspects and inflammatory biomarkers, which reinforces the relevance of an integrated approach to HIV treatment. In this way, effective stress management should be considered an essential part of health care for this population, promoting a better prognosis and greater physical and mental well-being.

With increasing longevity among people living with HIV, achieved by therapeutic advances, it is becoming increasingly relevant to adopt approaches that integrate psychological and emotional aspects into clinical treatment. Psychological support programs, such as psychotherapy and the promotion of healthy lifestyles, offer valuable tools for coping with the stress and emotional challenges brought on by the infection. In this way, combining medical treatment with psychosocial interventions can not only delay the progression to AIDS, but also provide more humanized care focused on integral well-being, broadening the prospects for health and quality of life.

In addition, research into HIV vaccines continues apace, with various approaches, including vaccines based on viral vectors and mRNA. In parallel, new treatments such as monoclonal antibodies and long-acting antiretrovirals offer encouraging prospects for more effective HIV control and even possible long-term eradication. These advances reinforce the importance of integrated management, combining emotional support, psychosocial interventions and therapeutic innovations in HIV care.

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731

REFERENCES

1. McIntosh R, et al. Medial prefrontal cortex connectivity with the nucleus accumbens is related to HIV serostatus, perceptions of psychological stress, and monocyte expression of TNF-a. Brain Behav Immun Health. 2024;41:100844.

2. Bekker LG, Hosek S, Laga M, Beyrer C. HIV infection. Nat Rev Dis Primers 2023; 9(1):42.

3. Battistini Garcia SA, Guzman N. Acquired immune deficiency syndrome CD4+ count. Treasure Island (FL): StatPearls Publishing; 2023 [citado 2025 jan 30]. Disponível em: https://www.ncbi.nlm.nih.gov/books/NBK513289/

4. Silvério, R. F. L. Cuidado às pessoas vivendo com HIV na atenção especializada: uma análise à luz da vulnerabilidade programática. 2023. 83 f. Dissertação (Mestrado em Saúde Coletiva) – Programa de Pós-Graduação em Saúde Coletiva, Instituto de Saúde Coletiva, Universidade Federal Fluminense, Niterói, 2023. Disponível em: https://app.uff.br/riuff/handle/1/33927. Acesso em: 25 jan. 2025.

5. Wong J, Sandler N, Kovacs C, Robbins G, Kamarulzaman A, Altfeld M. The many faces of immune activation in HIV-1 infection. Curr Opin HIV AIDS. 2020;15(2):113-120. Disponível em: https://journals.lww.com/co-hivandaids/Abstract/2020/03000/The_many_faces_of_immune_activation_in_HIV_1.9.aspx. Acesso em: 22 out. 2024.

6. Qin XM, Allan R, Park JY, Kim SH, Joo CH. Impact of exercise training and diet therapy on the physical fitness, quality of life, and immune response of people living with HIV/AIDS: a randomized controlled trial. BMC Public Health. 2024;24:730.

7. Ironson G, Hayward H. Do positive psychosocial factors predict disease progression in HIV-1? A review of the evidence. Psychosom Med. 2008;70(5):546-554.

8. Variava T, Watermeyer J. A systematic review exploring the psychosocial factors affecting adolescent access to HIV treatment services. Adolescents. 2022;3(1):10-40.

9. Hantsoo L, Hiles S, Eisenberger NI, Kiecolt-Glaser JK, Hagan K, Miller GE, Slusher AL, Boulware D, Carpenter L, Hudson P, Baker A, et al. Glucocorticoid–immune response to acute stress in women and men living with HIV. J Behav Med. 2019;42(6):1153-1158.

10. Rao D, Melendez-Torres GJ, John N, Perea-Burns S, Stein D, Lichtenstein B, Onorato N, Baral S. Gender differences in HIV risk and stigma: implications for prevention and treatment. J Acquir Immune Defic Syndr. 2015;68(Suppl 0):S100-S107.

11. Carr D, Smith A, Jones B. Chronic inflammation, immune metabolism, and T cell dysfunction in HIV infection. Front Immunol 2019; 10:85. Disponível em: https://www.frontiersin.org/articles/10.3389/fimmu.2019.00085/full. Acesso em: 22 out. 2024.

12. Page MJ, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;371:n71.

13. Kessler RC, Liu H, Kandel DB, Wang PS, Collins R, Tennen H, McLaughlin KA, Batten SV, Merikangas KR. Stressful life events and symptom onset in HIV infection. Am J Psychiatry. 1991;148(6):733-738.

14. Julnes PS, McDonald R, Schwabe C, Bianchi S, Berini C, Williams L, Klein L, Kaufman B, Gelman E, Lightman S, et al. The association between post-traumatic stress disorder and markers of inflammation and immune activation in HIV-infected individuals with controlled viremia. Psychosomatics. 2016;57(4):423-430.

15. Solomon GF, et al. Psychoneuroimmunology of health and long survival with HIV/AIDS: questionnaires, semistructured interviews, and laboratory findings. Int Congr Ser. 2002;1278:27-30.

16. Fumaz CR, et al. Psychological stress is associated with high levels of IL-6 in HIV-1 in-

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731

fected individuals on effective combined antiretroviral treatment. Brain Behav Immun. 2012;26(4):568-572.

17. Leserman J, Petitto JM, Gaynes BN, DeMasi R, Pacht E, McCutchan JA, McGwin G, McDaniel JS, McArthur J, McDonnell JJ, Waters D, et al. Progression to AIDS, a clinical AIDS condition and mortality: psychosocial and physiological predictors. Psychol Med. 2002;32(6):1059-1073.

18. Cole S, Kemeny M, Taylor S, Visscher B. Stress accelerates AIDS progression, undermines the effect of anti-HIV drugs. J Assoc Nurses AIDS Care 2002; 13(2):85.

19. Greeson JM, Batchelder AW, Safren SA, Leserman J, Pence BW, Hinkin CH, Ickovics JR, Ironson G, Schneiderman N, Costa PT, Miller EN. Psychological distress, killer lymphocytes, and disease severity in HIV/AIDS. Brain Behav Immun. 2008;22(6):901-911.

20. Rendina HJ, Siconolfi D, Tindle HA, Reilly ED, Grov C, Parsons JT, Karpiak SE. Psychosocial well-being and HIV-related immune health outcomes among HIV-positive older adults: support for a biopsychosocial model of HIV stigma and health. J Int Assoc Provid AIDS Care. 2019;18:1-11.

21. Birk TJ, McGrady A, MacArthur RD, Khuder SA. The effects of massage therapy alone and in combination with other complementary therapies on immune system measures and quality of life in human immunodeficiency virus. J Altern Complement Med 2000; 6(5):405-414.

22. Laperriere AR, et al. Exercise intervention attenuates emotional distress and natural killer cell decrements following notification of positive serologic status for HIV-1. Biofeedback Self Regul. 1990;15(3):229-242.

23. Corroon J, McGee M, Zajicek J, Percival SS. Pilot clinical trial of constitutional hydrotherapy in HIV+ adults. Adv Integr Med. 2018;5(1):23-28.

24. Mustafa T, et al. Association between exercise and HIV disease progression in a cohort of homosexual men. Ann Epidemiol. 1999;9(2):127-131.

25. Ghayomzadeh M, et al. Effect of a short-term lifestyle modification program on quality of life, anthropometric characteristics and CD4+ T cell count of HIV-infected patients in Tehran/Iran: a randomized controlled trial. Explore. 2019;15(4):308-315.

26. O'Cleirigh C, Safren SA, Mayer KH, Skeer M, Taylor S, Gifford AL, Safren M, Gebo KA. Written emotional disclosure and processing of trauma are associated with protected health status and immunity in people living with HIV/AIDS. Br J Health Psychol. 2008;13(1):81-84.

27. Alotiby A. Immunology of stress: a review article. J Clin Med [Internet]. 2024 [citado 2025 fev 3];13(21):6394.

28. Kołodziej J. Effects of stress on HIV infection progression. HIV AIDS Rev. 2016;15(1):13-16.

29. Costa LF, Jesus Medeiros R, Paungartner LM, Luft TD, Santos AP, Paiva TS, Fernandes MTC. Fatores psicossociais envolvidos na adesão ao tratamento do HIV/AIDS em adultos: revisão integrativa da literatura. Saúde Coletiva (Barueri), 2021; 11(61):4990-5005.

30. Calvetti PU, Müller MC, Nunes MLT, Bandeira DR. Fatores psicossociais associados à adesão ao tratamento e qualidade de vida em pessoas vivendo com HIV/AIDS no Brasil. J Bras Psiquiatr. 2014;63(1):8-15.

31. Gonzalez JS, Batchelder AW, Psaros C, Safren SA. Sex differences in the psychosocial impact of HIV disease. Curr HIV/AIDS Rep. 2011;8(4):236-242.

32. HIV.gov. Early antiretroviral therapy prevents non-AIDS outcomes in HIV-infected people. HIV.gov. 2015. Disponível em: https://www.hiv.gov/blog/early-antiretroviral-therapy-prevents-non-aids-outcomes-in-hiv-infected-people. Acesso em: 22 out. 20

DOI: https://doi.org/10.36489/saudecoletiva.2025v15i98p16716-16731