The difference of anti phenolic glycolipid-1 (PGL-1) immunoglobulin-M (IgM) level and nutritional intake in subclinical leprosy patients who reside at home and in the orphanage

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Abstrak

Penderita lepra selain ditemukan di rumah juga ada yang ditemukan di panti asuhan. Kondisi tempat tinggal yang berbeda tersebut memungkinkan perbedaan lingkungan, asupan gizi dan imunitas yang pada akhirnya mempengaruhi penularan kuman M. leprae. Tujuan penelitian ini adalah mengetahui perbedaan kadar IgM anti PGL-1 dan asupan gizi penderita lepra stadium subklinis yang tinggal di rumah bersama keluarga dengan penderita lepra stadium sublinis yang tinggal di panti asuhan. Studi observasional dengan pendekatan potong lintang ini dilakukan di Semarang, Jawa Tengah, Indonesia. Tigapuluh satu penderita lepra subklinis yang tinggal di panti asuhan dan 30 penderita lepra subklinis yang tinggal di rumah ikut dalam penelitian ini. Semua sampel diambil darah venanya, diperiksa kadar IgM anti PGL-1 nya dan dianalisis masukan nutriennya.Uji beda antara kedua kelompok dilakukan dengan independent t-test atau Mann Whitney test bila distribusi tidak normal. Terdapat perbedaan bermakna kadar IgM anti PGL-1, asupan protein, seng dan vitamin C (P < 0,05) antara kelompok yang tinggal di rumah dan panti asuhan. ***(Med J Indones 2007; 16:233-6)***

Abstract

Leprosy patients can be found in the orphanage, and ordinary house holds. The different living conditions in different places might cause differences in the environments, nutritional intake, and immunity, which in the end would affect the transmission of M. leprae. The aim of this study was to find out the difference in anti PGL-1 IgM level and nutritional intake between sub-clinical leprosy patients residing at home with their families and those living in the orphanage. This cross-section observational study was done in Semarang, Central Java, Indonesia. Thirty one sub-clinical leprosy patients living in an orphanage and 30 sub-clinical leprosy patients living at home were included in this study. Venous blood was taken from all of the subjects, the level of anti PGL-1 IgM was measured, and daily nutrient intake was analyzed. Differential test between the 2 groups was performed using independent t-test or Mann Whitney test, when the distribution was not normal. There was significant differences (P < 0.05) in the level of anti PGL-1 IgM, protein, zinc, and vitamin C intake between the 2 groups. ***(Med J Indones 2007; 16:233-6)***

Keywords: *nutrient intake, protein, zinc, vitamin C*

The study on Leprosy conducted in Semarang revealed the fact that there are leprosy patients who live at home with their own family, and those who reside in various orphanages. The detection of a transmission source at home and at some orphanages raises the possibility of finding subclinical sero-positive leprosy patients.

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The development of serologic methods in detecting the presence of specific antibodies against *M. leprae*, increased the findings of sero-positive leprosy by contact. One of the various way to detect sero-positive leprosy early is to measure the level of anti PGL-1 IgM. On several literatures the term sub-clinical leprosy is employed on cases where specific antibodies against *M. leprae* is found (sero-positive) without any manifestation of clinical symptoms of the leprosy itself.[1]

Principally, there is a synergic correlation between nutritional status and the incidence of a particular infection.[2] Diet is not considered to play a direct role in the epidemiology of leprosy, but malnutrition may increase the susceptibility to the disease. Significantly low serum levels of vitamin A and E, zinc, calsium

and magnesium have been reported in patients with leprosy. Environmental factors, such as overcrowding due to inadequate housing, lead to more frequent close contact with the source of infection and favour the spread of leprosy.[3] The over-crowded living condition of some orphanage and inadequate dietary pattern are thought to hasten the transmission of leprosy. The objective of this study was to reveal the difference in anti PGL-1 IgM level, and nutrient intake between the sub-clinical leprosy patients residing at their own home and those residing in a particular orphanage.

METHODS

This is an observational study using a cross sectional approach. This study was approved by the Medical Ethics Committee of the Medical Faculty, Diponegoro University/Dr. Kariadi Hospital, Semarang, Indonesia.

The subjects of this study were those who fulfilled the inclusion criteria: age between 10 – 25 years old, living together with a leprosy patient, showed no clinical symptom of leprosy, and sero-positive (anti PGL-1 IgM above 600 unit/ml).[4] All of the subjects both residing in an orphonase and at their own home in Semarang, Indonesia were included. The subjects were divided into 2 groups, those residing in an orphanage and at home.

Five mls of venous blood was drawn from each subject. The whole blood was centrifuged to separate the serum, which was then stored at –20ºC. Screening for subclinical leprosy was done by IgM anti PGL-1 test. The measurements were conducted in Tropical Disease Center, Airlangga University, Surabaya. For all subjects, the IgM anti PGL-1 levels were noted.

Quantified food frequency analysis was performed to determine daily nutrient intake using Nutrisoft software (Nutrition Research and Development Centre, Health Department of Indonesia). SPSS version 10.0 software was used for the statistical analysis. Daily consumption of nutrients (protein, zinc, and vitamin C) was noted and compared with Indonesian recommended nutrient intake to get the proportion of nutrient intake toward recommended nutrient intake.

The differences in anti PGL-1 IgM level, protein, zinc and vitamin C level in sub-clinical leprosy patients who resided in the orphanages and who lived at home were analyzed with independent t-test or Mann Whitney test when the distribution was not normal. Two-tailed tests were used and P – values < 0.05 was considered as significantly different.

RESULTS

The tracking of leprosy patients revealed two patients who resided in one of the orphanages in the border of Semarang and Demak Municipalities. The total residents of the orphanage was 64 people, of whom 31 were sero-positive (sub-clinical leprosy) and fulfilled the inclusion criteria. The sub-clinical leprosy patients who lived at the same house with leprosy patients were greater in number compared to those who lived in the orphanage, due to the more leprosy patients who lived at one particular house. However, those who fulfilled the inclusion criteria were only 30 patients.

More than half of the study subjects were female (84.9% of those who resided in the orphanages and 63.3% of those who lived at home. The education level of sub-clinical leprosy patients who lived in the orphanage mostly was junior high school, while those who lived at home finished senior high school.

The mean age and BMI of sub-clinical leprosy patients who lived in an orphanages and at home are shown in Table 1. There was a significant difference in age (P = 0.001) but no significant difference in BMI level (P = 0.699) between both groups of the sub-clinical leprosy patients.

Table 1. The mean age and BMI of sub-clinical leprosy patients living in an orphanage and at home

	Groups		*P*
	orphanage	home	
Age (years)	14.6 ± 2.0	17.2 ± 3.4	0.001*
BMI (kg/m^2)	18.1 ± 2.9	18.4 ± 3.5	0.699

* significant different (P < 0.05), with independent t - test

The mean anti PGL-1 IgM level, the mean protein, zinc, and vitamin C consumption of the sub-clinical leprosy patients living in an orphanage and living at home is shown in table 2. There were significant differences of the anti PGL-1 IgM level, protein, zinc, and vitamin C consumption between the sub-clinical leprosy patients living in the orphanages and at home (Table 2).

Table 2. Anti PGL-1 IgM level and nutrient intake of the sub-clinical leprosy patients living in an orphanage and at home

	Groups		*P*
	orphanage	home	
IgM anti PGL-1 (unit/ml)[*]	1434.1 ± 692.4	978.7 ± 253.7	0.005
Protein (%)[§**]	66.9 ± 14.6	89.4 ± 37.0	0.023
Zink (%)[§**]	31.8 ± 6.3	44.9 ± 21.1	0.015
Vitamin C (%)[§*]	15.8 ± 17.1	65.2 ± 50.6	0.001

* Mann Whitney Test ** Independent t - test
§ proportion between daily intake and Indonesian Recommended Nutrient Intakes

DISCUSSION

The level of anti PGL-1 IgM of sub-clinical leprosy patients in the orphanage was significantly higher compared to those living at home. This fact was probably caused by the crowded living condition in the orphanage. There were only three bedrooms in the orphanage, each measured 6 x 6 m^2. One room was occupied by 18 boys and 2 other rooms were allocated to the girls. The crowded condition, level of education and ignorance lead to higher exposures of orphanage residents to the symptomatic leprosy patients. Other factors were inadequate food intake in the orphanage due to economical limitation. Someone with low food intake would experience an increase in catabolism, causing malnutrition which in turn would cause destruction of barrier protection and body immune system.[5]

Concerning protein intake, which was lower in those living in the orphanage, those living in the orphanage were supposed to be more susceptible to infections. This suggestion is in accordance with the theory stating that lack of protein can significantly affect body immune system which in turn would promote infection.[5] A low protein intake will cause abnormality of the cellular immunity which is usually shown by the decrease in T lymphocyte, and natural killer cell activity, and interleukin 2 production. Moreover, there is a decrease in cytokine production, B cell function (decrease in secreted IgM), complement activity, and cell-mediated immunity.[6-8] *M. leprae* is an obligate parasite, thus defense mechanism toward *M. leprae* infection depends mostly on cellular immunity.[9]

Aside from its function on body immune system, protein also plays a substantial role on enzyme production. Protein is one of the building blocks of complement, which functions to increase phagocytosis and finally increases bacterial lysis. Another important function of protein is as micronutrient carrier, i.e. zinc. Lack of protein would disturb micronutrient transport.[10]

In the orphanage group, the consumptions of zinc and vitamin C were lower than those living at home. Zinc intake has a significant influence on the level of anti PGL-1 IgM. More over, zinc is very influential to the immune response, i.e. natural killer cell, phagocytosis ability of macrophage cells, T-helper and T-cytotoxic cells. Therefore, low zinc intake can disturb cellular and humoral immunity,[10,11] and correlated with the severity of leprosy.[12] However, this fact was not in line with the higher anti PGL-1 IgM level.

Vitamin C intake of sub-clinical leprosy patients living in the orphanage was significantly lower compared to their stay-at-home counterparts. Vitamin C intake of the orphans was very low due to lack of fruit consumption. Vitamin C is an antioxidant which is capable to absorb the negative impact of oxidants, leading to cell destruction, which is carried out by the phagocyte activity of the macrophage or natural biology process that involves active oxygen substance (SOR). The increase of SOR is known to act as a mediator of cell destruction on various pathogenic conditions. Test animals which were infected by *M. leprae* showed an increase in SOR that is correlated with high bacterial count.[13] Vitamin C as an antioxidant has a role in defense mechanism where it cuts radical reaction chain. Vitamin C also works indirectly to protect antioxidants, due to its ability to regenerate vitamin E, glutathione and flavonoid.[14]

A study by Sinha et al concerning the decrease of antioxidant i.e. vitamin C[15] and SOD[12] on *M. leprae* infection has been acknowledge for a long time. The reason of the decrease of SOD has not yet been fully understood. A hypothesis states that phagocytosing granulocyte produces superoxyde radicals that increase the use of SOD. The increase in SOD is a protective mechanism to scavenge cytotoxic radicals, and low zinc intake would affect the function of SOD.

In conclusion, there is a significantly lower level of anti PGL-1 IgM, and higher protein, zinc, and vitamin C intake in the sub-clinical leprosy patients living at home compared to those living in an orphanage.

Acknowledgements

Our gratefull thank to Prof. Shinzo Izumi, MD, PhD and Prof. Indropo Agusni, MD,DV, Leprosy Study Group of Tropical Disease Center, Airlangga University, Surabaya for the permission of IgM anti PGL-1 assay. We also thanked I Gusti Putu Yuliartha, MD, DV for his professional help in recruiting, screening and blood collection process of this study.

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