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The correlation between intake of energy, protein, fat of underweight and CD4+ count for children with hiv (The case study in the regional district and the city of Semarang)

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ABSTRAK

***Latar Belakang**: Peningkatan infeksi HIV anak di Indonesia searah dengan peningkatan presentase penularan AIDS dari ibu ke anaknya dari 3% (2013) menjadi 4,6% (2015). HIV anak menjalani terapi antiretroviral (ARV) untuk meningkatkan jumlah sel T-CD4+. Stadium klinis berat pada HIV anak menurunkan jumlah CD4+. Pemberian suplementasi zat gizi makro dan mikro dapat meningkatkan status gizi HIV anak yang menjalani ARV.*
***Tujuan**: Penelitian ini bertujuan untuk menganalisis hubungan asupan energi, protein, dan lemak terhadap status gizi berdasarkan berat badan dan jumlah CD4+ pada HIV anak di Kota dan Kabupaten Semarang.*
***Metode**: Penelitian ini menggunakan desain cross-sectional. Subjek yaitu anak usia 1-14 tahun sebanyak 31 subjek. Data dikumpulkan meliputi tinggi badan (TB), berat badan (BB), asupan zat gizi diperoleh dengan metode food recall 2x24 jam. Jumlah CD4+ melalui pemeriksaan darah subjek. Data dianalisis menggunakan uji Chi-square dan Regresi Logistik untuk menghitung Prevalence Rasio (PR).*
***Hasil**: Asupan protein memberikan risiko bermakna terhadap rendahnya jumlah CD4+ (PR=2,8; p=0,018; CI=1,331-5,891).*
***Kesimpulan**: Asupan gizi (energi, protein, lemak) tidak terkait dengan berat badan rendah (BB/U) dan stunting (TB/U). Asupan zat gizi yang berhubungan bermakna dengan jumlah CD4+ yang rendah (<500 sel/mm^3) hanya asupan protein. Asupan protein yang kurang pada HIV anak berisiko mengalami suppresi berat (jumlah CD4+ <500 sel/mm^3) sebesar 3,036 kali*

KATA KUNCI*: asupan gizi, HIV anak , jumlah CD4 +, stunting*

ABSTRACT

***Background:** The increase in HIV-infected children in Indonesia in line with the increase percentage of HIV positive children from mother to child transmission from 3% (2013) to 4.6% (2015). HIV-infected children using antiretroviral therapy (ARV) to increase the T-cells CD4+ count in HIV-infected children patients. Clinical stage heavily on lowering the CD4+ count for HIV-infected children. Supplementation of macro and micronutrients can improve the nutritional status of children using antiretroviral HIV. **Objectives**. The study aimed to analyze the relationship of intake of energy, protein, fat and clinical stage of nutritional status and CD4 counts for HIV-infected children in the regional district and the city of Semarang.*
***Methods**: A cross-sectional study in The Regional District and the City of Semarang. The subject of 31 HIV-infected children aged 1-14 years. Data collected included height, body weight, nutrient intake obtained by the method of Food Recall 2x24 hours. The number of CD4+ through blood test subjects. Data were analyzed using the Chi-Square test.*
***Results**: The intake of protein significantly increase the of low CD4+ count (PR = 3.036; p = 0.021; CI = 1.211 to 7.608 and PR = 2.8; p = 0.018; CI = 1.331 to 5.891). **Conclusions:** Nutrient intake (energy, protein, fat) is not associated with low body weight (WAZ), stunting (HAZ) and nutrient intake (energy, protein, fat) is not associated with low CD4 + incidence (<500 cells/mm3).*

KEYWORDS: *CD4+ count, HIV-infected children, nutrient intake, stunting*

INTRODUCTION

Infection Human Immunodeficiency Virus (HIV) is an infectious disease whose status rate is suppressed through global commitment goals in Millennium Development Goals (MDG's) in Indonesia together with improving maternal health and reducing child mortality (1-2). Globally, 400 children are infected with HIV every day and 290 children are at the stage of AIDS who die every day (2). HIV positive children have a higher risk of respiratory infections, diarrhea, and malaria and death compared with HIV negative children. Most HIV-infected children are malnourished with developmental delay and seizure disorders (2-4).

Population in the world in 2012, estimated there are ± 1.6 million children and adults who died from AIDS. The number increases in 2013, especially in children as much as 3.2 million (<15 years). Indonesia is at the concentrated epidemic level unless Papua Province is the fastest growing HIV epidemic in children and women in the Asian continent (5). The cumulative number of HIV and AIDS patients from 1 April 1987 to 30 September 2014 in Indonesia by category age, age 1-14 years have a cumulative total of 2.5% of 55,779 people. Central Java province ranks 6th highest for HIV / AIDS cases with total of 9,037 people with HIV and 3,767 AIDS patients with ratio between men and women is 1: 3 (6).Semarang city is the second highest HIV and AIDS area in Central Java and Semarang regency at the 14th place from 20 regencies/cities in Central Java (September 2015). Percentage of women is greater than 61.5% of men. This percentage increase was in line with mother to child transmission of AIDS by 4.6% and the percentage of HIV positive children by 3%. Based on data from Semarang City Health Office (2015), the amount of HIV children in Semarang City and Semarang Regency aged 1-14 years from the Semarang health service was 44 people (7).

HIV positive children are important for antiretroviral treatment (ARV) to increase CD4+ T-cell count and reduce viral load and reduce mortality. The risk factor for HIV-infected children starting ARVs is inadequate nutritional status. Intake of macronutrients plays a major role in improving the child's HIV nutritional status. Macro-nutritional supplementation for HIV starting ARVs is beneficial in increasing energy and protein intake as well as weight gain but has no effect on immunodeficiency and death (8-10). Research of children aged 1.5-15 years in India (2015) for 12 months, HIV-infected children have less energy intake in all age groups less than 50% of their needs. Nutrition status of HIV children in this study was stunting (59.7%), weightless (46.8%). The percentage is higher in HIV positive children who are not receiving ARV and who have morbidity (8)

HIV of children who are in clinical stages 3 and 4 have decreased immunity and low CD4 + counts. At this stage, HIV is susceptible to opportunistic infections (OIs) (5). Research in RSUP. Adam Malik Medan (2012), children aged 0-60 months with clinical HIV infection have oral candidiasis (34%) and followed by prolonged diarrhea (26.4%) and tuberculosis (24.5%) (11). Studies in infants aged 2-12 weeks, appropriate antiretroviral and earlier proved to be clinically better than HIV for children who did not receive antiretroviral therapy or were late for antiretroviral treatment (12). HIV-infected children with stage III are at risk of dying 3.74 times compared with HIV in stage 1 and 2 children. HIV-infected children on second-line ARV drugs are at risk of dying 1.33 times compared with first-line treatment with poor nutrition (13).

This study aims to analyze the relationship between intake of energy, protein, lemak of nutritional status and CD4+ count for children with HIV in The Regional District and The City Of Semarang

MATERIALS AND METHODS

This research was an observational analytic research with a *cross-sectional* design. The research was conducted in February until June 2016 for RSUP. Dr. Kariadi, RSUD. Tugurejo, RS. Panti Wilasa Citarum, BKPM Semarang, and the Melati Support Group. The population used were children who diagnosed with HIV. The method of selecting the sample by consecutive sampling was 31 respondents consisting of 18 male and 13 female.

Instrument used in the form of questionnaire data characteristic of sample, Height by using Microtoice with an accuracy of 0.1 cm, Body weight was measured using a Camry brand stepping scale with an accuracy of 0.1 kg, nutrient intake through method of *Food Recall* 2x24 hour, according to the CD4+ count data through the laboratory test. Independent variables are nutrient intake which consists of energy, protein, fat intake. Nutrient intake is categorized as less (<100%) and enough (≥ 100%) (14).

The dependent variables in this study were nutritional status based on height-for-age Z-scores (HAZ), weight-for-age Z-scores (WAZ) and CD4+ count. HAZ is categorized as stunting (<-2 SD) and normal (≥2 SD). WAZ is categorized as underweight (<-2 SD) and normal (≥2 SD) (15). CD4+ counts are categorized as heavy suppression (<500 cells / mm3) and no suppression (≥ 500 cells / mm3) (5,16)

The data collected were analyzed using the chi-square test to see the relationship between intake of energy, protein, fat of nutritional status and CD4+ count for children with HIV using SPSS version 16, while the sample characteristic data were analyzed descriptively. Before the research was carried out, parents were given an explanation of the advantages and disadvantages and all the processes carried out during the research. If parents are willing and allow their children to be the subject of research, parents are asked to sign informed consent. This research has been approved through the hearing of the Health Research Ethics Commission (KEPK) of the Faculty of Medicine, Diponegoro University, Semarang with No.660 / EC / FK-RSDK / 2015.

RESULTS

General characteristics of the study sample

In **Table 1** it can be seen that female respondent are more male than female respondents. Based on means, the age of the study respondents was between 5.7 years and CD4+ count was low (772.39c/uL).

Characteristics of research subjects based on nutritional intake (energy, protein, fat), CD4 + count and nutritional status

In **Table 2**, shows that most of the subjects had less energy intake (64.5%) while for protein intake, more fat was sufficiently categorized. In this research, CD4+ counts with heavy suppression category (54.8%) than no suppression (45.2%). The number of HIV children who are short (HAZ) is more (51.6%). This figure indicates that low and stunting CD4+ counts are a dominant problem in childhood HIV in the regional district and the city of Semarang

Relationship of nutrient intake with nutritional status

In **Table 3**, shows that there is a no significant relationship between nutrient intake (energy, protein, fat) with nutritional status of indicator WAZ ($p < 0.05$). The value of Prevalence Rate (PR), the intake of macronutrients, proving the intake of macronutrients is not a risk factor for stunting. In **Table 4**, shows that there is no significant relationship between nutrient intake (energy, protein, fat) with short / stunting events ($p > 0.05$).

Table 1. General characteristics of the study sample

Characteristics	n	%	Mean (SD)	SD	Minimum Value	Maximum Value
Age (year)	31	100	5.72	2.99	1.3	13
Sex						
Male	18	58.1				
Female	13	41.9				
Weight (kg)	31	100	17.45	6.00	8.0	38
Height (cm)	31	100	104.9	15.85	71	135.7
WAZ	28	90.2	-1.14	1.69	2.43	-4.78
HAZ	31	100	-1.81	1.58	2.73	-3.43
CD4+ count (c/uL)	31	100	772.39	618.32	16	2341

Table 2. Characteristics of research subjects based on nutrient intake (energy, protein, fat), CD4 + count and nutritional status

Variable	n=31	%
Energy intake (Kcal)		
Less	20	64.5
Enough	11	35.5
Protein intake (g)		
Less	14	45.2
Enough	17	54.8
Fat intake (g)		
Less	13	41.9
Enough	18	58.1
CD4+ count		
heavy suppression	17	54.8
No suppression	14	45.2
Nutritional status (WAZ)		
Underweight	14	45.2
Normal	17	54.8
Nutritional status (HAZ)		
Stunting	16	51.6
Normal	15	48.4

Relationship of nutrient intake with CD4+ count

In **Table 5**, shows that there was a significant association between protein intake with CD4+count ($p<0.05$). PR values for protein were 3.036 with 95% CI 1.211-7.608 which indicated that protein was a low-risk suppression factor (CD4+<500 cells/ mm3). This means that an HIV-infected child with a protein intake is less likely to experience a heavy suppression (CD4+ counts <500 cells / mm3) of 3.036 times.

DISCUSSION

General characteristics of the study sample

Based on the average age, CD4 + counts are less good because CD4 + count is <1000 c/uL (5.16). Based on the mean Z-score in general, the research subjects have good nutritional status but

Table 3. ***Analysis of nutrient intake relationship with nutritional status of WAZ***

Variable	Nutritional Status (WAZ)		PR (95%CI)	p value
	Underweight	Normal		
Energy intake (Kcal)				
Less	12 (60.0%)	8 (40.0%)	3.300 (0.896-12.153)	0.057
Enough	2 (18.2%)	9 (81.8%)		
Protein intake (g)				
Less	7 (50.0%)	7 (50.0%)	1.214 (0.561-2.630)	0.898
Enough	7 (41.2%)	10 (58.8%)		
Fat intake (g)				
Less	7 (53.8%)	6 (46.2%)	1.383 (0.643-2.982)	0.645
Enough	7 (38.9%)	11 (61.1%)		

Table 4. ***Analysis of nutrient intake relationship with nutritional status of HAZ***

Variable	Nutritional Status (HAZ)		PR (95%CI)	p value
	Stunting	Normal		
Energy intake (Kcal)				
Less	11 (55.0%)	9 (45.0%)	1.210 (0.566-2.585)	0.894
Enough	5 (45.5%)	6 (54.5%)		
Protein intake (g)				
Less	6 (42.9%)	8 (57.1%)	0.729 (0.353-1.503)	0.600
Enough	10 (58.8%)	7 (41.2%)		
Fat intake (g)				
Less	5 (38.5%)	8 (61.5%)	0.629 (0.288-1.373)	0.378
Enough	11 (61.1%)	7 (38.9%)		

Tabel 5. ***Analysis of nutrient intake relationship with of CD4+ count***

Variable	Jumlah CD4+		PR (95%CI)	Nilai p
	Heavy suppression	No Suppression		
Energy intake (Kcal)				
Less	9 (45.0%)	11 (55.0%)	0.990 (0.441-2.222)	1.000
Enough	5 (45.5%)	6 (54.5%)		
Protein intake (g)				
Less	10 (71.4%)	4 (28.6%)	3.036 (1.211-7.608)	0.021*
Enough	4 (23.5%)	13 (76.5%)		
Fat intake (g)				
Less	7 (53.8%)	6 (46.2%)	1.385 (0.643-2.982)	0.645
Enough	7 (38.9%)	11 (61.6%)		

stunting. Stunting occurring in HIV children is likely related to the HIV virus which disrupts the body's metabolism which has an impact on its growth. Child research in India (2012), poor sustained intake of food interferes with childhood HIV growth (17).

Characteristics of research subjects based on nutritional intake (energy, protein, fat), CD4 + count and nutritional status

Less energy intake such as the results of the above research if it occurs over a long period of time can cause malnutrition or insufficiency (5,16). A low CD4+ count suggests a child's immunologic status is low and susceptible to opportunistic infectious disease (13,16). CD4+ count may increase if antiretroviral is administered regularly and caloric intake as needed. Moderate clinical staging is a stage in which an HIV child has malnutrition without cause, diarrhea, and some minor infectious diseases (16). The clinical stages of childhood HIV will be more severe and accompanied by respiratory and skin disorders and high viral load if not regularly or inadequately antiretroviral therapy (8).

Stunting occurring in childhood HIV may be linked to an HIV virus that interferes with its metabolism which affects its growth (15). Less sustained intake of food also interferes with the child's HIV growth (17). More dominant stunting occurs in rural areas with less economic status, frequent exposure to diarrhea, and not getting exclusive breastfeeding, incomplete vaccinations, and low maternal education. The risk of stunting in these children is 5% and the risk is very high at age <2 years (18). This is consistent with the results of Swetha's study (2015), of 77 children with HIV aged 1.5-15 years, 59.7% stunted. HIV infected children not on ART have a high viral load and a low CD4 + count. This increases the risk of morbidity in HIV children (8).

Relationship of energy intake with nutritional status

The results of this study stated that there was no significant relationship between energy intake and nutritional status (WAZ and HAZ). This study is not in line with HIV studies of children aged 2-14 years in Tanzania, less energy intake occurs in children who have less weight (WAZ) (19). Child HIV research in Hyderabad, India (2009-2011), of HIV-infected children aged 1.5 to 15 years, males are more likely to have less nutritional status. This is because, in this study, boys have lower food intake than women (8). Boys are more active than girls so that their energy needs are more. So that when calculating energy requirements in each study subject pay attention to age, BB, gender, activity factor and multiplied by the chase factor to grow if it has a Z score <2 (15).

The need for higher energy intake in children's HIV than healthy children is due to increased body metabolism against HIV virus in the body (16). Less energy intake in children's HIV increases the rate of malnutrition (WHZ) by 46.8% and stunting (HAZ) of 19.5 % (20). In this study subjects with low BB with less energy intake category of 60%. Low weight occurs because of an imbalance between

energy intake with energy released by the body for the body's metabolism. In this study, most of the samples had a low energy intake (64.5%). This imbalance if continued over the long term will cause a decrease in BB and if not addressed soon will result in low BB and decreased body resistance to infection (BB not according to age standard) (16,20).

Weight loss is influenced by poor consumption patterns. Opportunistic infections and their effects on food intake, impaired absorption, and metabolism of food can cause weight loss (21). According to Sumiyati's research (2015), consumption patterns that are lacking in HIV enable opportunistic infections to be 7.47 times greater than those that have good consumption patterns. Opportunistic infections that commonly occur in HIV patients are Tuberculosis (TB) (31.82%), diarrhea (22.73%), diarrhea and TB (18.18%), TB and oral thrush (13.64%), diarrhea and hepatitis (4.55%), diarrhea with oral thrush (4.55%), oral thrush with diarrhea and with hepatitis (4.55%) (22). BB decrease >10% occur in HIV child stage III either accompanied by infectious diseases or fever for 30 days . In the period of malnutrition, energy needs will rise 50-100% to recover the BB and BB normal according to age. HIV children who experience malnutrition need the same energy and protein intake as malnourished children (BMI/U) without HIV who are not infected with HIV (20).

Relationship of protein intake with nutritional status

The results of this study indicate there is no significant relationship between protein intake with nutritional status (WAZ and HAZ). This study is in line with a research review (2013), of the 14 studies discussed, supplementing foods containing high energy and proteins such as amino acids or Spirulina did not significantly increase body weight but increased energy and protein intake in the study subjects (23). The study was not aligned with studies of children and adolescents in Brazil, Children and adolescents treated with antiretroviral therapy and adequate intake of energy and protein in HIV-infected children show a better BMI / U nutritional status) than with a healthy control group (HIV) without ARV (24).

HIV healthy children are children who do not lose weight or low weight or stunting and other infectious diseases. This may occur when an HIV-infected child has adequate protein intake in addition to adequate intake of energy dam and fat and micronutrients (20). In this study, some toddlers have underweight and stunting. In this study, the overall had underweight 45.2%, stunting 51.6% with subjects who had less protein intake by 45.2%. Dominant protein deficiency occurs in low socioeconomic communities. Poor protein deficiency in severe stages leads to kwashiorkor (25). In the subjects of this study the symptoms of kwashiorkor seen were inhibited growth seen from unsuitable TB age, decreased appetite, depigmented skin, dry, scaly, cracked (5,16,20). Problem these skins in childhood HIV are often made a referral to be consulted by a local specialist healthcare provider.

Adequate protein intake in children avoids loss of tissue during illness and restores it during recovery so that the proportion of fat and free fat mass can be maintained (20,25). Sufficient levels of adequate protein intake significantly improve nutritional status in childhood infections. According to Pettatolo's research, giving cork fish extract supplements for 4 weeks in HIV / AIDS patients can increase albumin levels (26). Amount and type of protein on HIV patients need attention and are advised to adjust to the needs that serve as protein stores in the body. Protein deposits are needed during inflammation and fever (16,20). Fever, sepsis, surgery, trauma, and injury can increase protein catabolism, resulting in an increase in protein requirement up to 1.5-2 g / kg BW (16,27). The child's HIV protein intake needs to be increased to reduce the risk of death during childhood HIV.

Relationship of fat intake with nutritional status

The results of this study indicate no significant relationship between fat intake with nutritional status (WAZ and HAZ). This study is not in line with HIV-infected children in Hyderabad, India (2009-2011) the association between percentage fat and nutritional status (8). Fat is the largest body energy reserve. Body fat is generally stored mostly (50%) in the underlying tissues of the skin, around the organs

in the stomach organ 45% and 5% intramuscular tissue. The fat layer underneath the skin isolates the body and prevents rapid body heat loss, thereby enabling the fat to maintain body temperature. Body fat cannot be perfectly hydrolyzed without the presence of carbohydrates (KH). Without KH there will be a result of burning fat in the form of ketones which can cause ketosis. Fat does not completely replace KH as an energy source. The brain, nervous system and red blood cells require glucose as a source of energy (16,20)

Essential fatty acids are fatty acids that can not be made in the body. Two essential fatty acids are omega 6 and omega 3 fatty acids. Essential fatty acids in daily life are obtained from marine fish, eggs, soybeans, fish oils. In children, cholesterol with fatty acids makes up 75% of the nerve wrappings in the brain that accelerates the delivery of nerve impulses (24). Fat intake in study subjects with less than 41.9%. Less fat intake indicates the presence of essential fatty acid intake is also lacking. Inadequate intake of essential fats decreases the delivery power of nerve impulses, resulting in less information loss and lower levels of intelligence in childhood HIV.

Essential fatty acids show more and more evidence of its benefits in human health. Its use is focused on the prevention of large body chronic diseases, especially regarding the reduction of cardiovascular risk, cognitive health, and eye health problems. Fatty fish is the most important natural source of EPA and DHA. The balance between n-6 and n-3 in the diet seems very important for better human health (27). Total fat intake, alpha-linolenic acid (ALA) and DHA intake are often low among pregnant and lactating women, infants and children in developing countries. To increase ALA intake by consuming plant food products (soybeans and oils, canola oil, and foods containing these products such as lipid-based nutritional supplements) have been proven worth it. To increase DHA status by increasing fish consumption or DHA fortification (28).

Relationship of energy intake with CD4 + count

The results of this study indicate that there is no relationship between energy intake with CD4+count. This study is not in line with research in South Africa (2010-2011), nutritional supplementation (388 kcal/day) for 6 months can increase CD4 + count on average by 151 cells / mm3. Nutritional supplementation was associated with CD4+count (p=0.002) (14). The study was supported by research in India (2009-2011), for 6 months observed, subjects were given energy intake according to the nutritional adequacy rate of his age. The energy intake has a significant relationship to increase the CD4+count (p <0.05) (8).

In this study HIV children were heavily suppressed (CD4 count + <500 cells/mm3) which had less energy intake by 45%. Energy intake is less likely to occur in HIV children with severe suppression. Less energy intake lowers weight. A decrease of 1.9 kg BB reduced CD4+count by 100 cells / mm3 (20). Less energy intake could not overcome the body's hypermetabolism due to the HIV virus so that it would affect the absorption of other nutrients. If this happens continuously it will increase opportunistic disease (16,20).

Infeksi opportunistic pada pasien HIV dapat meningkatkan terjadinya mortalitas. Infeksi ini terjadi karena adanya penurunan imunitas tubuh yang disebabkan oleh malnutrisi Malnutrisi terjadi karena kurangnya asupan gizi dan aktifitas fisik. Asupan zat gizi yang optimal merupakan tambahan penting dalam perawatan klinis pasien dengan HIV. Intervensi gizi dapat meningkatkan kualitas dan rentang hidup dan meningkatkan ketahanan pasien terhadap infeksi oportunistik. AKtivitas fisik yang sedang dapat meningkatkan kekebalan tubuh dan mengurangi infeksi akut dan memerangi kelainan metabolik (29-30).

Relationship of protein intake with CD4 + count

The results of this study indicate that there is a significant relationship between protein intake with CD4+count (p<0.05). The PR value for protein is 3.036 with 95% CI 1,211-7,608 which indicates that protein is a risk factor for severe suppression (CD4 + <500 cell / mm3). This means that an HIV-infected child with a protein intake is less likely to experience a heavy suppression of 3.036 times. Review of research in South Africa (2015), protein intake can be increased by giving high energy and

protein supplementation. This supplementation can increase the body weight but does not affect the increase in CD4 + count. This supplementation also does not reduce the occurrence of morbidity and mortality in childhood HIV (8). Study in South India (2005-2007, 2011), It was proven that supplementation of high-energy high protein for 6 months could increase CD4 + count by 132% and change in protein intake, albumin in HIV-TB patients. Supplementation of macronutrients has been shown to improve body immunity and prevent other infectious diseases and increase CD4 + count(31-32). Research in Zambia (2011), a 5 g / L increase in albumin can significantly reduce 40% of the dangers of death in HIV-infected and malnourished HIV patients (33).

HIV children with poor protein intake in this study who had severe suppression (CD4+<500 cells/mm3) were 71.4%. Less protein intake in HIV children has the possibility to reduce CD4+count. Protein intake is less affect the body's ability to fight infection. Decreased ability to produce antibodies against bacteria or viruses that enter the body. This decreased immune system is what causes other infections to occur in HIV children such as diarrhea and tuberculosis (17,20). Insufficient protein intake in HIV children will affect the immune cell system. HIV virus can follow the blood circulation directly by penetrating the blood vessel wall. After 4-11 days, HIV attempts to enter the target cell. The cells targeted by HIV are cells that are capable of expressing CD4+receptors. These CD4+receptors are found on the surface of T lymphocytes, monocytes, macrophages, Langerhans's, dendritic cells, astrocytes, microglia. Furthermore, the HIV virus attacks the DNA and RNA formed from the circulation of amino acids in the body. HIV virus can convert RNA to DNA in infected cells, then integrate with host cell DNA then replicate to new virus (5,20).

Less protein intake in children's HIV will result in the body's immune system getting weakened. Amino acids are important components in the formation of immune system cells. If protein intake is less then the amino acids that form immune cells that have CD4+receptors include those in the liver and spinal cord in small amounts. The HIV virus attacks cells that have CD4+receptors on the cell surface of T cells, monocytes, and macrophages and dendritic cells, but HIV lives better in T lymphocytes than other cells. T cells, as well as macrophages in the intestine, are the main reservoir of HIV in asymptomatic HIV stage children is the lymph node where the virus is found in large quantities attached to the follicular dendritic cells. In advanced infections, these cells will be damaged and the number of viruses in the lymph node is also less. The infected monocytes and lymphocytes will cause the virus to spread throughout the body; HIV will enter the brain through monocytes or infection in endothelial cells (20). This theory supports the results of research on HIV children aged 1-12 years (2006-2011), HIV children who received good ART with CD4 + counts had good neurological development such as children who were not especially infected with HIV during infancy (34). Infants who acquired HIV during fetal and early life tended to display poorer mean developmental scores than HIV-unexposed children. Mean motor and cognitive scores were consistently 1 to 2 SDs below the population mean. Mean scores improved if the infant received treatment before 12 weeks and/or a more complex antiretroviral regimen. Older HIV-infected children treated with highly active antiretroviral therapy demonstrated near normal global mean neurocognitive scores; subtle differences in language, memory, and behavior remained. HIV-exposed-uninfected children treated with antiretrovirals demonstrated subtle speech and language delay, although not universally (35)

Relationship of fat intake with CD4 + count

The results of this study indicate that there is no association between fat intake with severe suppression (CD4+count <500 cells/mm3). This study is in line with a child HIV study in Hyderabad, India (2009-2011), fat intake has no CD4+relation. Fat intake> 100% of RDA in HIV children in both the control group (without ARV) with the case group (ARV). Adequate fat intake in HIV children with ARVs increases in body fat mass during 6 months of supplementation. The increase in body fat mass had a significant association with CD4+count (p<0.010). The average increase in CD4 + cell count was

1058.97 ± 866.16 cells / mm3 to 1173.96 ± 659.55 cells/mm3 (8).

HIV children with less fat intake in this study had 53.8% heavy suppression. This suggests that most HIV-infants with less fat intake generally have a CD4+ <500sel/mm3 cell count. Less fat intake in childhood HIV indicates the disruption of fat-soluble vitamin absorption in the body of Vitamin A, D, E, K. Vitamin A and vitamin E are vitamins that have a role in the body's immune system. Vitamin A affects the differentiation of B lymphocytes that play a role in humoral immune processes. Vitamin E and selenium are closely related to each other through glutathione peroxidase which is an antioxidant enzyme (20,36). This is likely to cause low CD4+ counts in HIV-infected children. Therefore, to increase fat intake in HIV children, one of them is to increase the intake of omega 3 and omega 6 fats, especially docosahexaenoic acid (DHA), known to play an important role in brain and retinal development. Increased DHA intake is by consuming fish or DHA fortification, but this approach may be more expensive. In addition, breastfeeding for up to 2 years and so on is recommended to ensure adequate intake of essential fats early in life. This benefit is more pronounced in children (37).

Factors that cause fat metabolism disorders in the body not only due to less fat intake but ARV also contributes. One of the antiretroviral drugs proven to interfere with fat metabolism is a protease inhibitor (PI). PI was significantly associated with triglycerides and LDL-cholesterol values in childhood HIV. Increased triglycerides and LDL-cholesterol values are also associated with increased fat mass. Increasing the body fat mass improves the child's HIV quality of life. Quality of life can be seen from the improvement of the skin disease or other infections (19,38). Quality of life is supported by nutrient intake, physical activity consultation. Handling nutritional intake of HIV in children, namely with adequate intake of macro and micronutrients (intake of energy, fat, fiber, calcium, vitamins, A, D, E, K and vitamin C) can increase a low body mass index for age and z-score is high-age and can suppress the spread of the virus and increase immunity (39-40). Other treatments for the quality of life are nutritional counseling and exercise interventions effective for treating obesity, fat redistribution, and metabolic disorders. Physical activity interventions improve body composition, strength, and fitness in people infected with HIV. Collectively, evidence suggests that a proactive approach to nutrition and physical activity guidance and intervention can improve outcomes and help undo the poor metabolic, cardiovascular and psychological consequences of HIV and its treatment (36).

CONCLUSION AND RECOMMENDATION

Based on the results of research and data analysis can be concluded that : Nutrient intake (energy, protein, fat) is not associated with low body weight (WAZ),stunting (HAZ) and nutrient intake (energy, protein, fat) is not associated with low CD4 + incidence (<500 cells / mm3).

Based on the conclusions above, it is suggested that quantitative research is carried out supported by qualitative research in obtaining information related to gastrointestinal problems and complaints related to infectious diseases suffered in a month, physical activity and micronutrients (vitamin D, selenium and calcium).

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