

**LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : PROSIDING**

Judul Karya Ilmiah (paper) : *The Difference of BMI and Micronutrient Intake Between Multibacillary Leprosy and Non Leprosy (A Study in District Brondong, lamongan 2013)*

Jumlah Penulis : 2 Orang

Status Pengusul : Penulis ke-2

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Advanced Science Letters
Volume 23, Issue 4, 2017, Pages 3421-3423

The difference of BMI and micronutrient intake between multibacillary leprosy and non leprosy (A study in district Brondong, Lamongan 2013) (Article)

Fatimah, S., Rahfiludin, M.Z.

Faculty of Public Health Diponegoro University, Semarang, Indonesia

Abstract

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Background: There is a link between food shortages with leprosy. Some studies showed that the intake of micronutrients (vitamin A, vitamin E, zinc and anti-oxidants) may affect the immunological response. This study aimed to analyze the differences of BMI, intake of Vitamin A, Vitamin E, Vitamin C, and zinc among leprosy patients (positive serology) with non-leprosy. **Method:** This was a cross sectional study. Subject consisted of 20 non-leprosy and 20 leprosy patients. The levels of immunoglobulin M (IgM) anti Phenolic Glico lipid (PGL)-1 by ELISA method was used for leprosy screening. The measurement of nutrient intake was conducted by 1x24 hour recall and FFQ, treated with Nutrisurvey. Independent t-Test and Mann Whitney Test were used to determine differences in BMI and nutrient intake of leprosy and non-leprosy. **Results:** Mean BMI, intake of vitamin A, C, E and zinc were better on non-leprosy compare to leprosy patients. The statistic analyze showed significant differences of BMI ($p = 0,006$), intake of vitamin A ($p = 0,027$) and zinc ($p = 0,011$) among leprosy and non-leprosy. **Conclusion:** Health services should conduct counseling about the importance of good nutrition and the consumption of good nutrition to improve immune status, especially for non-leprosy person who lives with leprosy patient to prevent from infection. © 2017 American Scientific Publishers All rights reserved.

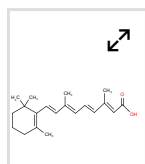
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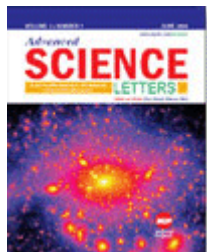
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The Difference of BMI and Micronutrient Intake Between Multibacillary Leprosy and Non Leprosy (A Study in District Brondong, Lamongan 2013)

Siti Fatimah* and M. Zen Rahfiludin

Faculty of Public Health Diponegoro University, Semarang, [Indonesia](#)

Background: There is a link between food shortages with leprosy. Some studies showed that the intake of micronutrients (vitamin A, vitamin E, zinc and anti-oxidants) may affect the immunological response. This study aimed to analyze the differences of BMI, intake of Vitamin A, Vitamin E, Vitamin C, and zinc among leprosy patients (positive serology) with non-leprosy. **Method:** This was a cross sectional study. Subject consisted of 20 non-leprosy and 20 leprosy patients. The levels of immunoglobulin M (IgM) anti Phenolic Glico lipid (PGL)-1 by ELISA method was used for leprosy screening. The measurement of nutrient intake was conducted by 1 × 24 hour recall and FFQ, treated with Nutrisurvey. Independent *t*-Test and Mann Whitney Test were used to determine differences in BMI and nutrient intake of leprosy and non-leprosy. **Results:** Mean BMI, intake of vitamin A, C, E and zinc were better on non-leprosy compare to leprosy patients. The statistic analyze showed significant differences of BMI ($p = 0,006$), intake of vitamin A ($p = 0,027$) and zinc ($p = 0,011$) among leprosy and non-leprosy. **Conclusion:** Health services should conduct counseling about the importance of good nutrition and the consumption of good nutrition to improve immune status, especially for non-leprosy person who lives with leprosy patient to prevent from infection.

Keywords: Leprosy, BMI, Vitamin A, Vitamin E, Vitamin C, Zinc.

1. INTRODUCTION

Leprosy remains public health problems in Indonesia. The World Health Organization noted Indonesia has the third highest number of leprosy patients globally after India and Brazil.¹ Leprosy is a disease with long incubation period. Studies in the Philippines and Venezuela showed in 2–4 years, a person who lives in a house with leprosy patient and have close contact with the patients have a greater risk of suffering from leprosy (especially multibacillary) compared to seronegative contact person.²

Subclinical leprosy (positive serology) has an important role in the prevention of leprosy. They could potentially become leprosy patients, and may serve as a source of transmission. Subclinical leprosy is commonly found in people who have close contact with leprosy patients, such as live in same house with MB leprosy patients. The risk of becoming leprosy is related to several factors such as severity of infection, susceptibility of people who closely contact (at home), frequency and duration of contact with leprosy patients. Individual factors are also noteworthy, such as age, gender, health behavior, physiology (related to nutritional factors).³ The presence of seropositive subjects who have turned to leprosy can be detected by examining the levels of

immunoglobulin M (IgM) anti Phenolic Glico lipid (PGL)-1. The use of PGL-1 antigen minimizes the possibility of cross reaction with other microbacteria.⁴

Leprosy and nutrition are related through immunity. Leprosy is also regarded as an immunologic disease, because the important role of cellular immunity. Malnutrition in general causes a disruption of immune response, which increases susceptibility to diseases. The malnutrition influences nutritional status (BMI).⁵ The relationship of immunity and nutritional factors, especially on infectious diseases, are often studied. For example in diarrheal disease and pulmonary tuberculosis, but it is still rarely performed on leprosy. A study in Bangladesh showed a link between food shortages with leprosy. Several other studies have shown that the immune response is affected by the intake of micronutrients, such as vitamin A, vitamin E, zinc and anti-oxidants.⁶

Serum vitamin A in patients with MB type of leprosy is much lower than non-leprosy,⁷ whereas vitamin A is necessary for cytokines regulatory. Retinoic acid is the most active metabolic form of vitamin A. Retinoic acid plays a role in the regulation of the synthesis of several cytokines such as interferon gamma and interleukin 2 productions. IFN- γ and IL-2 are cytokines produced by Th1 cells. In MB leprosy patients, Th1 cell is lower than Th2 cells.³ Vitamin E also plays a role in up-regulation of

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Trend Changes on Socio-Spatial Configuration by the Heating System Conversion in Korea

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The purpose of this study is to analyze how the heating system conversion affects the change of socio-spatial configuration to Korean housing systems and suggest the proper method based on quantitative data using simulation analyses. For this study, research targets have been chosen with plans from single-family houses and apartments in the period of 1950s through 1980s, and reorganized investigations through the classified space elements. As a result, this paper suggests for a research method to reveal the relationship between energy use, fuel types and spatial configuration with simulation techniques.

Keywords: On-dol Heating System, Heating Systems Conversion, Fuel Changes of Home Heating System, Spatial Configuration Change, Simulation of Heating Systems.

1. INTRODUCTION

Currently, one of most commonly-used heating systems in Korea is the radiant panel-heating system using water boilers in the floor. It was originated and developed from the traditional type of the heating system called On-dol that has recently been recognized as an excellent heating technology world-wide. For, it would be important to keep developing and maintaining its fundamental theories and to investigate how it affects socio-spatial configurations.

This study attempts to analyze the traditional heating system first of all with comparison between the type of single-family housing and the apartment unit, one of collective housing type appeared in the period of 1950s through 1980s in Korea. After that, periodic changes of heating equipment, type of fuel and planar composition by its fuel conversion for the above two target spaces have been investigated. Then, this paper suggests the most appropriate analysis methodology using 3D modeling that produces quantitative simulation data and multiple techniques.

The aim of this study is, eventually, to analyze how the heating system conversion affects the change of socio-spatial configuration from Korean traditional planar composition to its modern space system; it would include the classification of the spatial types that differentiates functions, positions and connections of spatial elements such as bedroom, living room, kitchen and so on.

1.1. Research Method

The temporal scope of the analysis has been set as the period between 1950s and 1990s, normally known as the most active

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era towards new appearance of variable housing types in Korea showing critical increase for the dissemination of modern housings. Every periodic step was separated by 10 years and classification and characteristics are shown each in Table I.

2. CONFIGURATION OF KOREAN TRADITIONAL RESIDENTIAL SPACE

2.1. Position on Spatial Features

The spatial composition of the traditional house has been determined by the plan in accordance with location of furnace kitchen and On-dol system.^a The basic form of the plan consists of On-dol room and multi-purpose kitchen for mixed-use of cooking and heating. On-dol room has not been connected to the kitchen located next to the master bedroom differentiated by the size of the house. Otherwise, it tends to be independently located; in this case, the furnace is called Ham-sil^b form that means the inside space of a closed mass.

On-dol room has continuously located around the kitchen, seems more complex, and been developed in the furnace form with a factor of angular format. As a result, it is placed on both sides around the kitchen, and this space shows two furnaces for heating each On-dol room mentioned above.

^aOxford dictionary is mentioning that On-dol in Korean traditional architecture, is underfloor heating which uses direct heat transfer from wood smoke to the underside of a thick masonry floor.

^bThis is in the form of direct burning under the floor without any furnace room or cage.



Design Suggestions for Building Enclosures Towards Energy-Efficient Lit Office Environments

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The purpose of this study is to analyze how the lighting system in office buildings affects the effectiveness of work environments and suggest the proper guidelines for designing energy-efficient lit office spaces. For this study, research targets have been chosen with building configurations for office buildings in the period of 1930s through today, and reorganized investigations through the classified redesign perspectives. As a result, this paper suggests for a research method to reveal the relationship between energy efficiency, design elements and spatial configuration with correlation analyses.

Keywords: Lighting System, Lit Office Environments, Energy Efficiency, Spatial Configurations, Building Enclosures.

1. INTRODUCTION

Buildings are normally using about forty percent of the entire energies consumed in the Earth, and especially eighty percent of the total amount is needed for building maintenance and fifty six percent occupies for operating lighting, heating and cooling. In other words, applicable suggestions in the architectural field could help resolve problems mentioned above. Building energies used for utilities such as heating, ventilation and air-conditioning (HVAC) and lighting are deeply related to the envelope system that causes severe energy loss depending on its configuration.¹¹

The aim of the study is to analyze how the lighting system in office buildings affects the effectiveness of work environments and suggest the proper guidelines for designing energy-efficient lit office spaces. For this study, research targets have been chosen with building configurations for office buildings from the past to the contemporary age, and reorganized investigations through the classified redesign perspectives for the building enclosure based on the light shelf system known as one of efficient eco-friendly lighting technologies.

Through this study, in addition, further innovated envelope systems have been suggested, and one of the representative instances is the kinetic façade motorized to operate them by programmed logics in order to control daylighting for lit office environments in smarter way. It is expected to examine a possible resolution to reform fundamental functions of building envelopes, adaptability to the façade design, energy efficiencies through controlling the lighting system, and so on.

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2. CONFIGURATION OF LIT OFFICE ENVIRONMENTS

2.1. Spatial Changes in Office Environments

Office conditions have changed a lot in the past thirty years. Fluorescent lighting, the mainstay of office lighting since the 1930s, mostly consisted of regular arrays of recessed lighting systems with the lamps covered by prismatic acrylic lenses as shown on Figure 1. These direct lighting systems provided bright walls and very bright horizontal surfaces. Bright working surfaces were believed to be important to maintain task visibility. The concern with providing good visibility was justified; it was not uncommon for people to spend many hours a day.

Today, almost every office worker spends at least part of the day working on a computer. This change in technology has profound implications for office lighting. Instead of a piece of paper on a horizontal surface, these employees read from a self-luminous, vertical, glass screen. The lensed lighting systems that provided good horizontal illumination on desks suddenly became sources of unwanted screen reflections. Screen glare can reduce the visibility of the material on the screen, with consequences ranging from the inconvenient to the disastrous, depending on the importance of the task and the extent of the problem. For example, stock traders need to read, precisely and quickly, the stock prices on their monitors.⁷

However, the paperless office is still a long way away. In addition to computer-based work, most people review documents on paper. Laser printers have reduced the difficulty of many visual tasks in offices, but poor-quality faxes can still be visually challenging. Lighting systems for offices today must provide good glare control on vertical surfaces, and yet provide adequate light



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Classification of Acute Luekemia Using HMLP Network Trained by Genetic Algorithm

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Leukemia is a type of cancer that can lead to death. The main problem with the leukemia diagnosis lies in the human error in reading the data analysis and the shortage of hematologists available, to perform the data analysis. Creating a computer-aided diagnosis system is one of the solutions where it can automatically interpret the data so that fast and accurate diagnosis of the disease can be conducted. Recently, most of the researches in the leukemia applied artificial neural network (ANN) for their system seek to classify the blood cells data into normal and abnormal. This study focuses on the automated detection of acute leukemia and it also attempts to classify the disease into Acute Myelogenous Leukemia (AML) and Acute Lymphoblastic Leukemia (ALL). This research utilises a type of neural network (NN) namely Hybrid Multi-layered Perceptron (HMLP) and trained by Genetic Algorithm (GA) to diagnose the data. The data are obtained from blood cells and 31 features are extracted such as size, radius, perimeter, standard deviation (red, green and blue), the mean of the pixels of colour (red, blue, green), second order moments, third order moments and affine moments. These features are inserted into the algorithm to calculate and determine the neural network performance. For the analysis, the data is evaluated using the 5-fold cross validation technique. This research shows that HMLP trained with GA provides a better classification performance with 92.67%, 88.67% and 96.67% of the overall, AML and ALL accuracy respectively.

Keywords: HMLP Network, Genetic Algorithm, Leukemia Classification.

1. INTRODUCTION

Blood cancer is one disease that is dangerous and potentially fatal. Leukemia is one of the several types of blood cancer.^{1,2} The Ministry of Health Malaysia reported that in 2007, there were 319 boys and 220 girls were registered and diagnosed with cancer.² It is also estimated that in 2004, the number of deaths per 100,000 population distribution was 0.9.^{2,5} Leukemia occurs because of the existence of the highest abnormal number of white blood cells in the body. Leukemia can be classified into two types namely Acute Leukemia and Chronic Leukemia. Acute leukemia is caused by the production of immature, too fast and uncontrolled white blood cells. Chronic leukemia occurs as a result of rapid growth (overgrowth) of mature white blood cells. Also, the Acute and Chronic Leukemia can also be classified into two types, and this is as shown in Table I. ALL is the most common sort of leukemia in young children and AML happens more commonly in adults than in children, and a lot more in men than women.¹ Most cases of CLL occur in people around the age of fifty to sixty and CML happens mainly in adults, and becomes more common as the age increases.¹

The number of leukemia cases has increased yearly. Early diagnosis for the disease is important for effective treatment of the disease. However, there are some limitations such as the lack of doctors and pathologies which can make early detection. To overcome the issue, several researches have proposed automating the diagnosis using artificial intelligent techniques.

Chen⁶ proposed the Gene Selection for Cancer Classification Using Bootstrapped Genetic Algorithms and Support Vector Machines (SVM). In this study, a set of 72 samples containing 7129 features for each sample are used. The SVM and GA algorithms with bootstrap are used to cater the problem of the small number of the dataset. The proposed bootstrapped GA/SVM algorithms are found to be well suited for the feature selection problem.

Mehdi et al.⁷ proposed the *k*-means clustering of third order polynomial based normalization of Acute Myeloid Leukemia (AML) and Acute Lymphocyte Leukemia (ALL). In their study, the *k*-means algorithm was used as classifier. A total of 72 samples had been used to determine the AML and ALL. The proposed method achieved a satisfactory classification accuracy of 96%.

Ji et al.⁸ suggested on the Partial Least Square (PLS) based Gene Selection and Identification of Tumor-Specific Genes.

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Commercial Potential of University Patents Through Patent Cooperation Treaty Application

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Technology transfer is the process of technologies developed by universities or by other government's institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. The best transferable results are patents. The aim of the study is to introduce new system of commercialization of patented inventions, where transferring inventions into marketable products could be more efficient than it is now. If technology transfer office manager determines that an invention has sufficient internationally commercial potential, university will probably choose to file a Patent Cooperation Treaty (PCT) application on an invention. This study try to evaluate commercial potential of university patenting through participation of PCT application in patent portfolio and a country's degree of concentration of PCT application filings.

Keywords: Technology Transfer Office, University Patenting, Commercialization Potential, Patent Cooperation Treaty, Patent

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1. INTRODUCTION

Today's business press is constantly full of articles about companies and their competitive advantages resulting from their intellectual property or intellectual capital. New industries, based on technologies like are emerging which are totally based on intellectual properties of the new companies. Business managers with basic intellectual property knowledge and intellectual property professionals are becoming increasingly influential leaders in the information age.¹ Patents and utility models are among the traditional and, at the same time, the most important tool of legal protection for technical solutions and inventions.

Universities have many assets: know-how, human capital, facilities, prototype equipment, networks etc., but why universities should be focused on patented and owned technology in the long term? The process of getting product into the market is most complex and as such requires much specialized professional expertise and expert knowledge.

The developing of invention is only beginning phase, but the final phase of the innovation process is the marketing and commercialization phase which is crucial for the success of any invention and innovation.² Patents valuation methods are mostly income or income-market-based. In these methods one of the key estimate is the cost of capital.⁸

This paper is not intended as an instruction on how to commercialize inventions, but is intended to present some new ideas that could serve as a basis for discussions how to increase

commercialization potential of university patents and assesses collaboration between university entities and other partners. The question therefore arises whether specific detachment of scientifically technological thinking stems from a meagre university involvement in the process of commercialization of inventions developed by them, whether it also has other institutional base? The main research question for this study is: Looking at the university patenting and evaluate PCT patent portfolio. PCT applications provide a high comparability among different countries and are frequently used in international analyses. Inventions, which are crucial for licensing, are frequently used to capture the innovative capacity of universities. As a further check of robustness, we include the number of patent families per university.

2. LITERATURE OVERVIEW

The geographical filing breadth represents the number of filing countries (or 'jurisdictions' as some patent office's represent regions) in which a university entity filed applications for the same invention. Patent applicants only receive patent protection in those jurisdictions where an application was filed. As such, geographical filing breadth is an indicator of commercialization potential.³ By filing one international patent application under the PCT, applicants can simultaneously seek protection for an invention in 148 countries throughout the world. Local patent application followed within 12 months by international application under the PCT, claiming Paris Convention priority, with "national phase" commencing at 30 months.⁴

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The Difference of BMI and Micronutrient
Intake Between Multibacillary Leprosy and
Non Leprosy (A Study in District Brondong,
Iamongan 2013)

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The Difference of BMI and Micronutrient Intake Between Multibacillary Leprosy and Non Leprosy (A Study in District Brondong, Lamongan 2013)

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Background: There is a link between food shortages with leprosy. Some studies showed that the intake of micronutrients (vitamin A, vitamin E, zinc and anti-oxidants) may affect the immunological response. This study aimed to analyze the differences of BMI, intake of Vitamin A, Vitamin E, Vitamin C, and zinc among leprosy patients (positive serology) with non-leprosy. **Method:** This was a cross sectional study. Subject consisted of 20 non-leprosy and 20 leprosy patients. The levels of immunoglobulin M (IgM) anti Phenolic Glico lipid (PGL)-1 by ELISA method was used for leprosy screening. The measurement of nutrient intake was conducted by 1 × 24 hour recall and FFQ, treated with Nutrisurvey. Independent t-Test and Mann Whitney Test were used to determine differences in BMI and nutrient intake of leprosy and non-leprosy. **Results:** Mean BMI, intake of vitamin A, C, E and zinc were better on non-leprosy compare to leprosy patients. The statistic analyze showed significant differences of BMI ($p = 0,006$), intake of vitamin A ($p = 0,027$) and zinc ($p = 0,011$) among leprosy and non-leprosy. **Conclusion:** Health services should conduct counseling about the importance of good nutrition and the consumption of good nutrition to improve immune status, especially for non-leprosy person who lives with leprosy patient to prevent from infection.

Keywords: Leprosy, BMI, Vitamin A, Vitamin E, Vitamin C, Zinc.

1. INTRODUCTION

Leprosy remains public health problems in Indonesia. The World Health Organization noted Indonesia has the third highest number of leprosy patients globally after India and Brazil.¹ Leprosy is a disease with long incubation period. Studies in the Philippines and Venezuela showed in 2–4 years, a person who lives in a house with leprosy patient and have close contact with the patients have a greater risk of suffering from leprosy (especially multibacillary) compared to seronegative contact person.²

Subclinical leprosy (positive serology) has an important role in the prevention of leprosy. They could potentially become leprosy patients, and may serve as a source of transmission. Sub-clinical leprosy is commonly found in people who have close contact with leprosy patients, such as live in same house with MB leprosy patients. The risk of becoming leprosy is related to several factors such as severity of infection, susceptibility of people who closely contact (at home), frequency and duration of contact with leprosy patients. Individual factors are also noteworthy, such as age, gender, health behavior, physiology (related to nutritional factors).³ The presence of seropositive subjects who have turned to leprosy can be detected by examining the levels of

immunoglobulin M (IgM) anti Phenolic Glico lipid (PGL)-1. The use of PGL-1 antigen minimizes the possibility of cross reaction with other microbacteria.⁴

Leprosy and nutrition are related through immunity. Leprosy is also regarded as an immunologic disease, because the important role of cellular immunity. Malnutrition in general causes a disruption of immune response, which increases susceptibility to diseases. The malnutrition influences nutritional status (BMI).⁵ The relationship of immunity and nutritional factors, especially on infectious diseases, are often studied. For example in diarrheal disease and pulmonary tuberculosis, but it is still rarely performed on leprosy. A study in Bangladesh showed a link between food shortages with leprosy. Several other studies have shown that the immune response is affected by the intake of micronutrients, such as vitamin A, vitamin E, zinc and anti-oxidants.⁶

Serum vitamin A in patients with MB type of leprosy is much lower than non-leprosy,⁷ whereas vitamin A is necessary for cytokines regulatory. Retinoic acid is the most active metabolic form of vitamin A. Retinoic acid plays a role in the regulation of the synthesis of several cytokines such as interferon gamma and interleukin 2 productions. IFN- γ and IL-2 are cytokines produced by Th1 cells. In MB leprosy patients, Th1 cell is lower than Th2 cells.³ Vitamin E also plays a role in up-regulation of

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IL-2 cells T.⁸ High levels of lipid peroxidation as measured by the MDA levels in patients with leprosy, demonstrates the importance of the role of antioxidants in the disease.⁷ Vitamin E is classified as antioxidant vitamin.

Level of zinc serum in patients with leprosy is in accordance with the spectrum of leprosy, which indicates the degree of cellular immune responses.⁹ Several reports showed a gradual decrease in zinc serum levels in patients with leprosy from PB to MB type, with the lowest levels on MB type.¹⁰ There is an inverse relationship between the levels of IgM anti PGL with plasma zinc in people who live with leprosy patients.¹¹

The study was conducted in the District Brondong, Lamongan. Lamongan has the third highest cases of leprosy incidents in Central Java Province. The prevalence of leprosy in the district Brondong is the highest in Lamongan (in 2008), so in 2013 serological study of leprosy was conducted in this district. Based on this background, this study aimed to determine the differences in BMI and intake of nutrients, which decrease the immunity of patients seropositive, which a few years later can become a leper, even can infect family members.

2. METHOD

The type of research was analytic survey with a cross sectional design. Subjects consisted of 20 persons in each group (leprosy and non-leprosy). Screening of leprosy and non-leprosy was done by examining the levels of immunoglobulin M (IgM) anti Phenolic Glico lipid (PGL)-1 by ELISA method. BMI was measured by weight and the height. Intake of vitamin A, vitamin C and zinc was measured by using a 1 × 24 hour recall method and FFQ which were treated by Nutrisurvey program. Statistical test to determine differences in BMI, intake of vitamin A, vitamin C and zinc were Independent *T* tests.

2.1. RESULTS

2.2. Characteristics

The majority (55%) of leprosy patients were graduated from elementary school education, while the non-leprosy junior high school.

2.3. The difference of BMI, Intake Vitamin A, Vitamin E, Vitamin C, and Zinc

Mean BMI, intake of vitamin A, vitamin E, vitamin C and zinc were higher in the not leprosy than lepers. More details data can be found on Table II.

Statistical analysis showed there were differences in BMI (0,006) intake of vitamin A (0,027) and zinc (0,011) among

Table I. Characteristics of the subjects.

Variable	Leprosy		Non leprosy	
	F	%	f	%
Women	12	60	12	60
Men	8	40	8	40
Total	20	100	20	100
Primary school	11	55	5	25
Junior high school	5	25	8	40
Senior high school	4	20	7	35
Total	20	100	20	100

Table II. The difference BMI, intake Vit A, E, C, Zn

Variable	Leprosy		Non leprosy		<i>p</i>
	Mean	SD	Mean	SD	
BMI	20,3	3,07	23,17	3,12	0,006 ^a
Vit A (µg RE)	457	–	944	–	0,027 ^b
Vit E (mg)	3,95	2,32	4,75	2,27	0,278 ^b
Vit C (mg)	46	–	51	–	0,343 ^b
Zinc (mg)	9,05	–	9,95	–	0,011 ^b

Notes: ^a = Independent *t* test, ^b = Mann Whitney test.

leprosy patients and non-leprosy, while vitamin E and C were not significantly different.

3. DISCUSSION

Nutritional status of patients with leprosy has a significant effect on their immune system, because good nutritional status is a good protection against pathogens. The immunological system, which is fully supported by proteins, will provide the maximum defense and reduce the effects of tissue damage due to infections. The interaction between infections, including leprosy, and nutrition in a human body is expressed as a synergistic event. During infections, nutritional status declines. Decrease of nutritional status increases susceptibility to infection.

Immune response becomes less effective in the condition of malnutrition. Several studies revealed that 95% of people have no immunity (resistance) against leprosy. Theoretically, leprosy patients would have thin nutritional status due to the increase of protein catabolism.⁶

Median of vitamin A intake in leprosy patients (457 ug RE) was lower than those of the healthy subjects (944 ug RE). These results support the previous findings that level of serum vitamin A in patients with type MB leprosy is much lower than non-leprosy.⁶ Levels of serum vitamin A is determined by food intake. The Mann Whitney test showed there was significant difference between the levels of vitamin A in leprosy patients compared to healthy subjects ($p < 0.05$). The results are consistent with previous research that showed a significant relationship with the negative direction between the intake of vitamin A with titer anti PGL-1.⁶

Mean of vitamin E intake among leprosy and non-leprosy was similar. Independent *t*-Test showed no significant differences between leprosy and non-leprosy's vitamin E intake ($p > 0.05$). The results are consistent with Apriani's research stating that vitamin E is not a risk factor in patients with leprosy.^{11,14} The case of vitamin E deficiency is rare, so it is possible there is no difference between the intakes of vitamin E with a non-leprosy (healthy) patients.

Median vitamin C intake is almost the same among the leprosy and non-leprosy, which is less than the recommended Nutrition Adequacy Score (75 mg/KgBW). The result of this study does not correspond to Zen R research that stated that people with vitamin C deficiency are 2.56 times more likely to experience leprosy. The lack of intake of protein, vitamin C and zinc will disrupt the body's immune system, so it can be easily attacked by *Mycobacterium leprae*.¹² Based on the results of the recall and FFQ society consumption patterns, fruit is always available and the food is easily accessible by the public at an affordable price.

The intake of vitamin A, C, E, zinc is negatively associated with higher levels of IgM titers of anti PGL-1. The results of

several studies showed negative significant correlation between the titers IgM anti PGL-I with the intake of energy, protein, vitamins A, C, E, B6, calcium, iron, zinc and copper. Samples whose intake of vitamin C, vitamin B6 and copper is less than the RDA risk respectively of 2.56; 2.93 and 3.15 times as likely to be KSS (Serology subclinical Leprosy) compared with the sample intake meets the RDA.^{4, 13, 14}

Leper zinc intake is lower than the healthy subjects. Mann Whitney statistical test showed there was significant difference in zinc levels of non leprosy and leprosy patients ($p < 0.05$). These results support the findings of previous studies that showed serum zinc levels in patients with leprosy in accordance with the spectrum of leprosy; that is the picture of the degree of cellular immune responses.⁹ Several research showed a gradual decrease in zinc serum levels in patients with leprosy from type PB to MB, with the lowest levels on the type MB. 10. There is an inverse relationship between the levels of IgM anti PGL with zinc plasma in people who live adjacent to the lepers.^{12, 13}

4. CONCLUSION

Subjects who lived in leprosy endemic areas or adjacent to leprosy patients, need to increase the intake of nutritious foods, especially animal protein and zinc. The intake of nutritious foods is expected to increase the immune response, so that the subjects who live nearby are not easily infected.

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