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THE RELATIONSHIP BETWEEN CD4 COUNTS AND BODY MASS INDEX IN CHILDREN WITH HIV IN WANGAYA REGIONAL GENERAL HOSPITAL

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ABSTRACT

Background: By 2023, 1.37 million children under the age of 15 around the world were infected by HIV. Children with HIV have a high prevalence of stunting, underweight, and wasting associated with low CD4 count. The purpose of the study was to determine the relationship of CD4 counts to body mass index-for-age (BMI-for-age) in children with HIV.
Patients and Methods: This study was an analytic cross-sectional study at Wangaya Regional General Hospital in January-September 2024. Inclusion criteria are children who have been diagnosed with HIV, aged 0-18 years, have complete medical record data, including age, gender, weight, height, and CD4 counts. Exclusion criteria were incomplete data and patients with overweight and/or obesity. Data were analyzed using Chi-square test, which was processed with the SPSS program; p value <0.05 was considered significant.
Results: The number of respondents was 37 children. The mean age was 138.6 months. The gender was predominantly female (56.8%), 29 children (78.3%) had CD4 counts ≥500 cells/mL. The mean body weight was 38.8 kg, and the average height is 139.3 cm. BMI-for-age analysis found that 29 children (78.4%) was well-nourished. Opportunistic infections were experienced by 3 children. Analysis of the relationship between CD4 counts and BMI-for-age of children with HIV stated that there was no relationship between the two variables with a p-value of 0.65.
Conclusion: There was no association between CD4 count and BMI-for-age in pediatric patients with HIV. Further research is expected to include a larger number of subjects, more complete data, and a larger area.
Keywords: HIV, pediatric, CD4, body mass index

INTRODUCTION

By 2023, 40 million people worldwide will be infected with Human Immunodeficiency Virus (HIV) with 1.37 million of them being children under the age of 15. An estimated 685 children are infected with HIV every day.[1-2] UNICEF reports that by 2023 the highest prevalence of children <15 years with HIV will be in East and Southern Africa (around 810,000 cases).[3] Indonesia alone reported around 19,000 cases of children <15 years with HIV. This is a significant increase from the 1900 cases reported in 2010.[4] Approximately 250 children die from Acquired Immunodeficiency Syndrome (AIDS).[1-2]

Children with HIV often experience malnutrition and growth delays, with high prevalence of stunting, underweight, and wasting.[5] The prevalence of stunting in children with HIV is very high, with reported rates of 46.6% in Cambodia, 49.68% in East Africa, and 51.4% in sub-Saharan Africa. The prevalence of wasting was also significant, with 13.1% in Cambodia, 24.65% in East Africa, and 24.5% in sub-Saharan Africa. The prevalence of underweight was reported at 41.63% in East Africa and 39.0% in sub-Saharan Africa.[6-8] A study on the nutritional status of children with HIV in Indonesia showed 40% of participants were malnourished.[9]

Malnutrition, including stunting, wasting and underweight in children with HIV, is associated with poorer immune function, as indicated by lower CD4 counts.[10-12] Lower CD4 counts increase the risk of opportunistic infections such as tuberculosis and herpes zoster. CD4 count is a reliable marker for assessing disease progression and risk of complications.[13-4] Children with better nutritional status tend to have higher CD4 counts and better overall health outcomes.[10,11,15]

The purpose of this study was to determine the relationship between CD4 count and BMI-for-age in children with HIV at Wangaya Regional General Hospital. Knowledge of this relationship is essential for the clinical management of children with HIV. By understanding how CD4 count affect BMI-for-age, appropriate nutritional interventions can be designed to support the health of these children, improve their quality of life, and reduce HIV-related mortality and morbidity.

Patients and Methods

This study is a cross-sectional analytical study at Wangaya Regional General Hospital in January-September 2024. All research data comes from medical records with the approval of the Health Research Ethics Committee of Wangaya Regional General Hospital, with the Ethical Clearance Letter number 000.9.2/6835/RSUDW. This is an analytic unpaired study with a method of sampling that is consecutive sampling. Inclusion criteria were children who have been diagnosed with HIV, aged 0-18 years, who have complete medical record data, including age, gender, weight, height, and CD4 counts. Exclusion criteria were incomplete data and patients with overweight and/or obesity. CD4 counts were categorized into normal (CD4 ≥500 cells/mL) and decline (CD4 <500 cells/mL). BMI-for-age was also categorized

into well-nourished (BMI-for-age = -2 SD to -1 SD WHO Z score) and malnourished (BMI-for-age < -2 SD to -1 SD WHO Z score). The flow of participants is shown in Figure 1.

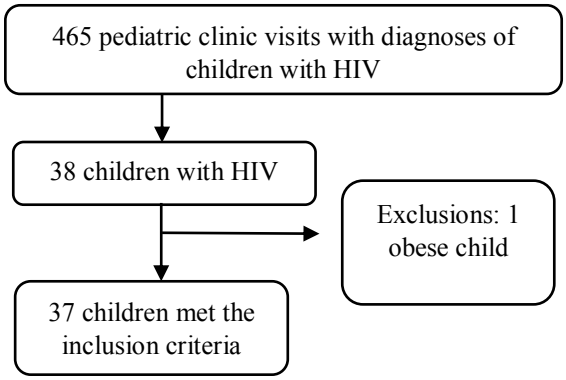

Figure 1. Flowchart of study participants.

From a total of 465 pediatric clinic visits with diagnoses of children with HIV during the duration of the study, only 38 children with HIV. The other data was the double data, which is the same patients who came every month control. One child was excluded due to obesity, leaving 37 eligible children to be included in the study. Data were analyzed using the Chi-square test, which was processed with the SPSS program version 29; *p value* <0.05 was considered significant.

RESULT

The number of participants in this study was 37 children. The mean age was 138.6 months, with the youngest age being 32 months and the oldest age being 211 months. The gender of this study was dominated by 21 female (56.8%), while 16 children (42.3%) were male. CD4 count <500 cells/µL were experienced by 8 children (21.6%) and 29 children (78.3%) had CD4 count ≥500 cells/µL. The mean weight of the patients was 38.8 kg, with a minimum of 10 kg and a maximum of 52 kg. The mean height was 139.3 cm. The lowest height was 82 cm and the highest was 135.5 cm. BMI-for-age analysis revealed that 8 children (21.6%) were malnourished and 29 children (78.4%) were well nourished. Opportunistic infections were present in 3 children, pulmonary tuberculosis in 2 children and urinary tract infection in 1 child. Demographic data are shown in Table 1.

Table 1. Demographics of respondents

Demographics	Mean (SD)*/ Proportion (%)
Age (months)	136.6 (44.8)
Gender	
Male	16 (43.2)
Female	21 (56.8)
Weight (kg)	30.7 (11.3)
Height (cm)	135.5 (19.7)
BMI-for-age*	
Malnourished	8 (21.6)
Well-nourished	29 (78.4)
CD4 count	
Decline	8 (21.6)
Normal	29 (78.4)
Opportunistic infections	
Yes	3 (8.1)
No	34 91.9)
Total	37 (100)

Analysis of the relationship between CD4 count and BMI-for-age in children with HIV indicated that there was no relationship between the two variables with a p-value of 0.65 with an OR of 0.53 (95% CI 0.1-2.8). The results of the analysis are shown in Table 2.

Table 2. Relationship between CD4 count and BMI-for-age in children with HIV

CD4 count	BMI-for-age		Total	*P-value*	OR (CI 95%)
	Malnourished	Well-nourished			
Decline	3 (37.5%)	5 (62.5%)	8	0.33	2.88 (0.51-16.17)
Normal	5 (17.2%)	24(82.8%))	29		
Total	8	29	37		

DISCUSSION

The mean age of the respondent was 11.5 years. Meanwhile, according to Schwarzenberg et al, nutritional interventions in the first 1000 days of life by providing protein, zinc, iron, choline, folate, iodine, vitamins A, D, B6, B12, and long-chain polyunsaturated fatty acids are critical for children's neurological development and mental health throughout life.[16] Research by Moghaddam et al. also states that good nutrition in the first 2 years of life, especially breast milk and complementary foods, can improve physical growth, mental development and overall health.[17] Therefore, the provision of nutritional interventions in the study population has passed the optimal period.

Females dominated this study with 21 children (56.8%). A study in Jamaica also found that children were significantly more likely to contract HIV through sexual transmission, with a female to male ratio of 4:1. High-risk behaviors among this group of adolescents include early sexual initiation, failure to use condoms, body piercing, drug use, tattooing and transactional sex.[18] HIV-infected girls generally have higher CD4 counts and percentages than boys and tend to initiate antiretroviral therapy (ART) earlier because of their health status.[19] Compared to boys, girls have lower quantities of HIV RNA, but following ART commencement, their CD4 T cell immune reconstitution is quicker and more thorough.[20]

In this study, only 8 children (21.6%) were malnourished, while 29 children (78.4%) were well nourished. Research at Wangaya Regional General Hospital from February to March 2022 found that 40% of the children were malnourished, so there has been a significant improvement in the nutrition of children with HIV within 2 years.[21] Children and adolescents with HIV have lower mean weight and height than the uninfected population.[22] Children with HIV have lower total body fat and extremity fat, but higher trunk fat compared to HIV-exposed but uninfected children. This may increase the risk of cardiovascular disease in adulthood.[23] Fat-free mass (FFM) is significantly lower in children with HIV than in the normal population, but FFM as a percentage of body weight is not significant in either children with HIV or the normal population. Low body weight and FFM in children with HIV are generally associated with an increased risk of mortality.[24] Weight monitoring is a significant predictor of clinical progression and treatment failure, independent of CD4 count.[25]

Children with HIV in resource-limited settings such as East Africa have a high prevalence of underweight, wasting and stunting. These conditions occur due to reduced food intake, malabsorption, and increased nutrient utilization and excretion.[7] However, a study in Uganda found that administration of highly active antiretroviral therapy (HAART) to children with HIV for 48 weeks resulted in a significant increase in weight and height according to the WHO Z-score curve, even in those who did not achieve full viral suppression.[26] The site of this study was in Indonesia, a developing country, specifically at Wangaya Regional General Hospital in Denpasar Regency. The management program for children with HIV at Wangaya Regional General Hospital is quite comprehensive. The management program starts during pregnancy, namely screening mothers with HIV, providing prophylaxis for babies born to mothers with HIV, giving ARVs (antiretrovirals) as early as possible after the child is diagnosed with HIV, and regularly monitoring the success of ARV therapy until the child is an adult. This can be seen in the dominance of well-nourished children with HIV.

CD4 counts in children with HIV in this study were 78.4% or 29 children within normal limits. Only 8 children (21.6%) with HIV had decreased CD4 counts below normal. In a similar study at Wangaya Regional General Hospital from March to June 2023, 10 children (27.8%) had decreased CD4 count.[27] Therefore, it can be concluded that there is an improvement in CD4 count in children with HIV at Wangaya Regional General Hospital. CD4 counts remain the most accurate indicator of a patient's clinical and immunological state.[28] Higher hemoglobin levels, younger age at ARV medication commencement, and the absence of opportunistic infections are all associated with improved CD4 count recovery in HIV patients.[29] In this study, consistent with the study. ARV therapy in the study patients was started as early as possible, where most respondents were diagnosed early when they had not experienced opportunistic infections and nutritional status was well-nourished so that CD4 count were normal in most respondents.

Opportunistic infections occurred in only 3 children in this study. Research in the United States from 1997 to 2016 also showed a decrease in cases of opportunistic infections in children with HIV.[30] A significant decrease in cases of opportunistic infections in HIV patients occurred in low- and middle-income countries within the first year of ARV administration.[31] The incidence of opportunistic infections in children with HIV receiving ARV therapy was 8.65 per 100 person-years. Factors that may increase the risk of opportunistic infections include low CD4 count, poor adherence to ARV use, and starting ARV therapy more than 7 days after HIV diagnosis.[32]

Analysis of the relationship between CD4 count and BMI-for-age in the study showed no significant relationship between the two variables, with a p-value of 0.33 and OR 2.88 (95% CI 0.51-16.17). This finding contradicts Dundagilla's study, which showed an association between CD4 count and height and weight in children with HIV. Low CD4 count are associated with a high incidence of stunting, underweight and wasting.[33] Kariminia's research also states that a weight-for-age WHO Z score below -3 SD is associated with a higher risk of death, and a weight-for-age below -2 SD is associated with immunological failure, regardless of CD4 count and age at ARV initiation.[25] Another study found that lower CD4 count in HIV-infected children were associated with higher mortality, and factors such as age, WHO clinical stage, history of tuberculosis, and BMI negatively affected the likelihood of survival.[34] The difference in results in this study may be due to the limited sample size and duration of the study.

Limitations of the study included lack of analysis of adherence and age at ARV initiation due to incomplete data. The study population was limited to one hospital. Further research is expected to include a larger number of subjects, more complete data and a wider area.

CONCLUSION

There is no association between CD4 count and BMI-for-age in pediatric patients with HIV.

Conflict of Interests

The researcher carried out this study on their own initiative without receiving any funding. This research has no conflicts of interest. The hospital has granted ethical approval for this study.

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