ORIGINAL RESEARCH

THE ASSOCIATION BETWEEN BODY MASS INDEX AND HANDGRIP STRENGTH AMONG HIV AND AIDS INPATIENTS

Hubungan antara Indeks Massa Tubuh dan Kekuatan Genggaman Tangan Pasien Rawat Inap HIV dan AIDS

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ABSTRACT

Background: Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) patients are vulnerable to a decreasing nutritional status. Nutritional status is one of the factors that can affect body mass, which correlates with handgrip strength. **Purpose:** This study aims to describe the body mass index (BMI) and handgrip strength profiles of HIV and AIDS inpatients. **Method:** A *cross-sectional* design was used in this observational study. The population were HIV and AIDS inpatients between August and September 2018. The patients were selected using a *purposive sampling* technique; 16 patients met the inclusion criteria of the study. Primary data were collected via questionnaire and measuring handgrip strength, while secondary data were collected from the patients' medical records. A descriptive test was used for the analysis. **Results:** Most of the HIV and AIDS inpatients were male (81.25%), were between 20 and 39 years old (75.00%), were employed (50.00%), had a middle education level (62.50%), had been hospitalized for four to five days (categorized as a short length of stay; 75.00%), had been diagnosed with HIV for five years or more (87.50%), and were in the third HIV clinical stage (68.75%). The HIV and AIDS inpatients had an average BMI of 19.19 ± 2.48 kg/m^2; with 18.75% severely underweight patients, 25% mildly underweight patients, and no overweight patients. The average handgrip strength was 20.58 ± 10.6 kg and 43.75% of patients were classified as having a low handgrip strength. **Conclusion:** Malnutrition still leads to nutritional problems in HIV and AIDS inpatients.

ABSTRAK

Latar Belakang: Pasien dengan HIV dan AIDS rentan mengalami penurunan status gizi. Massa tubuh yang berhubungan dengan kekuatan genggaman tangan dapat dipengaruhi banyak faktor salah

satunya status gizi. **Tujuan:** *Penelitian ini bertujuan untuk mengetahui profil indeks massa tubuh (IMT) dan kekuatan genggaman tangan pasien rawat inap HIV dan AIDS .* **Metode:** *Rancang bangun cross-sectional digunakan pada penelitian observasional ini. Populasi penelitian yaitu seluruh pasien rawat inap HIV dan AIDS antara Agustus sampai September 2018. Jumlah sampel yang sesuai dengan kriteria inklusi penelitian yaitu 16 pasien berdasarkan teknik purposive sampling. Data primer dikumpulkan melalui kuesioner dan pengukuran kekuatan genggaman tangan sedangkan data sekunder dikumpulkan dari rekam medis pasien. Dilakukan dengan uji deskriptif dalam penelitian ini.* **Hasil:** *Sebagian besar pasien rawat inap HIV dan AIDS dalam penelitian ini berusia 20-39 tahun (75,00%), berjenis kelamin laki-laki (81,25%), bekerja sebagai pegawai swasta (50,00%), memiliki tingkat pendidikan menengah (62,50%), dirawat inap selama 4 atau 5 hari yang digolongkan menjadi masa rawat pendek (75,00%), telah didiagnosa HIV selama ≤5 tahun (87,50%), dan telah berada pada stadium klinis 3 (68,75%). Rata-rata IMT pasien sebesar $19,19\pm2,48$ kg/m^2; sebanyak 18,75% pasien dengan status gizi kurang tingkat berat, 25% pasien status gizi kurang tingkat ringan dan tidak ada pasien terdeteksi sebagai status gizi lebih. Rata-rata kekuatan genggaman tangan sebesar $20,58\pm10,6$ kg dan sebanyak 43,75% mempunyai kekuatan genggaman tangan lemah.* **Kesimpulan:** *Malnutrisi masih menjadi masalah gizi pada pasien rawat inap HIV dan AIDS .*

INTRODUCTION

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) is still considered a global health problem. There were 1.8 million new HIV cases diagnosed worldwide in 2016. New HIV cases found in the Asia Pacific region reached 270,000 (Joint United Nations Programme on HIV/AIDS, 2017). In Indonesia, there were 41,250 HIV cases and 10,146 AIDS cases diagnosed in 2016 (Ministry of Health RI, 2019).

Decreased body function can occur in HIV and AIDS patients because of the HIV infection (Hawkins, Brown, Margolick, & Erlandson, 2017). Along with its natural history of the HIV virus in human body, decreased immunity can cause malnutrition and decreased muscle function and strength. This decrease in muscle function and strength can be used as an indicator to estimate disability risk, morbidity, and mortality in HIV and AIDS patients (Flood, Chung, Parker, Kearns, & Sullivan, 2014; Sayer & Kirkwood, 2015; Schrack, et al., 2016).

Assessing handgrip strength is one way to assess an individual's muscle strength. There are several things that can affect handgrip strength, such as gender, hand dominance, nutritional status, and psychological factors. Handgrip strength is developed as the result of muscle work in the hand and forearm, which are often used to do daily activities (Manoharan, Sundaram, & Jason, 2015).

Nutritional status can be measured via several methods; one of these methods is anthropometry. Body mass index (BMI) is the most commonly used anthropometric measurement. BMI can be easily assessed by obtaining a patient's body weight and height. BMI can estimate the patient's body condition, including assessing for malnutrition or obesity, as these are related to muscle mass and body fat (Sulastini et al., 2010). According to earlier research on HIV and AIDS inpatients, their BMI average is 18.29 ± 2.93 kg/m2 and they are generally categorized as underweight (Rahardjo, 2010). Nutritional status can have more of an influence on low handgrip strength compared to infection factors and inflammation in HIV and AIDS patients with malnutrition or a BMI of less than 18.50 kg/m2 (Filteau et al., 2017). This study aims to describe the characteristics (BMI or nutritional status) and handgrip strength of HIV and AIDS inpatients.

METHOD

A cross-sectional design was used in this observational study. The data were collected from August 20 to September 16 2018 at the Dr. Soetomo General Hospital in Surabaya. The population for this study were the HIV and AIDS inpatients hospitalized during the data collection period. The inclusion criteria required patients to be 21 years of age or older, able to sit in bed, fully conscious, able to communicate verbally, and willing to participate in the research by signing an informed consent form. According to this criteria, 16 patients were eligible to participate in the research, which was decided by a purposive sampling method.

Direct interviews were conducted with the patients to determine characteristics that were not listed on their medical records and measurements of handgrip strength were collected as primary data. Handgrip strength measurements were collected using a handgrip dynamometer called the T.K.K. 5401 Takei Physical Fitness Test Grip Strength Dynamometer Grip-D. The measurements were conducted on the hand that was not being used for the IV drip, with three repetitions and a pause for approximately 60 seconds between the repetitive measurements. The collected data were then categorized as weak, low, or normal handgrip strength.

Secondary data, including patient characteristics, body weight, and height, were collected from the patients' medical records. This data included gender, age, occupation, education level, length of stay, HIV diagnosis duration, opportunistic infection status, and HIV clinical stage. BMI values were obtained by processing the patients' body weight and height data.

The patients' ages were categorized into two groups – between 20 and 39 years old and between 40 and 60 years old. Gender was divided into male and female. Education level was categorized into three groups – primary, middle, and higher. Length of stay was categorized as short (<6 days) and long (≥6 days). HIV diagnosis duration was counted from the time the patient was diagnosed as HIV positive after being tested using three HIV testing methods. The results were then categorized into four categories – less than one year, one to five years, five to 10 years, and more than 10 years. Opportunistic infections status was identified based on the presence or absence of opportunistic infections experienced by HIV and AIDS patients, including digestive, respiratory, and hematological opportunistic infections. The patients' HIV clinical stage was categorized as early (stages 1 and 2) and advanced (stages 3 and 4). BMI values retrieved from converting the patients' body weight and height were categorized into three groups – less than 17.00 kg/m2, 17.00 kg/m2 to 18.50 kg/m2, and 18.50 kg/m2 or more.

All the collected data underwent a univariate analysis using a frequency distribution to determine the final distribution. This study received ethical approval from the Health Research Ethics Committee of the Dr. Soetomo General Hospital, Surabaya, with registration number 0380/KEPK/VII/2018, on July 9 2018.

RESULTS

Patient's Characteristics

This study showed that most of the HIV/AIDS inpatients were male (81.25%) and between 20 and 39 years old (75.00%). Most were employed (50.00%) and had a middle education level (62.50%). Most of the patients had been hospitalized for four or five days, categorized as a short length of stay (75.00%), had been diagnosed with HIV for one to five years (87.50%), and were in the third (advanced) HIV clinical stage (68.75%). Most of the inpatients had respiratory (62.50%), digestive (62.50%), and hematological opportunistic infections (68.75%; see Table 1).

Body Mass Index and Handgrip Strength

The average BMI of the HIV and AIDS inpatients was 19.19±2.48 kg/m2 and almost half of the inpatients had a BMI value of less than 18.50 kg/m2. The average handgrip strength of the patients was 20.58±10.60 kg and almost half of the respondents had weak or low handgrip strength (see Table 2).

DISCUSSION

HIV and AIDS Inpatient's Characteristics

Most of the HIV and AIDS inpatients were in the early adult age group, with an age range of 20 to 39 years old. These results are supported by previous studies on HIV and AIDS patients, which show that most HIV and AIDS cases occur in adulthood (26-45 years old; Anwar, Nugroho, & Tantri, 2018; Paratika & Ernawaty, 2019). Adulthood period is a period when someone Adulthood is a period when people begin to engage in sexual activities, which can include homosexual and heterosexual behavior; sexual activity is the most common risk factor for HIV and AIDS transmission (Fitrianingsih, Ersa,

Indriayni, & Wirdayanti, 2019; Ministry of Health RI, 2019).

Table 1
HIV and AIDS Inpatient Characteristics Distribution

Variable	n	%
Age (years old)		
20 – 39	12	75.00
40 – 60	4	25.00
Gender		
Male	13	81.25
Female	3	18.75
Occupation		
Civil Servant / Military / Policeman	2	12.50
Private Employee	8	50.00
Entrepreneurs	2	12.50
Farmers / Fishermen / Laborers	1	6.25
Students	2	12.50
Unemployed	1	6.25
Education Level		
Primary	3	18.75
Middle	10	62.50
Higher	3	18.75
Length of Stay		
Short (< 6 days)	12	75.00
Long (≥ 6 days)	4	25.00
HIV Diagnosis Duration (years)		
< 1	7	43.75
1 – 5	7	43.75
>5 – 10	1	6.25
> 10	1	6.25
Respiratory Opportunistic Infection		
Yes	10	62.50
No	6	37.50
Digestive Opportunistic Infection		
Yes	10	62.50
No	6	37.50
Hematological Opportunistic Infection		
Yes	11	68.75
No	5	31.25
HIV Clinical Stage		
Early	2	12.50
Advanced	14	87.50
Total	16	100.00

Most of the patients were male. This finding is supported by the earlier research at the Infectious Disease Hospital Prof. Dr. Sulianti Saroso Hospital in Jakarta, which shows that most HIV and AIDS patients are male (Anwar,

Nugroho, & Tantri, 2018). Research has also shown that sexual intercourse without using a condom (free sex), with more than one partner, and homosexual behavior are risk factors that mean men are more likely to be exposed to HIV (Risal & Gunawan, 2018).

Table 2
HIV and AIDS Inpatient's BMI and Handgrip Strength Distribution

Variable	n	%
BMI (kg/m^2)		
Average 19.19±2.48		
< 17.00	3	18.75
17.00 – < 18.50	4	25.00
≥ 18.50	9	56.25
Handgrip Strength (kg)		
Average 20,58±10,60		
Weak or Low	7	43.75
Normal	9	56.25
Total	16	100.00

Most of the HIV and AIDS inpatients work as private employee (eight inpatients). This is supported by the Fourth Quarterly Report of HIV-AIDS and Sexually Transmitted Diseases (STDs) from 2017, which states that the highest number of AIDS cases are experienced by employees, at 26.40% (Ministry of Health RI, 2019). Most of the HIV and AIDS inpatients work as private employee (eight inpatients). This is supported by the Fourth Quarterly Report of HIV-AIDS and Sexually Transmitted Diseases (STDs) from 2017, which states that the highest number of AIDS cases are experienced by employees, at 26.40% (27.30%; Rahardjo, 2010). Engaging in an occupation with a high level of mobility and stress (such as employees and entrepreneurs) and possessing less knowledge and awareness of HIV and AIDS transmission are contributing factors to HIV transmission (Saktina & Satriyasa, 2017).

Most of the respondents have a middle education level (Senior High School). These results are supported by a 2010 study of HIV and AIDS inpatients at the Dr. Soetomo General Hospital, which found that most inpatients had graduated from high school (45.46%; Rahardjo, 2010). Most of the respondents have a middle education level (Senior High School). These results are supported by a 2010 study of HIV and AIDS inpatients at the Dr. Soetomo General Hospital, which found that most inpatients had graduated from high school (Kusuma, 2011). Most of the respondents were hospitalized for four or five days (25.00%, respectively), with a median

stay of 4.5 days and a range of two to 15 days. These results are not in line with earlier research on HIV and AIDS inpatients at the Dr. Cipto Mangunkusumo Hospital, Jakarta, which found that the patient's median length of stay was 11 days, with a range of two to 75 days (Puspitasari, Yunihastuti, Rengganis, & Rumende, 2016). This difference may be caused by several factors, including each patient's disease progression and the presence of opportunistic infections that were the main cause of the hospitalization. Patients with complex and acute opportunistic infections may require a longer stay than others (Coelho, Ribeiro, Veloso, Grinsztejn, & Luz, 2017; Dias & Martins, 2015).

This study found that most patients had been diagnosed with HIV for five years or less, with an average of 30 months or 2.5 years. Similar results were found in a study conducted on HIV patients in Pontianak, which showed that 57.10% of patients had been diagnosed with HIV for less than five years (Novianti, Parjo, & Dewi, 2015).

The results of the current study show that most patients had hematological opportunistic infections. Anemia, a hematological opportunistic infection, is a disease that HIV patients are susceptible to, especially patients at an advanced HIV clinical stage (Kerkhoff, Wood, Vogt, & Lawn, 2014). Anemia can be caused by several factors, such as inflammation due to the effects of hepcidin, micronutrient deficiencies, and the inhibition of hematopoiesis due to Anti-Retroviral (ARV) side effects (Minchella et al., 2015).

Other types of opportunistic infection, such as digestive, respiratory, and excretory infections, are often diagnosed in HIV and AIDS patients. In 2010, an earlier study at the Dr. Soetomo General Hospital mentioned that the opportunistic infection most often experienced by 38.89% of respondents was candidiasis auris, a digestive opportunistic infection, followed by tuberculosis and other respiratory infections, which were experienced by 27.78% of respondents (Rahardjo, 2010).

HIV and AIDS inpatients who participated in this study were mostly in the third HIV clinical stage. These results are not in line with previous research conducted at the Dr. Soetomo General Hospital, which found that most inpatients are at the fourth HIV clinical stage or the AIDS phase (Rahardjo, 2010). Based on the observations made by the researchers, this difference was due to the main causes of patient hospitalization when the study was conducted, even though the studies were conducted in the same location.

HIV and AIDS Inpatient's Body Mass Index and Handgrip Strength

The average BMI of the patients was 19.19±2.48 kg/m2, which can be categorized as a normal nutritional status. These results are not in line with the 2010 study of HIV and AIDS inpatients at the Dr. Soetomo General Hospital, which found that the BMI average of patients was 18.29±2.93 kg/m^2 (underweight; Rahardjo, 2010). Patients in the current study had an average BMI in the normal category, but 43.75% of respondents had BMI values of less than 18.50 kg/m2, which categorized them as underweight. The difference in results may be due to several factors, such as the difference in patient characteristics, including the patients' HIV clinical stage. In the earlier study by Rahardjo (2010), most of the patients were at the fourth HIV clinical stage or the AIDS phase, which causes an increased risk of HIV-wasting syndrome (Sulastini et al., 2010).

The average handgrip strength of the respondents was 20.58±10.60 kg. This is not in line with earlier studies on HIV outpatients in Brazil, which found that the average handgrip strength of patients' right hands was 39.05±11.88 kg and the average of their left hands was 35.40±10.53 kg (Trombeta et al., 2017). There are several factors that may have led to this difference in results, such as the difference in patient criteria and the method used to measure handgrip strength. In Trombeta et al (2017) study, the respondents were outpatients, while, in the current study, they were inpatients. In the current study, handgrip strength was measured with patients in a sitting position on the edge of their bed; in the earlier study, the measurements were carried out in a standing position.

Nutritional status assessment through anthropometry using the patient's BMI is the most frequently used method, but there are certain patient conditions that disallow this measurement. Handgrip strength is considered a better, more practical, and more accurate way to describe nutritional status than BMI values (Kizilarslanoglu, Kilic, Gokce, Sakalar, & Ulger, 2017). Handgrip strength can be used alone or with other measurements to describe a patient's nutritional status or body composition (i.e. muscle mass; Bohannon, 2015). Handgrip strength can be used alone or with other measurements to describe a patient's nutritional status or body composition (Liao, 2016). A low BMI value and a decrease in muscle mass are some indicators to assess the incidence of malnutrition (Cederholm et al., 2019). Muscle mass is an important component for

determining muscle strength. Handgrip strength is a reliable and non-invasive method of measuring muscle strength. When BMI is used in conjunction with handgrip strength, the determination of a patient's malnutrition status can be more accurate (Haider et al., 2016; McLean & Kiel, 2015; Stessman, Rottenberg, Fischer, Hammerman-Rozenberg, & Jacobs, 2017).

Research Limitation

BMI data collected for this study were based on secondary data gathered from the patients' medical records. It is necessary to choose other, more accurate, methods of determining a patient's nutritional status that do not make a patient feel uncomfortable, so that primary data can be collected. Additional samples are needed to increase the data's variation.

CONCLUSION

Some HIV/AIDS inpatients have a low BMI and handgrip strength. Malnutrition still leads to nutritional problems in HIV/AIDS inpatients.

CONFLICT OF INTEREST

The authors declare that no conflict of interest in this study.

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