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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 $1 \times 24$ 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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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 $1 \times 24$ 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 leprosy patients and non-leprosy, while vitamin E and C were not significantly different.

**Table I. Characteristics of the subjects.**

| | Leprosy | | Non leprosy | |
|---|---|---|---|---|
| Variable | *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**

| | Leprosy | | Non leprosy | | |
|---|---|---|---|---|---|
| Variable | Mean median | SD | Mean median | SD | *p* |
| BMI | 20,3 | 3,07 | 23,17 | 3,12 | 0,006[a] |
| Vit A ($\mu$g RE) | 457 | – | 944 | – | 0,027[b] |
| Vit E (mg) | 3,95 | 2,32 | 4,75 | 2,27 | 0,278[a] |
| 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.*

## 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 1gm 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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