

## ORIGINAL ARTICLE

# TUBERCULOSIS WORSEN THE NUTRITIONAL STATUS OF HIV PATIENTS IF UNSUPPORTED BY GOOD NUTRITION: A CROSS SECTIONAL STUDY AT PULMONARY DISEASES CENTER SEMARANG CITY, INDONESIA

Lintang Dian Saraswati<sup>1</sup>, Dina Rahayuning Pangestuti<sup>2</sup>, Praba Ginandjar<sup>3</sup>

<sup>1</sup>Department of Epidemiology and Tropical Diseases, Faculty of Public Health, Diponegoro University, Jl. Prof Sudharto SH Tembalang Semarang, Indonesia. Zip code: 50275

<sup>2</sup>Department of Public Health Nutrition, Faculty of Public Health, Diponegoro University, Jl. Prof Sudharto SH Tembalang Semarang, Indonesia. Zip code: 50275

<sup>3</sup>Department of Epidemiology and Tropical Diseases, Faculty of Public Health, Diponegoro University, Jl. Prof Sudharto SH Tembalang Semarang, Indonesia. Zip code: 50275

## ABSTRACT

Malnutrition, HIV and tuberculosis (TB) disease is a triangle of death that should be given attention. This study was comparing nutritional status of HIV patients with and without TB in Semarang, Indonesia, to describe the effect of TB burden to their nutritional status. The study design was cross-sectional study. The study began with an examination of sputum and chest X-rays, then examined by anti- HIV antibodies using the method of screening of 3 times. About 56 subjects were recruited to the HIV group and 36 subjects to the HIV-TB. The anthropometric examination was carried out by using scales, microtoise, Mid Upper Arm Circumference ribbon, and Body Impedance Analyzer to measure body fat. Interviews were conducted to the subject on physical activity examination, 24 hours dietary recall and food frequency questionnaire. Data analysis using Independent t-test or Mann-Whitney test. The results showed that group of HIV- TB had worse nutritional status than those suffer from TB. Body weight, BMI, MUAC, BMR, and Vitamin A blood serum in HIV patients with TB was significantly lower than the HIV group. The nutritional status of HIV patients with TB was significantly more malnourished than counterparts (underweight: 25.7% vs 14.3%). Dietary intake of vitamin A, Fe, Zn, energy, protein and fat was better in HIV group compared to HIV-TB group. Respondents who are 19 years old on average were stunting, an indicator of malnourished in a long time. TB can worsen the nutritional status of HIV patients if not supported by good nutrition.

**Keywords:** HIV, TB, nutritional status, vitamin A, dietary intake, Semarang, Indonesia

## INTRODUCTION

Tuberculosis (TB) and HIV/AIDS are both a chronic disease. TB is the leading cause of death in people infected with HIV and HIV infection increases the risk of TB by 20-40-fold.<sup>1-3</sup> Vice versa, HIV AIDS is known to increase the risk of tuberculosis because of damage to the immune system as a result of HIV infection predispose a person infected with tuberculosis, and the disease is now known as the sentinel manifestations of HIV disease progression towards AIDS.<sup>4-7</sup>

Increased population with HIV-AIDS in Asia has an effect on the endemic infectious diseases such as TB.<sup>8,9</sup> The incidence of HIV-AIDS pandemic can also increase the cost of treatment of TB such as the provision of anti-TB drugs<sup>10</sup> that has been given for free at the health center level and BKPM so could jeopardize the achievement of the Millennium Development Goals targets.

Malnutrition has been described in patients with TB were shown to decrease visceral protein, anthropometric indices, and micronutrient status.<sup>11</sup> Micronutrient deficiencies can impair the immune system, so it affects the response to chemotherapy,<sup>12,13</sup> which depends on the optimal functioning of the cell-mediated immune response,<sup>14</sup> and therefore in addition to infectious diseases (HIV-AIDS and TB) which increase in number, also micronutrient

deficiencies is a major public health problem in developing countries.<sup>5,15</sup> The relationship between vitamin A deficiency and the morbidity and mortality from infectious diseases has been known for several years. This study was comparing nutritional status among HIV patients with and without TB in Semarang City, Central Java Province, Indonesia, to describe the effect of TB burden among HIV patients to their nutritional status.

## METHODOLOGY

### *Selection and Description of Participants:*

The subject was TB patients, who seek treatment at Pulmonary Health Center (BKPM=Balai Kesehatan Paru Masyarakat) Semarang City. The study began with an examination of sputum and chest X-rays, and then examined by anti- HIV antibodies using the method of screening of 3 times to determine the status co-infection. About 56 subjects were recruited to the HIV-infected group and 36 subjects to the HIV with TB co-infected group.

## METHODS

The study design was a cross-sectional observational study conducted with quantitative methods. The two groups were examined anthropometric profile (body weight, height, mid-upper-arm-circumference (MUAC), and body fat percentage), physical activity level, Basal

Metabolite Rate (BMR), and levels of vitamin A and E in blood. The anthropometric examination was carried out by using scales, microtoise, MUAC ribbon, and Body Impedance Analyzer (BIA) to measure body fat. Interviews were conducted to the subject of physical activity examination and 24 hours dietary recall and food frequency questionnaire for nutrition intake. Among subjects, three children were recruited in the study (11, 12 and 15 years old, respectively). To their nutritional status, a program of WHO Anthro plus was used to calculate the Body Mass Index (BMI) for age. To describe the dietary

intake of subjects, 46 subject of HIV-infected group and 31 subjects of HIV with TB co-infected were interviewed by using 24-hr recall method (for energy, protein and fat) and Food Frequency Questionnaire (for vitamin A, vitamin E, Fe, and Zn).

#### Ethics

Ethical clearance was obtained from the Commission of Ethics of Medical and Public Health Research, Faculty of Public Health, Diponegoro University.

**Tabel 1. Characteristics of HIV patient compared to HIV+TB patient in anthropometric profile and nutritional status**

Variable	n		Total (n)	p value
Body weight (kg)				
HIV	56	56.7±10.9	53.7±12.6 (92)	0.004*
HIV+TB	36	49.1±13.7		
Height (cm)				
HIV	56	158.7 (94-179)	158 (94-179) (92)	0.339
HIV+TB	36	155.5 (100-175)		
Body Mass Index (kg/m <sup>2</sup> ) <sup>a</sup>				
HIV	54	22.2±3.7	21.5±3.5 (85)	0.003*
HIV+TB	31	20.2±2.9		
Mid Upper Arm Circumference (cm)				
HIV	24	27.5±3.1	26.3±3.2 (38)	0.001*
HIV+TB	14	24.2±2.3		
% Body fat				
HIV	55	23.0±8.9	21.8±8.3 (91)	0.076
HIV+TB	36	20.0±6.9		
Nutritional status based on BMI (%), n)				
HIV				
Underweight	8	14.3	18.7 (17) 48.4 (44) 33.0 (30)	0.032*
Normal	24	42.9		
Overweight	24	42.9		
HIV+TB				
Underweight	9	25.7		
Normal	20	57.1		
Overweight	6	17.1		
Basal Metabolite Rate (BMR) (kcal)				
HIV	55	1308.9±236.5	1251.5±253.9 (91)	0.007*
HIV+TB	36	1163.9±257.8		
Physical activity level (PAL)				
HIV	55	2.4 (1.1-17.2)	2.4 (1.1-17.2) (91)	0.503
HIV+TB	36	2.5 (1.3-15.7)		
Total energy expenditure (TEE) (kcal)				
HIV	54	3158.5 (1640.1-27279.2)	3086.1 (511.6-27279.2) (90)	0.193
HIV+TB	36	2852.7 (511.6-23424.5)		
Vitamin A serum (mcg)				
HIV	50	464.6±390.6	435.2±146.7 (83)	0.024*
HIV+TB	33	141.6±144.9		
Vitamin E serum (mg)				
HIV	50	16.3±17.8	16.9±5.1 (83)	0.201
HIV+TB	33	4.4±6.1		

<sup>a</sup> subject aged under 19 years old (7 children) were excluded, mean BMI-for-Age Z-score: -1.1±2.5 (normal), HAZ: -2.5±1.4 (stunting)

\*Significantly different

## Statistic

Distribution of data was determined by Kolmogorov-Smirnov test. Comparison of characteristics in anthropometric profile, nutritional status (vitamin A and E serum) and dietary intake among the two groups were tested to see the difference between groups using Independent t-test or Mann-Whitney test.

## RESULTS

Based on the characteristics of the subjects, body weight, body mass index (BMI), BMR, nutrition status, upper arm circumference

(female subjects) and vitamin A in the blood showed a significant difference between the two groups (Table 1). Weight, BMI, and MUAC in HIV patients with TB group was significantly lower than the group without TB-HIV.

Almost all nutrients were lacking in HIV+TB group compared to HIV group (Table 2). On the physical activity variables showed that HIV patients either with concomitant TB or do not have a very high load activity that exceeds 2.4 (extremely high). Based on the results of multiplication by BMR subjects, obtained TEE subject is high enough (Table 1).

**Table 2: Dietary intake of HIV patient compared to HIV+TB patient**

Variable	HIV (n=46)	HIV+TB (n=31)	Total	p value
Vitamin A ( $\mu\text{g}$ ) <sup>a</sup>	864 (30.3-4929.8)	469.55 (134.1-1887.0)	675.2 (30.3-4929.8)	0.003*
Fe (mg) <sup>a</sup>	2.3 (0.2-5.8)	1.75 (0.8-10.4)	2 (0.2-10.4)	0.176
Zn (mg)	1.49 $\pm$ 0.76	1.45 $\pm$ 1.09	1.47 $\pm$ 0.89	0.768
Energy (kcal)	1087 $\pm$ 19	1099.49 $\pm$ 313.88	1091.91 $\pm$ 317.55	0.686
Protein (g)	40.67 $\pm$ 14.89	36.73 $\pm$ 16.39	39.16 $\pm$ 15.49	0.498
Fat (g)	36.2 $\pm$ 18.30	29.21 $\pm$ 16.32	33.52 $\pm$ 17.78	0.219

<sup>a</sup> Median (min-max)

\*Significantly different

## DISCUSSION

Weight, BMI, and MUAC in HIV patients with TB group was significantly lower than the group without TB-HIV. The nutritional status of HIV patients with TB more malnourished, however, there are many patients in groups of HIV who were overweight (overweight). Different result came from Brazil which stated all patients under tuberculosis therapy (infected and not infected with HIV) suffered from malnutrition.<sup>16</sup> HIV infection is associated with indicators of low lean body mass in adults with TB; socioeconomic factors and TB severity are important correlates of wasting, independent of HIV.<sup>17</sup>

Based on these results it can be seen that TB can worsen the nutritional status of HIV patients if they are not supported by good nutrition. In this study, the data subject to the condition or nutritional status of HIV + TB patient groups before suffering from TB cannot be shown to explain more about the changes in the nutritional status of these groups as a result of TB disease. Similar to this study, many types of research in India<sup>18</sup>, Uganda<sup>4</sup>, and Indonesia (Nusa Tenggara Timur)<sup>15,19</sup> consistently found that the nutritional status of those who suffer from TB and TB with HIV co-infected were under the recommendation.

As it is known that the nutritional status determines the recovery process of patients with TB, HIV and especially for those who suffer from both. HIV-TB patients with a BMI of more than 18.5 can be increased CD4+ T-cell recovery rate better than those who are malnourished.<sup>4,20-22</sup> In

percentage of body fat was also found that body fat among subjects with HIV-TB was lower than the counterpart. Similar to study in India, also found that the body fat and triceps skin fold thickness assessment result among HIV negative, HIV positive without TB and HIV positive with TB were worsened, respectively.<sup>23-25</sup> Incontrary, in HIV patients, disorders in glucose metabolism seem to be side effects of highly active antiretroviral therapy (HAART) which may be favoured by obesity, abdominal fat accumulation and familial disposition for diabetes mellitus (DM) so HIV patients on long-term PI therapy with overweight (HOMA-Index, BMI, and waist circumference) and familial disposition for DM are at high risk to develop abnormalities of glucose metabolism.<sup>26</sup>

On the physical activity variables showed that HIV patients either with concomitant TB or do not have a very high load activity that exceeds 2.4 (extremely high). Based on the results of multiplication by BMR subjects, obtained TEE subject is high enough (Table 1). The results showed that most of the subjects belonging to the groups who need large energy intake due to the high burden of their physical activities. Activity energy expenditure, not only through voluntary exercise but also through spontaneous, daily, physical activities can have a positive effect on reducing body weight.<sup>27-30</sup> Given the status of those with HIV and HIV with TB, their nutritional status was very noteworthy adequacy, especially vitamin A and E.

According to dietary intake assessment result, it was found that almost all nutrients were lacking

in HIV+TB group compared to HIV group (Table 2). This result could answer the condition of anthropometric profile and vitamin A serum as show in Table 1. Results of dietary intake may indicate that the profile of blood serum and anthropometric subjects substandard nutrition recommendation because nearly all subjects both in the group with HIV or HIV- TB is far from Indonesian Recommended Dietary Allowances. Intake of vitamin A was significantly different among both groups, which is lower among HIV+TB group. Although other nutrient did not show the significant differentiation statistically, the trend showed that subjects who suffer from HIV with TB had lower intake than counterparts.<sup>31-37</sup>

Respondents who are 19 years old on average were stunting, an indicator of malnourished in a long time. Stunting is a linear growth retardation, which results from inadequate intake of food over a long period that may be worsened by chronic illness. Over a long period, inadequate nutrition or its effects could result in stunting.<sup>38</sup> Undernutrition is common in human immunodeficiency virus (HIV) infection and it contributes significantly to its morbidity and mortality. Undernutrition among HIV-infected, ART-naïve children, aged under five years old may be reduced if programmatic interventions are guided toward early initiation of ART among eligible HIV-infected caregivers and the promotion of HIV/tuberculosis coinfection control efforts.<sup>39</sup> Undernutrition and stunting are common among HIV-infected children at all stages of the disease in India. Early and aggressive nutritional intervention is required if long-term outcomes are to be improved.<sup>23,40</sup> However, we can not recall the data when the subject was born was already infected with HIV or HIV-TB as well whether as birth weight was normal or gain a low birth weight. In other words limitation in the nutritional status of children below 19 years due to lack of data. However, this is only happening on seven subjects.

## CONCLUSIONS

TB can worsen the nutritional status of HIV patients if they are not supported by good nutrition. These can be seen from body weight, BMI, MUAC, BMR, and Vitamin A blood serum, dietary intake of vitamin A, Fe, Zn, energy, protein and fat which was better in HIV group compared to HIV-TB group. Respondents who are 19 years old on average were stunting, an indicator of malnourished in a long time.

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