INTRODUCTION

Leprosy or Morbus Hansen is a chronic infectious disease caused by obligate intracellular bacteria *Mycobacterium leprae* (*M. leprae*). Leprosy mainly damages the skin and peripheral nerves. However, leprosy can also affect muscles, eyes, bones, testes and other internal organs. This disease is an infectious disease that leads to many complex problems, not only from a medical perspective but has also affected social, economic, cultural, security and national security issues. Based on data from the World Health Organization (WHO), official reports from 136 countries in 6 regions, the number of new leprosy cases during 2015 was 210,758. New leprosy cases were primarily discovered in the Southeast Asia region, accounted for 156,118 cases. It was later found that the top five leprosy endemic countries globally are India, Brazil, Indonesia, Bangladesh and Congo.

Based on Indonesia’s health data profile in 2015, it was stated that Indonesia was ranked third in the world leprosy epidemiology with the development of 17,202 new leprosy cases. In North Sumatra only, it was already reported that there were 197 cases in which 25 of them were paucibacillary type (PB) leprosy and the remaining 172 cases were multibacillary type (MB).

The course of leprosy disease depends on individual factors which can affect the host's immune response. Several factors which influence leprosy are host factors, *M. leprae* bacteria, and environmental factors, including the patient’s nutritional status. Deficiencies in various vitamins and elements are reported to affect the innate or acquired immune responses, which may then cause an imbalance response to pathogens.

Vitamin A and its precursors, retinoic acid and β-carotene, are non-enzymatic antioxidants essential for the body. These nutrients can interact with free radicals, such as peroxyl, inhibiting lipid peroxidation, and hydroperoxide through peroxyl radical stabilization. Vitamin A is known to have an irreplaceable role in regulating various immune response components, including innate and acquired immunity (cellular and humoral).

To determine the levels of vitamin A in type PB and MB leprosy patients, the levels of vitamin A were compared between PB and MB leprosy cases. The relationship between vitamin A levels and the bacterial index was tested using Pearson correlation. Results: Most of these subjects were MB, male predominance, in 16-35 years with 21 subjects. The bacterial index of 0 can be found in 16 subjects (47.1%), +1 in 8 subjects (23.6%), +2 in as many as 5 subjects (14.7%), and +3 in 5 subjects (14.7%). The vitamin A level in MB type leprosy was lower than PB type leprosy (p = 0.001). We also found a negative correlation between vitamin A levels and the bacterial index values (r = -0.632, p = 0.000).

Conclusion: The higher the bacterial index value is, the lower the vitamin A level will be.

**ABSTRACT**

**Background:** Leprosy or Morbus Hansen is a contagious, chronic, and infectious disease mainly caused by *Mycobacterium leprae* (*M. leprae*), affecting the skin and peripheral nerves. Vitamin A is an essential non-enzymatic antioxidant for the body, which regulates various immune response components. A decline in the levels of vitamin A was discovered in leprosy. This study determined the levels of vitamin A and its comparison in multibacillary (MB) and paucibacillary (PB) type leprosy patients, also the relationship between vitamin A levels with bacterial index.

**Method:** This cross-sectional study included thirty-four leprosy patients, conducted at the Leprosy Division in Dermatology and Venereology Department of Haji Adam Malik General Hospital Medan, Pirngadi General Hospital Medan, Lau Simomo Leprosy Hospital, Sicanang Leprosy Hospital, and Belidahan Leprosy Hospital with consecutive sampling techniques from March to October 2018. We determined the levels of vitamin A and its comparison in multibacillary (MB) and paucibacillary (PB) type leprosy patients, also the relationship between vitamin A levels with bacterial index. A T test was then performed to compare vitamin A levels between PB and MB types of leprosy. The relationship between vitamin A levels and the bacterial index was tested using Pearson correlation.

**Results:** Most of these subjects were MB, male sex predominance, in 16-35 years with 21 subjects. The bacterial index of 0 can be found in 16 subjects (47.1%), +1 in 8 subjects (23.6%), +2 in as many as 5 subjects (14.7%), and +3 in 5 subjects (14.7%). The vitamin A level in MB type leprosy was lower than PB type leprosy (p = 0.001). We also found a negative correlation between vitamin A levels and the bacterial index values (r = -0.632, p = 0.000).

**Conclusion:** The higher the bacterial index value is, the lower the vitamin A level will be.

**Keywords:** leprosy; vitamin A; bacterial index

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Comparison of vitamin A levels between PB and MB types of leprosy, and the relationship between vitamin A levels and bacterial index in leprosy patients.

METHODS

This study was an observational analytic study with the cross-sectional method. In this study, 34 samples of leprosy patients were taken using consecutive sampling techniques from leprosy patients who came to the Leprosy Division in Dermatology and Venerology Department of Haji Adam Malik General Hospital Medan, Pirngadi General Hospital Medan, Lau Simomo Leprosy Hospital, Sicanang Leprosy Hospital, and Belidahan Leprosy Hospital that meet the inclusion and exclusion criteria, from March to October 2018.

The subjects of this study were leprosy patients who were divided according to their cardinal signs, > 15 years old, and willing to take part in the study by signing informed consent. Subjects were directly excluded if they were pregnant or breastfeeding, including those who consumed any antioxidant drugs and vitamin A.

Later on, the baseline data were recorded, bacteriological examination and blood sampling were conducted to check the vitamin A levels. Skin scrapings were taken from two or three locations: ear lobe and active skin lesions. Moreover, staining was done by the Ziehl-Neelsen method. Nonetheless, the bacterial index was also assessed using Ridley’s logarithmic scale. Then the blood sample was taken to determine the vitamin A levels with a hydride atomic generation absorption spectrometer. Then the results will be presented in units of µg/dl.

Leprosy patient characteristics distribution data, including gender, age, type of leprosy, and bacterial index, are presented in the form of a descriptive table. The results of vitamin A measurement levels were reported in mean values (median ± SD). A T test was then performed to compare vitamin A levels between PB and MB types of leprosy. The relationship between vitamin A levels and the bacterial index was tested using Pearson correlation.

RESULTS

We found 18 (52.9%) MB-type leprosy patients and 16 (47.1%) PB-type leprosy patients. Based on gender, 24 men (70.6%) and ten women (29.3%). Based on the age group, the age group of 16-35 years were 21 people (61.7%), the 36-55 years age group were eight people (23.5%), and the 56-75 years age group were five people (14.7%). The results of the bacterial index examination showed a bacterial index of 0 in 16 people (47.1%), +1 in approximately 8 people (23.6%), +2 in as many as 5 people (14.7%), and +3 also in 5 people (14.7%) (Table 1).

In addition, Table 2 displays the results of the vitamin A examination levels, and the mean value of vitamin A levels in MB type leprosy was 275.833 µg / dl. In comparison, the mean vitamin A levels in type PB leprosy were 452.062 µg/dl, and a T test was initiated to conclude that the vitamin A levels in MB type leprosy were lower than the vitamin A level of PB type leprosy (p=0.001).

This study concluded a negative correlation between vitamin A levels and bacterial index in leprosy patients (r=-0.632, p=0.000), meaning that the higher the bacterial index value, the lower the vitamin A levels would be (Table 3).

DISCUSSION

Leprosy or Morbus Hansen is a chronic infectious disease mainly resulted from central M. leprae.3-11 WHO data on the epidemiology of leprosy showed a significant reduction in the prevalence of leprosy globally after the introduction of multi-drug therapy (MDT).4 Based on the 2015 Indonesian Health Profile, it was reported that the number of leprosy patients in Indonesia levitated from 17,025 cases in 2014 to 17,202 cases. In North Sumatra Province alone, there were 197 recent leprosy cases with a prevalence of 1.41 per 100,000. Based on these detailed data, it was stated that there were 25 cases of PB-type leprosy and 172 cases of MB-type leprosy.5,6

Leprosy can affect any age. However, most of the incidence is found in young and productive ages. Based on sex, leprosy can impact both men and women. Nevertheless, reports in several countries found that the incidence rate is more frequent in men than women. Leprosy also

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Table 1. Leprosy characteristics patients’ distribution

| Variables | Frequency | % |
|-----------|-----------|---|
| Sex       |           |   |
| - Men     | 24        | 70.6 |
| - Women   | 10        | 29.3 |
| Age       |           |   |
| - 16-35   | 21        | 61.7 |
| - 36-55   | 8         | 23.5 |
| - 56-75   | 5         | 14.7 |
| Leprosy type |     |   |
| - MB      | 18        | 52.9 |
| - PB      | 16        | 47.1 |
| Bacteria Index | |   |
| - 0       | 16        | 47.1 |
| - +1      | 8         | 23.6 |
| - +2      | 5         | 14.7 |
| - +3      | 5         | 14.7 |

Table 2. Comparison of vitamin A levels between MB and PB type leprosy

| Leprosy type | n   | Mean ± SD (µg/dl) | p-value |
|--------------|-----|------------------|---------|
| Type MB leprosy | 18  | 275.833±128,395 | 0.001   |
| Type PB leprosy | 16  | 452.062±37,689 |         |

Table 3. Relationship between vitamin A levels and bacterial index

| Bacterial Index | N   | Mean (µg/dl) | p-value | r    |
|----------------|-----|--------------|---------|------|
| 0              | 16  | 452.06       |         |      |
| +1             | 8   | 339.38       |         | -0.632 |
| +2             | 5   | 285.4        |         |      |
| +3             | 5   | 163.60       |         |      |
indicates that it can also be influenced by socioeconomic conditions, where leprosy is more common in low socioeconomic conditions.\textsuperscript{12,13}

Vitamin A and its precursors, retinoic acid and \( \beta \)-carotene, are highly significant antioxidants for the body.\textsuperscript{6} Vitamin A also regulates many components in the immune response, including innate and acquired immune responses.\textsuperscript{14–16} In the innate immune response, vitamin A deficiency is associated with decreased phagocytosis and oxidative burst activity of macrophages.\textsuperscript{16}

Previous studies have proven decreased vitamin A serum concentrations in leprosy, especially in lepromatous leprosy patients, where there is depression of the Th1 immune response and replication of the \( M. \ leprae \) in macrophages and were dominated by the humoral response. Lima et al. determined lipid peroxidation and non-enzymatic levels in leprosy. They reported an increase in MDA levels than controls, increasing equal to the disease spectrum where the highest levels were found in lepromatous type leprosy.\textsuperscript{8,10}

In this study, it was also discovered that there was a deplete in the vitamin A levels compared to controls with a more significant decline in lepromatous type leprosy.

**Study limitation**
The limitation of this study is the small number of research samples, so it cannot accurately describe the population.

**CONCLUSION**
Vitamin A levels were lower in MB type leprosy than PB type leprosy. The higher the bacterial index is, the lower the vitamin A levels in leprosy patients will be.

**DISCLOSURE**

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**Author Contribution**
All authors have contributed to all processes in this research, including preparation, data gathering and analysis, drafting and approval for publication of this manuscript.

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**Conflict of Interest**
The authors declare no conflict of interest regarding the publication of this article.

**Ethical Consideration**
The Health Research Ethical Committee of the Medical Faculty of Universitas Sumatera Utara has approved this research with letter number NO: 310/TGL/KEPKFKUSU-RSUPHAM/2018.

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