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Original Article

Analysis of vitamin E in leprosy patients

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Abstract

Background Mycobacterium leprae is the primary causative agent of the chronic infectious illness leprosy, can affect peripheral nerves and the skin. Vitamin E, a fat-soluble antioxidant, is essential in the body and can modulate various immune responses. Previous study showed reduced vitamin E levels in leprosy patients. This study evaluated vitamin E levels, differences in paucibacillary and multibacillary type leprosy subjects, and the correlation between bacterial index and vitamin E levels.

Methods In this study, 24 leprosy subjects have been included in this analytical investigation using a cross-sectional methodology. Between March and October 2018, the study was carried out in the Dermatology and Venerology Department of the Leprosy Division at the Haji Adam Malik General Hospital in Medan, Pirngadi General Hospital in Medan, Belidahan Leprosy Hospital, Sicanang Leprosy Hospital, and Lau Simomo Leprosy Hospital.

Results Leprosy was found primarily in males (70.8%), 16–35 years old (50%). The mean value of vitamin E levels in MB leprosy (9.62±3.91 mg/L) was lower than in PB leprosy (10.55±2.12 mg/L). This study showed a statistically significant correlation between bacterial index and vitamin E levels (r=0.284, p=0.043).

Conclusion There is a correlation between bacterial index and vitamin E levels.

Key words
Vitamin E; Leprosy.

Introduction

Leprosy is a neglected tropical disease that nevertheless poses a serious public health risk in developing and underdeveloped nations. At least one of the three cardinal signs must be present in order to diagnose leprosy in a patient who has not yet accomplished a full course of treatment. These signs are: enlargement of the thickening of peripheral nerves combined with a loss of sensation and weakness in the muscles these nerves innervate; reddish or pale skin patches with a loss of local sensation; and evidence of acid-fast bacilli in slit skin smear.[1,2]

The disease remains a public health problem in underdeveloped regions, making it known as the disease of people with low incomes. Nutritional deficiencies weaken the immune system, weakening the body's immune defenses against infections.[3] One of the various mechanisms that influence the pathogenesis of leprosy is oxidative stress resulting from an imbalance between natural antioxidants and ROS.[4] Micronutrient and vitamin deficiencies affect the innate adaptive immune response, resulting in an imbalance in the host response to pathogens.[5] Decreased levels of antioxidant and nutrients increase oxidative stress and skin and

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neurological disorders during M. leprae infection.[6] Vitamin E, a fat-soluble antioxidant, is an unsaturated phospholipid that plays a role in the immune system by protecting cell membranes and reducing lipid peroxidation.[7] This study investigated the levels of vitamin E and their comparison in paucibacillary (PB) and multibacillary (MB) type leprosy as well as the correlation between bacterial index and vitamin E levels.

Methods

In this study, 24 leprosy subjects have been included in this analytical investigation using a cross-sectional methodology in accordance with the inclusion and exclusion criteria. Between March and October 2018, the study was carried out in the Dermatology and Venereology Department of the Leprosy Division at the Haji Adam Malik General Hospital in Medan, Pirngadi General Hospital in Medan, Belidahan Leprosy Hospital, Sicanang Leprosy Hospital, and Lau Simomo Leprosy Hospital. Each subject had signed the informed consent. Subjects who were pregnant, breastfeeding, or consumed antioxidant drugs and vitamin E were excluded. This study was performed following the principles of the Declaration of Helsinki.

Basic data were noted, bacterial examination and blood sampling are performed to determine vitamin E levels. Scrapings of the skin are taken from three or two locations, including auricles and active skin lesions. The Ziehl-Neelsen staining procedure is used, and the logarithmic Ridley scale was used to calculate the bacterial index. The collected data are analyzed by Shapiro-Wilk for the normality of data distribution. Then, the average levels of vitamin E levels of the MB and PB groups were then compared and analyzed with the T-test. The Kruskal-Wallis test was used to determine the correlation between the bacterial index and vitamin E levels in leprosy subjects.

Results

In this study, the data were normally distributed. The demographic characteristics of leprosy subjects were highest in males (70.8%) compared to females (29.2%). Based on age group, 12 subjects (50%) were in the 16–35 age group. The mean age of these study subjects was 38.54±16.44. Subjects consisted of 13 with multibacillary (MB) leprosy and 11 others with paucibacillary (PB) leprosy. The bacterial index showed that most subjects were negative (58.3%) **(Table 1)**.

The mean value of vitamin E in all subjects with leprosy was 10.04±3.18 mg/L. **Table 2** showed that the mean value of vitamin E levels in MB leprosy (9.62±3.91 mg/L) was lower than in PB leprosy (10.55±2.12 mg/L). A T-test was conducted and showed that there was no statistical significance between vitamin E levels in MB and PB leprosy **(Table 2)**. This study also

Table 1 Baseline characteristics of leprosy subjects.

Characteristics	*n*	*%*
Gender		
Males	17	70.8
Females	7	29.2
Age (years old)		
16 – 35	12	50.0
36 – 55	7	29.2
56 – 75	5	20.8
Leprosy type		
PB	11	45.8
MB	13	54.2
Bacterial index		
0	14	58.3
+1	5	20.8
+2	2	8.3
+3	3	12.5

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

Leprosy type	*n*	*Mean ± SD (mg/L)*	*P-value*
PB	11	10.55 ± 2,12	0.468
MB	13	9.62 ± 3.91	

Table 3 Correlation between bacterial index and vitamin E levels.

Bacterial index	*n*	*Mean ± SD (mg/L)*	*P-value*	*r*
0	14	11.00 ± 2,22		
+1	5	8.20 ± 3.90	0.043	0.284
+2	2	13.00 ± 4,24		
+3	3	6.67 ± 2,08		

shown that there is a statistically significant difference between bacterial index and vitamin E levels with a weak correlation r=0.284, p=0.043) **(Table 3)**.

Discussion

Leprosy may affects the skin, peripheral nerves, the upper respiratory track, and the mucosa of the eyes, leading to progressive nerve damage and deformities.[6] Around 80% of new cases reported globally come from India, Brazil, and Indonesia.[1] According to WHO, new cases of leprosy worldwide decreased from 217.968 in 2016 to 210.671 in 2017. South East Asia was the highest in 2017 for new cases, around 153.487. Indonesia is the third country with the highest number of cases of leprosy, with 16.826 cases in 2016 and 15.910 in 2017.[8]

Leprosy was found primarily in males (70.8%), 16-35 years old (50%). This study is relevant to the study by Pranata, Nugrahaini, and Fajariah that the majority of subjects were male (70.3%) and the age group of leprosy was 36–55 years old (50%), followed by 18–26 years old (29%).[9] Leprosy was classified into paucibacillary (PB) leprosy (2 to 5 skin lesions) and multibacillary (MB) leprosy (> five skin lesions).[2] In our study, we found that the majority of subjects with MB leprosy (54.2%).

Vitamin E, also called alpha-tocopherol, is a fat-soluble antioxidant. With its antioxidant action that breaks antioxidant chain, it can effectively protect against lipid peroxidation. Vitamin E contains antioxidant and membrane-stabilizing properties in addition.[4] One of the roles of vitamin E is the activity of free radical scavenging in the aqueous phase of cells and the circulatory system to cleanse the reactive oxygen species produced.[10] Although our study found no statistically significant correlation between vitamin E levels in leprosy, PB and MB, this study shows MB leprosy has a lower mean vitamin E level than PB leprosy. This study was similar to several studies that found that vitamin E level was significantly decreased in both PB and MB leprosy subjects compared to controls.[4,11] Increased use of vitamin E in lipid peroxide scavenging can cause serum vitamin E levels to drop. Low levels of antioxidants can expose tissues to oxidative stress-mediated changes in biomolecules and cells. They can contribute to leprosy patients' inflammatory episodes, organ damage, suppressed cell-mediated immune response, and nerve degeneration.[4]

As TNF-α, NO, and ROS have microbicidal effects and can cause tissue damage, tissue inflammation caused by an immune response can also lead to clinical manifestation of infection. Thus, antioxidant compounds (dietary or endogenous) and cytokine modulations are crucial for a balanced immune response for host protection and pathogen control.[6] Vitamin E can inhibit lipid peroxidation by neutralizing the peroxyl radical. The isolated elevated quantities of vitamin E can have a pro-oxidant effect, causing the characteristic changes of the free radicals; therefore, a precise equilibrium of the concentrations of these components is required.[7]

In the study of Vijayaraghavan *et al*. explained the protective role of vitamin E in leprosy. They demonstrated that exogenous vitamin E supplementation may protect against the harm produced by ROS throughout the disease's progression and antileprosy chemotherapy.[12]

The antioxidant defense can compensate for the ability of multidrug therapy to induce the production of free radicals in leprosy patients. A balanced diet best supplies antioxidants; However, leprosy patients are often lack socioeconomic status.[13] A study by Wagenaar *et al*. found that compared to the controls, people with leprosy had less money to spend on food and their diets were less varied. A group of patients ate food with low nutritional value such meat, fish, eggs, vegetables, fruits, and milk. However, the body's immune system needs proteins, vitamins, and minerals to fight infection.[3] Insufficient food intake reduces intake of carbohydrates, fats, proteins, vitamins and minerals, and nutritional deficiencies may weakens the immune system against infection.[14]

Conclusion

There is a correlation between bacterial index and vitamin E levels.

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