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A Study of Selenium in Leprosy

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Abstract

INTRODUCTION: Leprosy is a chronic infection caused by *Mycobacterium leprae*. Selenium, on the other hand, is a substance, which is needed for its protective role against microorganism infection.

AIM: This study aims to know the association between selenium serum levels with bacteriological index.

METHODS: This is an analytical cross-sectional study model. Sampling was done with consecutive sampling method in Pirngadi General Hospital, Lau Simomo Leprosy Hospital and H. Adam Malik General Hospital. Samples were taken from patients' venous blood serum then selenium levels were measured.

RESULTS: This study found 30 leprosy patients consisted of 19 patients with paucibacillary (PB) leprosy and 11 patients with multibacillary (MB) leprosy. Selenium serum levels of patients with PB leprosy (mean = 97.16 µg/dL) were found to be significantly higher than MB leprosy (mean = 77.27 µg/dL) with p = 0.008 using t-test. The negative correlation between selenium serum levels with bacterial index in patients with leprosy was also found in this study using Spearman's rho test (r = - 0.499, p = 0.005).

CONCLUSIONS: Selenium serum levels of patients with PB leprosy are higher than patients with MB leprosy, and high bacteriological index in patients with leprosy were correlated with low selenium serum levels.

Introduction

Leprosy, also known as Hansen's disease is a chronic infection caused by *M. leprae* bacteria which primarily targets skin and peripheral nerves [1] [2]. Leprosy is common in developing countries [3]. According to World Health Organization (WHO) report in 2016 that received from 143 countries, the prevalence of leprosy was registered as 0.23 per 10.000 populations with 171.948 leprosy cases on treatment. During the year, 214.783 new cases (2, 9 per 100.000 populations) were reported globally. A country can be classified as leprosy endemic country if the mean prevalence is found more than 1 case per 10.000 inhabitants (10 cases per 100.000 inhabitants). According to the criteria, from highest to lowest, India, Brazil, Indonesia, Ethiopia and Bangladesh are the five leprosy endemic countries with most leprosy new cases in the world [4] [5].

Agent – host - environment model can be used to explain numerous factors that affect the natural history of Hansen's disease. *M. leprae* serves as the agent factor. Host factors include age, gender, genetics, nutritional status, and immunity levels. Environmental factors include living and migrating to leprosy endemic areas [6] [7].

Nutrition holds a crucial role in affecting both cellular and humoral immune system. Trace element deficiency may cause inadequate host response to the infectious pathogens [8].

Selenium is one of the trace elements that hold a crucial role in the immune system and protection against free radicals. Selenium is a

biological antioxidant. Selenium is known to have a role in glutathione peroxidase activation – the main enzyme to defend against oxidative stress [9]. Glutathione catalyses hydrogen peroxide and organic hydroperoxide reduction, and this can protect the fat and other tissues against oxidative damage [8].

This study aims to know the association between selenium serum levels with bacteriological index.

Methods

This is an analytical cross-sectional study model and was held from June until November 2017 at Pirngadi General Hospital, Lau Simomo Leprosy Hospital and H. Adam Malik General Hospital. The inclusion criteria consist of leprosy patient, above 15 years old, and the exclusion criteria are patient with a history of antioxidant consumption. Samples were taken from patient's venous blood serum then selenium levels were measured using ICP - MS (Introductive Couple Plasma Mass Spectrometry) method with Agilent 7700 machine. Slit - skin smears were taken to measure the bacteriological index.

Samples were taken from two or three locations including both earlobes and active skin lesion. Staining was done with Ziehl - Neelsen method. The bacteriological index was then scored according to Ridley logarithmic scale.

The collected data then analysed using Kolmogorov Smirnov to evaluate the normality of data distribution. The mean selenium level in PB and MB group was then compared and analysed using T-test. Spearman rho was used to see the correlation between selenium serum levels with bacteriological index.

Results

Leprosy patient's characteristics

This study has found 30 samples that satisfied the inclusion and exclusion criteria. Samples consisted of 19 (63.3%) paucibacillary (PB) leprosy patients and 11 (36.7%) multibacillary (MB) leprosy patients.

Based on the bacteriological index distribution, this study found most cases have 0 (negative) bacteriological indexes at 19 cases (63.3%). Characteristics of leprosy patients are summarised in Table 1.

Table 1: Leprosy patient's characteristics

No.	Characteristics		Amount (n)	(%)
1.	Gender			
	-	Male	20	66.7
	-	Female	10	33.3
2.	Age group			
	-	16-35	12	40
	-	36-55	11	36.7
	-	56-75	7	23.3
3.	Leprosy classification			
	-	MB	11	36.7
	-	PB	19	66.3
4.	Bacteriological index			
	-	0	19	63.3
	-	+1	6	20
	-	+2	2	6.7
	-	+3	3	10

Selenium serum levels in Paucibacillary (PB) leprosy patients and Multibacillary (MB) patients

The selenium serum levels mean found in this study were 97.21 µg/dl for PB leprosy patients and 77.27 µg/dl for MB leprosy patients. The mean difference between two groups was 19.94 µg/dl. A t-test was then performed to know the selenium serum levels difference between the two groups. The test found a significant difference between selenium serum levels of PB leprosy patients and MB leprosy patients. Thus it can be concluded that selenium serum levels in PB leprosy patients are higher than selenium serum levels in MB leprosy patients.

Correlation between selenium serum levels with bacterial index in leprosy patients

Spearman's rho test was performed to see the correlation between selenium serum levels with bacteriological index. Negative correlation between selenium serum levels with bacteriological index in leprosy patients was then found ($r = -0.499$; $p = 0.005$). It can be concluded that the higher the bacteriological index is, the lower selenium serum level will be (63.3%)

Discussion

According to the gender distribution, this study found more male leprosy patients (20 people, 66.7%) compared to female leprosy patients (10 people, 33.3%). This finding is similar to a study done by Miranzi (2010) in Brazil [10] where 455 leprosy cases 55.4% were found in the male. Several pieces of evidence hinted a causal relationship between the region with diagnosed and treated leprosy patients gender ratio. In Asian regions, more males are registered as leprosy patients compared to females while in African regions more females are registered as leprosy patients compared to males [11].

Most cases in this study were found within the 16-35 years old age group at 12 cases (40%) followed

by 36-55 years old age group at 11 cases (36.7%). A study by Verkevisser in Brazil found that most of the leprosy cases within the 34 - 49 age group at 31.4%. This is important since people from this age group are economically productive and thus have a higher transmission risk [11].

A study by Ramakrishnan et al. in India found selenium levels in patients with lung tuberculosis were lower (66 µg/dl) than healthy controls (113.1 µg/dl) [12]. Another study was done by Lettow et al. in Malawi which involved 579 lung tuberculosis patients with HIV and 222 lung tuberculosis patients without HIV found selenium deficiency in 85% of the patients with lung tuberculosis without HIV and 87% of the patients with HIV [13]. Selenium has long been recognised for its wide spectrum of action over the cellular and humoral system and has been demonstrated to regulate levels of interleukins, thus affecting susceptibility to bacterial infection [9].

Moraes et al., do a study about the association between selenium levels with bacteriological test conversion during anti-tuberculosis treatment. It was found that high selenium levels after 60 days treatment with anti-tuberculosis medication was associated with bacteriological test conversion in patients with lung tuberculosis [14]. Another study also showed that vitamin E and selenium administration might lower oxidative stress and heighten antioxidant capacity in patients with lung tuberculosis [15]. Selenium supplementation also may suppress tumour necrosis factor and its receptors. It was the hypothesised that selenium supplementation may contribute to elimination and/or suppression of mycobacterial diseases [16].

It can be concluded from this study that lower selenium serum levels were found more within MB leprosy patients compared to PB leprosy patients. Higher bacteriological index in leprosy patients was also correlated with lower selenium serum levels. Thus, selenium serum levels investigation might have a prognostic value to evaluate the condition of leprosy patients. Further investigations are needed however to assess the efficacy of selenium administration in patients with leprosy.

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