

Zinc and Selenium

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Submission date: 22-Aug-2024 08:56PM (UTC+0700)

Submission ID: 2436111412

File name: RK_Tan_Seleniun.pdf (661.42K)

Word count: 2419

Character count: 13414

Zinc and Selenium Status among Lymphatic Filariasis Subjects in Indonesia

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Neglected Tropical Diseases (NTDs) are proxy of poverty and Lymphatic Filariasis (LF), 1 of the NTDs is still endemic in Indonesia, as in 2015, microfilaria rate still account for 1-20%. As lower the income received by someone, gave an impact on lower purchasing capability for a good source of food to maintain their health status. Zinc and selenium were known as an important micronutrients for immune response system against the parasite infection. Aim of the study is to explore zinc and selenium status among 37 LF post therapy subjects, from October 2014 to May 2015 in 3 villages of Balangan District, South Borneo. Zinc and selenium status were measured by ICP-MS procedure taken from hair samples. There was a deficiency in selenium (0.31 µg/g ; min-max 0.18 – 0.59 µg/g), as the zinc status was normal (172.66 µg/g; min-max 69.11 – 664.65 µg/g). All of the subjects worked as farmer in rubber plantation site with minimum monthly wages compare to regional minimum standard and frequently have vegetable and phyto protein as their daily food which were low in selenium and zinc. Selenium supplementation can be considered to enhance the selenium level to support the body's natural defense system due to filariasis infection.

Keywords: *Indonesia, lymphatic filariasis, selenium, zinc*

INTRODUCTION

Lymphatic Filariasis (LF), widely distributed in countries with tropical season, is caused by three species of filarial worms, which are *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*. These species are all tissue-invasive nematodes and attack human lymphatic system and also damage lymphatic vessels, thus causing permanent damage in the chronic stage in the form of elephantiasis (Mark et al, 2005). WHO (2015) has reported that 73 countries were filariasis endemic, with 1.400 million people being at risk for infection, 120 million being already infected, more than 40 million having disabilities as a result of Lymphatic Filariasis developing into lymphedema, elephantiasis and hydrocele (CDC 2014; Suryanaryana et al 2014; Kemenkes RI 2010). One-third of cases in the world found in Sub-Saharan Africa and conversely, the rest of the cases (65%) is discovered in South East Asia, including Indonesia.

The World Health Assembly (WHA) stated that LF has become a global health problem since 1997, including Indonesia, however it was being neglected at all level until now. Chronic stage of LF infection occurs years after acute phase. Lymphedema and elephantiasis as form of the chronic stage may reduce the work productivity of the patient and caused socio-economic and epidemiological burden for the patients, their families, as well as the community and state. The results of study conducted in 1998 by the Indonesian Ministry of Health and the Faculty of Public Health, University of Indonesia, showed that the annual healthcare expenditure for one LF patient was around 17.8 % of the total house-hold expenditure or 32.3 % of the household food costs (Myrtle et al, 2007). Lymphatic filariasis also caused a huge economic burden as much as US\$ 1.3 billion/year in lost productivity and cost of intervention for LF will also lead to economic difficulties to government, as LF are common in low and middle low economic countries (WHO, 2015; Edeltraud et al, 2016). WHO mentioned that one common features shared by all NTDs was mainly affect the population dwelling in poverty, thus that NTDs is a proxy of poverty in one country. About 32% of NTDs' cases can

be found among lower middle income countries, including Indonesia, as data from World Bank in April 2016 also mentioned that Indonesia was in the group of lower middle income country, along with India, Myanmar, Phillipines and many others. The World bank also recorded that almost 40% of Indonesian's people have gross income at Rp. 330.776 per-person monthly or about \$ 22.60 (World Bank, April 2016). Due to the minimum wages received by subjects, reduce their ability to buy and fulfill a good source of food (macronutrient and micronutrient) to maintain their health status. Nutritious food is important for immune system to fight against parasite (Valerie 2003; Stephen 1989). There is a strong relationship between malnutrition and infection, as undernutrition enhances the risk of getting infection, and conversely infection worsen undernutrition. This relationship often found synergistic, however both combination could also be antagonistic. Micronutrient deficiencies is a port d'entree for parasite infection and leads to malnutrition, conversely. Zinc (Laura et al, 2010; Humberto et al, 2015) and selenium (Suguru et al, 2013) is important micronutrients in innate and Th2- type immune response system against the parasite infection. Evidence of the relationship between malnutrition and infection or in reverse, is not enough to see the relationship clearly (Stephen 1989). Most of the studies only revealed the relationship among gut parasite infection with nutrition status, but there was seldom research explored the interaction between nutrition and tissue invasive nematode, especially lymphatic filariasis. This study was conducted to explore the zinc and selenium status among lymphatic filariasis subjects at remote endemic area in Indonesia.

METHOD

Subjects were 37 inhabitant from 3 vilages in Balangan District, which were Gulinggang, Hukai and Hamarung. The subjects have been given LF therapy with DEC and albendazole for 10 days within six months before collection of hair sample among subjects participated in this cross-sectional study. They were recruited from the database of Health District Department of Balangan. Those subjects that were new cases and have not been given therapy, have conflicts with religious matter, and those who were in chronic stage of LF were excluded from this study. The patients were included in our study if they agreed to participate and signed an informed consent form. This study have been approved by ethics committee in Faculty of Medicine, Universitas Trisakti.

Blood and hair samples were collected at the same time on 10 pm by pooling the subjects at one of community leaders house. Blood samples were collected with finger prick method for capillary blood and being made in blood smear preparat (Suriyani et al, 2016), used to count the microfilaria. The smears were air-dried before stored in dry storage for sample transportation for analysis purpose. Hair samples were collected based on Rosalind Gibson (Rosalind, 2005) method, stored on clean plastic envelope and labelled by individual. Hair specimens was analyzed for the zinc and selenium status by inductively coupled plasma mass spectrometry (ICP-MS) procedure in accredited diagnostics laboratories (Prodia Laboratory, Jakarta, Indonesia). Food intake for zinc and selenium sources were assessed by using semi-quantitative food frequency (SQ-FFQ) form for weekly.

The analysis was performed by using SPSS software. The statistical methods included the mean and standard deviation, after verify normality and homogeneity of variances.

RESULTS

A total of 37 subjects participated in the study with mean age was 44.5 ± 11 years. Most of the subjects were rubber plantations workers with lower wages monthly compensation, and work in the rubber location around 6 hours per-day (6 am to 12 pm), within duration of work around 10 years. The subjects' biomarker status of zinc and selenium are shown in Table 1.

Table 1. Biomarkers of zinc and selenium status

Food source	Frequency		
	Once / week	2-3 times / week	> 3 times / week
Animal protein			
Beef	√		
Liver and spleen	√		
Fish (in form of salted fish)			√
Chicken meat		√	
Oyster	-	-	-
Shellfish	-	-	-
Phyto protein			
Tofu			√
Tempe			√

DISCUSSION

From the present study, normally LF subjects with completed therapy should be cured from the parasites. However, only 51% of the subject was cured from the parasites, and the rest remained with the parasites. The influence of therapy were from complain taking a medicine and personal protection, such as used a repellent and balance diet, against the mosquito bites. The nexus of nutrition, infection and immune system could be used as a basic approach on mass plan of medication for tropic infection diseases, based on local content in each province (Rina, 2009).

Nutrition, especially micronutrient and vitamins, usually needed in small dose to maintain a healthy homeostatic immune system and antibody formation. Exploration of the interrelationship on micronutrient, also vitamins, and parasitic infection are just limited in vitamins A, C, E, and minerals zinc, iron and iodine, such as a study done in malaria endemic area showed that decreased serum retinol has a association with asymptomatic parasitaemia.³⁰ In contrary finding, result of the study in micronutrient zinc used as supplementation in Guatemalan school children and the result revealed that the supplementation did not have effect in prevention of intestinal helminth and protozoa reinfection. Many others micronutrient have not been studied extensively for the role in human immune system against the parasitic infection, including selenium (Peter et al 2008; Suzanne et al 1994).

In the present study, we found that most of the subjects was poor economic status and work as a labour of rubber plantation, with average per-day earning Rp.50.000,-. As we known that good sources of zinc and selenium are animal protein, such as red meat, thigh part of chicken and fish. However, with their per-day earning was not sufficient to fulfill need of zinc and selenium sources, which is known to enhance the immune system. Thus, due to that reason, they fulfill requirement with phyto protein and vegetables sources, which is low of micronutrient and lots of phytate contain. This findings were paralel as Gibson (Gibson,2005) that were commonly found in low income and low middle income that based their nutrient intake on fruit and vegetables.

From the biomarker, reported that zinc level was normal and selenium was low. This result was contrary with their nutrient intake. The calculation based on zinc bioavailability, the result of this study was low (15%), It means that phytate-zinc ratio more than 15 (K Michael , 2010).

There is limited information due to this study on iron that have competitive interaction with zinc.

CONCLUSION

Poor nutritional status, especially in micronutrient such as zinc and selenium, may have a chance of predisposition of parasitic infection, which however should be able to be reduced by promoting and enhancing the use of local food that contain rich zinc and selenium

ACKNOWLEDGMENT

The study was funded by a grant from the Directorate of Higher Education, Ministry of Research, Technology and Higher Education in Leading Research Universities scheme.

The funders had no role in the study design, data collection and analysis, decision of publish or preparation of the manuscript. We are grateful for the Department of Health in Balangan District and the head of Gulinggang, Hamarung and Hukai village who helped in data retrieval. We also would like to thank Mr. Rasimin who helped in the process of the blood smear and staining.

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