Original Article

Althea Medical Journal
ISSN Online: 2337-4330
https://doi.org/10.15850/amj.v12n4.4179

Cognitive Function and Nutritional Status in Pre-Elderly Individuals with Human Immunodeficiency Virus

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Abstract

Background: Human immunodeficiency virus (HIV) infection remains a global health issue, particularly in Africa and Asia. Cognitive impairment may early develop in individuals living with HIV and can therefore potentially impact nutritional status. This study aimed to assess the correlation between cognitive function and nutritional status in pre-elderly individuals with HIV.

Methods: A cross-sectional study was conducted from March 2023 to October 2024 among individuals living with HIV aged 45–59 years in Jakarta, Indonesia. Cognitive function was measured using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) and nutritional status was evaluated using body mass index (BMI). Data were analyzed using the Chi-square test with Jeffrey's Amazing Statistics Program (JASP).

Results: Of the 157 respondents, most were male (75.2%) with a mean age of 49±4.17 years. The majority were unmarried (44.6%), employed (70.1%), had incomes below the Jakarta minimum wage (74.5%), and had completed senior high school education (56.0%). Mild cognitive impairment was found in 70.7% of participants, whereas normal nutritional status was the most common (45.9%). However, no significant relationship was found between cognitive function and nutritional status (p=0.161).

Conclusion: Mild cognitive impairment is prevalent among pre-elderly individuals with HIV, most of whom have normal nutritional status. Although no significant relationship is observed between cognitive function and nutritional status, these findings highlight the importance of incorporating early cognitive screening into routine HIV care to support healthy aging and timely identification and management of cognitive decline.

Keywords: Cognitive impairment, HIV patient, nutritional status, pre-elderly

Althea Medical Journal.
2025;12(4):247–253

Received: February 13, 2025
Accepted: September 4, 2025
Published: December 31, 2025

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Introduction

Beyond the increase in life expectancy, people living with human immunodeficiency virus (PLHIV) face challenges associated with accelerated biological aging. HIV infection remains a global public health issue. According to the World Health Organization (WHO), approximately 39 million people were living with HIV worldwide in 2022.[1] In Indonesia, 13,279 HIV cases were recorded in 2023 among 1,230,023 individuals tested, with the majority of cases (65.5%) occurring in the 25–49 age group.[2] Globally, HIV has shifted from an acute and fatal disease into a chronic condition due to the widespread use of antiretroviral therapy (ART). This epidemiological transition has led to a "graying" of the HIV population. A

similar trend is emergingiIn Asia, including Indonesia, where an increasing number of PLHIV are surviving into middle age and older adulthood. Although ART has significantly improved survival, life expectancy among PLHIV remains lower than that of the general population.[3] As PLHIV live longer, they become increasingly vulnerable to age-related health problems, including cognitive impairment. Aging with HIV differs from typical aging due to accelerated immunosenescence and a higher risk of age-associated illnesses appearing earlier than expected.

Cognitive impairment is one of the most common complications among PLHIV and can occur even in individuals receiving ART, with reported prevalence ranging from 30% to 70%, depending on the population studied and assessment methods used. Cognitive impairment in HIV, often referred to as HIV-associated neurocognitive disorder (HAND), is associated with reduced quality of life, poorer adherence to ART, and increased morbidity. Importantly, cognitive decline tends to appear earlier in PLHIV compared to in the general population, driven by the combined effects of chronic viral infection, persistent inflammation, and potential ART-related neurotoxicity. One study reported that 68.2% of pre-elderly with HIV experienced mild cognitive impairment, and 13.6% had moderate cognitive impairment.[4] Another study found a higher prevalence of cognitive impairment among individuals aged 17–34 years (67.7%) compared to those aged 35–50 years (32.3%).[5]

Nutritional status is another critical determinant of health trajectory of HIV patients. A study in Brazil[6] reported the prevalence of malnutrition among HIV patients at 36.1%, whereas in Indonesia, it was reported at 58% in Bali,[7] and 9.2% in Semarang.[8] Cognitive impairment may affect eating patterns and nutritional intake, potentially leading to inadequate or imbalanced nutrition.[9] Conversely, increased cravings for carbohydrates and sweet foods have also been observed, which may contribute to overweight or obesity in pre-elderly living with HIV.[10] Nutritional status is commonly measured by body mass index (BMI), classified according to Asia-Pacific criteria. A value of <18.5 kg/m^2 indicates underweight, 18.5–22.9 kg/m^2 normal weight, 23–24.9 kg/m^2 overweight, and 25–29.9 kg/m^2 obesity.

The relationship between cognitive function and nutritional status among pre-elderly with HIV remains inconclusive. While several international studies have reported this associations, the findings are inconsistent, with some showing weak or unclear relationships. Moreover, most existing studies focus on young adults or elderly populations, leaving limited evidence regarding the pre-elderly age group (45–59 years). This life stage is particularly important because cognitive decline in HIV patients may begin appear earlier than in the general population, and nutritional vulnerabilities often emerge before old age. Identifying cognitive and nutritional changes during this transitional period is essential to enable timely interventions that may prevent further deterioration and improve long-term quality of life. Hence, this study aimed to determine the correlation between cognitive function and nutritional status among pre-elderly with HIV in Jakarta, Indonesia, to provide evidence for integrated screening, education and care strategies in HIV management.

Methods

This cross-sectional study was conducted from March 2023 to October 2024 using data derived from a larger study entitled *Sindrom Kerentaan dan Dampaknya pada Kualitas Hidup Pralansia dan Lansia dengan HIV*. Ethical clearance was obtained from the Research Ethics Committee of the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia (No. 15/04/KEP-FKIKUAJ/2024).

To minimize selection bias and enhance participant diversity, recruitment was conducted in collaboration with five community-based organizations serving PLHIV, namely Kios Atma Jaya, Yayasan Srikandi Sejati, Yayasan Pelita Ilmu (YPI), Yayasan Bandungwangi, and Ikatan Perempuan Positif Indonesia (IPPI). Counselors and health workers from these organizations assisted in identifying eligible participants and explaining the study's objectives. Individuals who expressed interest were then screened by trained researchers based on inclusion and exclusion criteria.

A consecutive sampling method was applied, where all eligible individuals who met the inclusion and exclusion criteria during the study period were invited to participate. This approach was selected to improve representativeness compared with convenience sampling, although it remains a non-probability technique and may limit the generalizability of findings beyond the study

population. A total of 157 participants were included, with a mean age of 49 years.

The inclusion criteria were individuals diagnosed with HIV by a doctor, receiving ART for at least one year, aged 45–59 years, and willing to participate by signing informed consent. Exclusion criteria included severe depression as assessed by the Patient Health Questionnaire-9 (PHQ-9) results, visual impairment, dyslexia or dysgraphia, and the presence of specific eating pattern such as reduced meal frequency, reduced meal portions, and altered dietary habits that could confound nutritional assessment.

The PHQ-9 was a validated and widely used instrument for screening and assessing the severity of depression in both clinical practice and research settings consisted of nine questions corresponding to diagnostic criteria for major depressive disorder outlined in the DSM-IV and remained applicable to the DSM-5 criteria. Each item evaluated core depressive symptoms such as low mood, loss of interest, sleep disturbances, appetite changes, fatigue, feelings of worthlessness, difficulty concentrating, psychomotor changes, and suicidal thoughts. The PHQ-9 was also useful for monitoring symptom progression and evaluating treatment response. Participants who screened positive for severe depression were excluded from the analysis and referred to mental health services available through partner organizations. Similarly, individuals reporting visual or literacy impairments were guided to appropriate care resources. Ethical considerations were strongly emphasized. Written consent was obtained after participants received detailed explanations of the study's objectives, procedures, risks, and benefits. Participant confidentiality was ensured through data anonymization and secure data storage.

Instrument selection was based on its reliability and validation in the Indonesian populations. Cognitive function was measured using the Indonesian version of the Montreal

Table 1 General Characteristics of the Study Population (n=157)

Variables	n	%
Gender		
Male	118	75.2
Female	39	24.8
Marital status		
Unmarried	70	44.6
Married	38	24.2
Divorced	23	14.6
Widowed	26	16.6
Employment status		
Unemployed	47	29.9
Employed	110	70.1
Economic status		
< Jakarta minimum wage	117	74.5
≥ Jakarta minimum wage	40	25.5
Education level		
Elementary school	16	10.2
Junior high school	26	16.6
Senior high school	88	56
Academy/college	27	17.2
Cognitive Function		
Normal	20	12.7
Mild cognitive impairment	111	70.7
Moderate cognitive impairment	25	15.9
Severe cognitive impairment	1	0.6
Nutritional status		
Underweight	21	13.4
Normal	72	45.9
Overweight	25	15.9
Obese	39	24.8

Table 2 Relationship Between Cognitive Function and Nutritional Status

Cognitive Function	Nutritional Status		p-value
	Normal	Abnormal*	
	n (%)	n (%)	
Normal	13 (65.0)	7 (35.0)	0.161
Mild cognitive impairment	49 (44.1)	62 (55.9)	
Moderate cognitive impairment	10 (38.5)	16 (61.5)	

Note: *Abnormal includes underweight, overweight and obese categories. Categories were combined to meet the assumptions of the Chi-square test.

Cognitive Assessment (MoCA-Ina), which had higher sensitivity (0.88) and specificity (0.74).[11] The MoCA-Ina had been adapted and validated cross-culturally, demonstrating sensitivity in detecting mild cognitive impairment, which was important when early changes might go undetected. Respondents were classified as having severe cognitive impairment if their score was <10, moderate cognitive impairment if their score was 10–17, mild cognitive impairment if their score was 18–25, and no cognitive impairment if their score was 26–30.[12]

Nutritional status was measured using BMI, calculated as body weight in kilograms divided by height in meters squared (kg/m^2). BMI was classified according to Asia-Pacific criteria as underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2) overweight (23–24.9 kg/m^2) obese (25–29.9 kg/m^2).[13]

Univariate analysis was employed to describe characteristic of participants, including gender, cognitive function, and nutritional status. Bivariate analysis using the Chi-square test was performed to assess the correlations between cognitive function and nutritional status. Statistical analyses were conducted using Jeffrey's Amazing Statistics Program (JASP), with statistical significance set at $p<0.05$.

Results

A total of 157 participants were included. Most participants were male (75.2%), with a mean age of 49 years (SD=4.17). Nearly half were unmarried (44.6%), the majority were employed (70.1%), and most had a montlhy income below the Jakarta minimum wage (74.5%), and the predominant educational level was senior high school (56%). Regarding cognitive status, mild cognitive impairment was the most prevalent category (70.7%). In terms of nutritional status, most participants had a normal BMI (45.9%) (Table 1).

Bivariate analysis using the Chi-square test showed no significant association between cognitive function and nutritional status (p=0.161). Participants with mild and moderate cognitive impairment were more frequently classified as having abnormal nutritional status; however, these differences did not reach statistical significance (Table 2).

Discussion

This study highlights the interplay between HIV-induced accelerated aging, cognitive decline, and nutritional status in the pre-elderly individuals living with HIV. However, no relationship has been found between cognitive function and nutritional status, a finding that contrast with reports from studies in China, India, and Nigeria.[13] One rational explanation for this discrepancy links to methodological aspects. For example, a cohort study in China has included intravenous drug users, a subgroup with a different risk profiles for both cognitive impairment and malnutrition, which may explain the from this study on pre-elderly with HIV.[14] Another study has reported a significant relationship between cognitive function and nutritional status in a non-HIV population residing in nursing homes, where more severe cognitive deficits are more common. This highlights the strong association between the severity of cognitive deficits and the likelihood of developing cognitive impairment, emphasizing the importance of early detection and intervention in high-risk individuals. The study has used the Mini Nutritional Assessment (MNA) and Mini-Mental State Examination (MMSE) to assess nutritional status and cognitive function.[15] The MNA is considered more comprehensive than the BMI by incorporating factors such as weight loss, eating habits, and mobility.[16,17] Meanwhile, MMSE is more commonly used to detect severe cognitive impairment, such as dementia.[18]

This study identifies a high prevalence of mild cognitive impairment among people

living with HIV, consistent with studies in Ethiopia (35.1%), Singapore (52.8%), and Italy (54.8%).[19–21] This high prevalence underscores the importance of early detection and education about cognitive function, as individuals with HIV are more vulnerable to faster cognitive impairment, especially in older age.[22] Routine cognitive screening using tools such as the Montreal Cognitive Assessment (MoCA) in HIV clinics allows earlier detection and timely intervention, potentially delaying the progression of impairment to HIV-associated dementia (HAD). Incorporating cognitive screening into integrated geriatric-HIV services may provide a multidisciplinary approach to managing the complex health needs of aging PLHIV.[23]

From a nutritional perspective, the predominance of normal BMI in this study may reflect effective health education and adherence to ART. Several studies have shown that ART-related nutritional counselling and regular follow-up can help maintain stable nutritional status among PLHIV.[7,24,25] Nevertheless, a substantial proportion of participants were overweight or obese, raising concerns about the long-term risks such as metabolic syndrome and cardiovascular disease. In contrast, a study conducted in Bali reported a high prevalence of malnutrition, often associated with opportunistic infections such as oral candidiasis, which can impair appetite and food intake.[6] These differences suggest that factors such as nutritional knowledge during ART therapy play a role in maintaining normal nutritional status in PLHIV, helping maintain a balanced diet, and preventing malnutrition or obesity.[26]

In terms of policy implications, integrating geriatric principles into HIV care is increasingly important. As more PLHIV survive into middle and older age, healthcare systems must adapt to address multimorbidity, not only virological suppression but also including the management of aging-related conditions such as cognitive decline, frailty, and nutritional imbalances. Multidisciplinary clinics involving physicians, nutritionists, psychologists, and social workers can provide more comprehensive care. These integrated services may improve medication adherence, patient satisfaction, and long-term health outcomes in the aging HIV population.

However, this study has several limitations. The cross-sectional design limits causal inference, and the reliance on BMI may be a barrier to detecting early-stage malnutrition, especially in aging HIV population, as BMI does not account for muscle mass, fat distribution, or recent weight changes. In addition, participants were recruited from selected community organizations in Jakarta, which may limit the generalizability of the findings to the broader national population. Uneven distribution across cognitive and nutritional categories may also have contributed to the lack of statistically significant associations. Future studies with larger, more evenly distributed samples, and longitudinal designs are needed to better clarify the relationship between cognitive function and nutritional status in pre-elderly individuals living with HIV. Furthermore, the future studies should also incorporate more comprehensive nutritional measurement tools, such as the Mini Nutritional Assessment (MNA), and consider additional determinants of nutritional status, including hormonal, inflammatory, and environmental factors, to provide a more accurate and specific evaluation of nutritional status.

In conclusion, there is no significant relationship between cognitive function and nutritional status, as measured by BMI, among pre-elderly individuals living with HIV in Jakarta. Interestingly, mild cognitive impairment is the most commonly identified cognitive issue in this population. These findings underscore the need to integrate early cognitive screening into routine HIV care, alongside nutrition education and counselling, to support healthy aging. A multidisciplinary, geriatric-oriented approach may facilate earlier identification of cognitive decline, promote nutritional well-being and improve overall quality of life in this vulnerable population.

Acknowledgements

The authors express their sincere appreciation to the primary data collection team, including Elizabeth Audrey Pricilla, Bernadetta Belvania Loviana, Budi Crisetyati, Chika Berlia Putri, Ghinaa Difanny Irhan, Fajrina Rizki Rasyiqiah, Ni Wahan Mutiara Suasti Suta, and Vanessa Lee, for their valuable contributions to data collection.

Authors' Contributions

FCP, V, APA, NH, and KK all made substantial contributions to this study. All authors were involved in study conceptualization, methodological design, and preparation of the initial manuscript draft. APA and NH provided critical input on study design, supervised the research process, and contributed to data interpretation. FCP, APA, and NH were

responsible for data collection, statistical analysis, and drafting the results section. V, NH, and KK contributed to data interpretation and provided expertise on public health implications. All authors reviewed, revised, and approved the final manuscript and agree to be accountable for all aspects of the work.

Conflict of Interest

The authors declare no conflict of interest.

Funding

This study was supported by Atma Jaya Catholic University of Indonesia through the *Hibah Desentralisasi* grant (Grant ID: 0431/III/LPPM-PM.10.01/03/2023).

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