Pharmacology and Clinical Pharmacy Research
Volume 2 No. 2 August 2017
ISSN:2527-7322 | e-ISSN: 2614-0020
doi: 10.15416/pcpr.2017.2.2.51

Assessment of Plasma Selenium-Binding Protein-1 Level in Geriatric Population

Anisa F. Dewi[1], Lazuardhi Dwipa[2], Ronny Lesmana[3]

[1]Faculty of Medicine, Universitas Padjadjaran, West Java, Indonesia
[2]Geriatry Division, Department of Internal Medicine, Faculty of Medicine, Universitas Padjadjaran, West Java, Indonesia
[3]Physiology Division, Department of Anatomy and Biology Cell, Faculty of Medicine, Universitas Padjadjaran, West Java, Indonesia

Abstract

Geriatric physiologically undergoes aging process that can cause decreasing cell function and increasing risk of degenerative diseases caused by the accumulation of reactive oxygen species (ROS) in the body. Selenium (Se) is an antioxidant, which is needed for maintaining the balance of ROS. The aim of this study was to observe the selenium-binding protein (SELENBP1) level in relation with the geriatric patients charcateristics including sex, age, body mass index (BMI), activity of daily living (ADL), instrumental activity of daily living (IADL), cognitive function, nutrition, depression, and insomnia status. The study used cross-sectional quantitative descriptive study design on 14 geriatric patients in Geriatric Outpatients Clinics, at a hospital in Bandung. The data was obtained by interviewing the patients and then blood samples were taken. The analysis of SELENBP1 was done using ELISA kit. The average level (SD) of SELENBP1 from all of the characteristics group was 2.68 (0.69) ng/ml. The highest SELENBP1 level was identified in female geriatric patients and followed by male and pre-obese groups. The lowest SELENBP1 level was identified in geriatric patients aged 70-79 years.

Keywords: elderly, SELENBP1, selenium.

Introduction

Geriatric physiologically undergoes aging process, which can cause decreasing cell function and increasing risk of degenerative diseases. The accumulation of reactive oxygen species (ROS) will increase along with the aging process taking place, which can cause DNA damage and lead to the cell disruption and dysfuntion.[1] Selenium (Se) as the selenoproteins antioxidant is required to protect against the elevated level of ROS in the body.[2] Selenium is one of the important component of antioxidant enzymes such as glutathione peroxidase (GPx), which exhibited strong antioxidant activity in protecting cells against oxidative stress obtained from ROS.[3]

Corresponding: Annisa F. Dewi. Faculty of Medicine, Universitas Padjadjaran, Jatinangor, West Java, Indonesia. Email: annisa_fdewi@gmail.com.

Selenium as exogenous antioxidants can be supplied from food intake, for instance seafood, cereals, and meat products contain high levels of Se, and low levels of selenium are found in milk, fruit, and vegetables.[2] Thus, selenium intakes are reflected with body mass index (BMI).[4] Selenium level is also related to geriatric syndrome such as cognitive function, depression, and sleep deprivation.[5,6]

One of the selenium binding protein subtypes is selenium-binding protein (SELENBP) 1. The SELENBP1 will bind to selenium and regulate glutathione peroxidase (GPX) activity in protecting against oxidative stress.[7] However, in Indonesia, study reported on SELENBP1 level in geriatric patients is still limited. Thus, the aim of this study is to identify selenium-binding protein level in geriatric patients charcateristics including sex, age, body mass index (BMI), activity of daily living (ADL), instrumental activity of daily living (IADL), cognitive function, nutrition, depression and insomnia status, which can be used as preliminary study.

Methods

This study has been ethically approved by Health Research Ethics Committee Fakultas Kedokteran Universitas Padjadjaran No. 615/UN6.C1.3.2/KEPK/PN/2016. The study was conducted in Geriatry outpatient clinics, Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia. The participants were fourteen geriatric patients aged above 60 years old, who had signed informed consent and willing to particapte in this study cooperatively. The study was done using cross-sectional quantitative descriptive study design. The exclusion criterias are the participants who undergo protein-restriction diet and consume antibiotic within a month.

The variables in this study were plasma selenium level, sex, age, BMI, ADL, IADL, nutrition, depression, and insomnia status. All of the participants personal data included in the variables were obtained through interviews accompanied with the questionnaires. The questionnaires used in this study were Barthel Index assessing ADL, Lawton Index assessing IADL, mini nutritional assessment (MNA) assessing nutrition status, mini mental status examination (MMSE) assessing cognitive function, geriatric depression scale (GDS) assessing depression status, and insomnia rating scale (IRS) assessing insomnia status.

After the interview, a volume of 2 ml blood samples were taken and transferred to EDTA tube and centrifuged for 20 minutes at 1000xg. The samples were stored in aliquots at -80oC for later used for further analysis of SELENBP1 levels. The analysis of SELENBP1 level was using enzyme-linked immunosorbent assay (ELISA) kit for Selenium Binding Protein (SELENBP1) (SEG326Hu, Cloud Clone Corp., USA).

The results were analyzed using statistical data processing program and presented as mean and standard error of mean (SEM). Normality test using Shapiro-Wilk test was performed to confirm that the data were normally distributed.

Results and Discussion

All fourteen geriatric subjects were interviewed based on the questionnaires. The interview results were presented in Table 1.

The data distribution of SELENBP1 level was normally distributed and it showed a minimum standard error. The detection range of the ELISA kit was grouped into three, such as low (0.3 – 6.6 ng/mL), medium (6.7 – 13.2 ng/mL) and high (13.2 – 20.0 ng/mL). The average levels of SELENBP1 in this study was classified as low with 2.68 ± 0.69 ng/

Table 1. Baseline characteristics in geriatrics outpatients clinics

Characteristics	n (%)	Mean
	14	
Sex		
Male	8 (57.1)	
Female	6 (43.9)	
Age (years)		
60–69	7 (50.0)	66
70–79	3 (21.4)	74
≥80	4 (28.6)	83
Body Mass Index		
Normal (18.5–22.9)	4 (28.6)	20.5
Pre-obese (23.0–24.9)	4 (28.6)	24.1
Obese (≥25.0)	6 (42.9)	28.8
Activity Daily Living		
Independent	13 (92.9)	
Mild Dependent	1 (7.1)	
Moderate Dependent	0	
Severe Dependent	0	
Total Dependent	0	
Instrumental Activity Daily Living		
Independent	13 (92.9)	
Dependent	1 (7.1)	
Malnourish status		
Normal	11 (78.6)	
Risk of malnutrition	3 (21.4)	
Malnutrition	0	
Mini Mental Status Examination		
No cognitive impairment	13 (92.9)	
Mild cognitive impairment	1 (7.1)	
Severe cognitive impairment	0	
Geriatric Depression Scale		
Normal	12 (85.7)	
Suspect depression	2 (14.3)	
Depression	0	
Insomnia Rating Scale		
Normal	5 (35.7)	
Moderate	7 (50.0)	
Severe	2 (14.3)	
Very severe	0	

Table 2. Plasma SELENBP1 level

Characteristics	N	Mean ± SEM (ng/ml)
	14	2.68 ± 0.69
Sex		
Male	8	2.48 ± 0.23
Female	6	2.95 ± 0.29
Age (years)		
60–69	7	2.60 ± 0.33
70–79	3	2.23 ± 0.12
≥80	4	2.90 ± 0.26
Body Mass Index		
Normal (18.5–22.9)	4	2.60 ± 0.15
Preobes (23.0–24.9)	4	3.08 ± 0.23
Obes (≥25.0)	6	2.77 ± 0.44
Malnourish status		
Normal	11	2.74 ± 0.23
Risk of malnutrition	3	2.47 ± 0.15
Geriatric Depression Scale		
Normal	12	2.71 ± 0.74
Suspect depression	2	2.50 ± 0.63
Insomnia Rating Scale		
Normal	5	2.70 ± 0.47
Moderate	7	2.73 ± 0.54
Severe	2	2.45 ± 0.05

mL ranged from 1.40 – 4.60 ng/mL (Table 2). The highest SELENBP1 level was identified in female geriatric patients and followed by male and pre-obese groups, respectively. While, the lowest SELENBP1 level was identified in geriatric patients with aged 70 - 79 years. The result can be seen on Table 2.

Selenium is a micronutrient trace element. There are 3 kinds of selenium-containing protein, which are selenomethionine, selenocysteine, and selenium-binding protein (SELENBP1).[7] One of the main components of selenocycteine is glutathione peroxidase (GPX) enzyme, which plays an important role for cell protection against oxidative stress and free radical impairmaint. Selenium is one of the important component of antioxidant enzymes such as glutathione peroxidase (GPx), which exhibited strong antioxidant activity in protecting cells against oxidative stress obtained from ROS (Valko,

2006). ROS acts reactively in the body, which cause DNA impairment and accelerate the aging process.[8] The accumulation of free radicals and ROS followed by decreasing antioxidants activity associated with a lower level of selenium presented in the body.

Selenium measurement can be done directly or indirectly by assessing the activity of GPX or measuring the SELENBP1 level using ELISA. This study measured selenium indirecty by determining the level of SELENBP1 using ELISA kit. Thus, a high level of SELENBP1 indicates an increase GPX activity and free radicals suppression.[7] The average of SELENBP1 level in female geriatric patients was higher than the male group (Table 2). This result supported the previous study, which found out female selenium level was higher than in male.[9]

Patients with the risk of malnutrition were found to have lower SELENBP1 level than normal group. This study result supported the previous study, which revealed the malnourished patients have a lower level of selenium.[10] The SELENBP1 level of ADL, IADL and cognitive impairments were above average of the study result obtained. The SELENBP1 level of patients with cognitive impairments supported the previous study, which explored that selenium deficiency occured as a declining of cognitive function.[11] The SELENBP1 level was lower on the patients with suspect of depression, which related to the previous study report showed lower selenium level increased the occurrence of depression.[12] The results can be seen in Figure 1.

The increase accumulation of free radicals and ROS leads to the lowering of cell function. In this study, plasma SELENBP1 level was found out to be increased along with age among male group (Figure 2). It supported the previous study done by Benes,

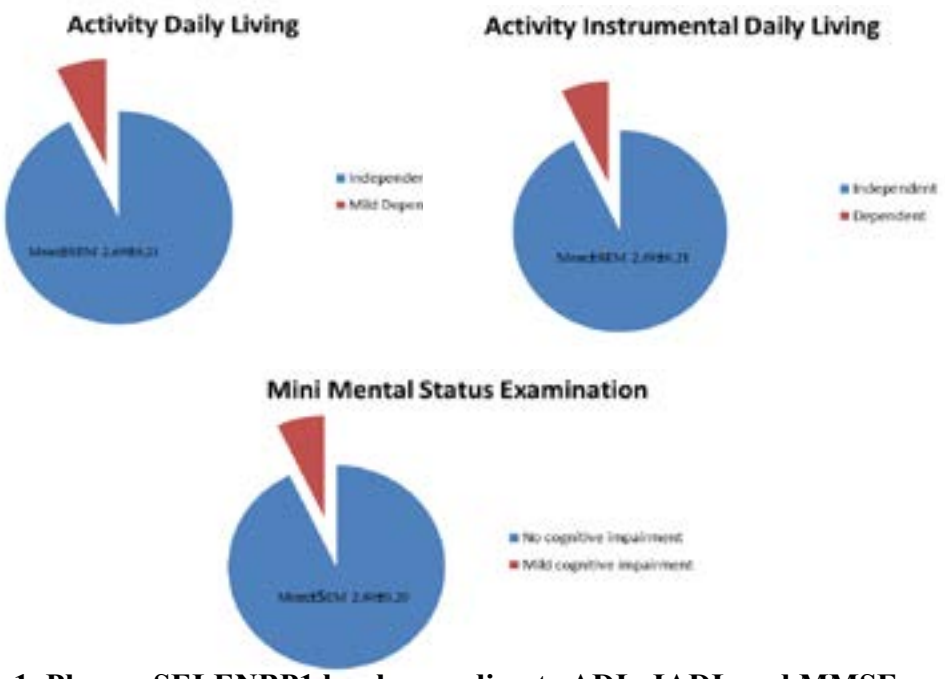

Figure 1. Plasma SELENBP1 level according to ADL, IADL and MMSE

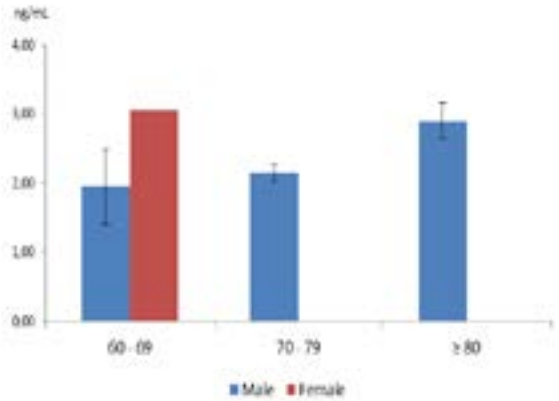

Figure 2. Plasma SELENBP1 level according to age.

et al and Sanchez *et al* in which an increasing selenium level appeared along with aged, in both genders.[4,13]

The higher SELENBP1 level was shown among the pre-obese group than others (Figure 3). This phenomenon reflected to the decreasing GPX activity, which leads to the accumulation of oxidative stress in the body and caused a pre-obese condition. In contrast to study conducted by Benes *et al*, which showed an increasing level of selenium occured among male with BMI below 20, but showing no difference among female.[4] This could be differ since food containing selenium intake in each individual are varies. Prostaglandin D2 (PGD_2), works as sleep inducer, which is catalyzed by PGD_2 synthase. Se-containing compound in the body, such as $SeCl_4$ and Na_2SeO_3, might inhibit the enzyme activity and could cause sleep disorder.[6] This study result showed an increasing selenium level in patients with moderate sleep deprivation among male, however showed a lower level in female. (Figure 4). Among the female group, the selenium level did not show the same level. This might be caused by other individual factors that can alter the selenium level in the body, whether food containing selenium intakes or other comorbidity. The limitation of this studies were indirect selenium measurement by determining the SELENBP1 level using ELISA is not quite reflecting plasma selenium level, because

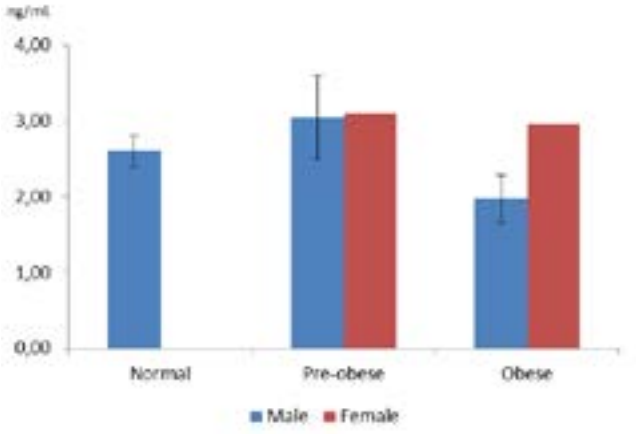

Figure 3. Plasma SELENBP1 level according to BMI.

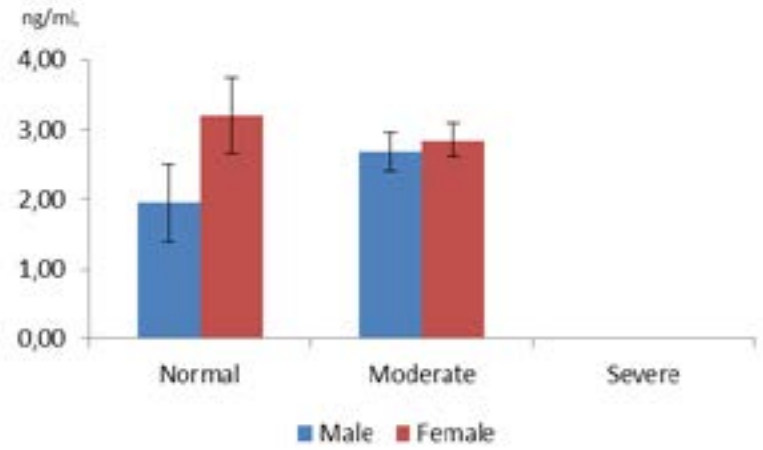

Figure 4. Plasma SELENBP1 level according to insomnia status.

(a) SELENBP1 actually represents more GPX activity than selenium directly, (b) not all selenium binds to SELENBP1, there are other form of selenium, (c) there are few studies regarding SELENBP1, which explained that SELENBP1 are only located intracellular, whereas others explain that there are physiological function of SELENBP1;7 (ii) small samples used in this study, due to the limitation of time and place; (iii) not adjusting the comorbid of each individual, whereas comorbid might affect meal and nutrition pattern thus the oxidative stress will affect the selenium level.[13]

As different levels were shown for each characteristics, it is recommended to do similar study with larger samples and wider population thus the blood selenium level can be more defined; assessment of food intake might also be done, especially those with high selenium foods. The intervention can be given toward those in regard increasing antioxidants, suppressing oxidative stress condition, and prevention of degenerative diseases among elderly. Examining the activity of GPX might also help and ensure the work of two different parameters.

Conclusions

The highest SELENBP1 level was identified in female geriatric patients and followed by male and pre-obese groups, respectively. While, the lowest SELENBP1 level was identified in geriatric patients aged 70-79 years.

Acknowledgement

None.

Funding

None.

Conflict of Interest

None declared

References

1. Jin K. Modern biological theories of aging. *Aging and Disease.* 2010;1(2):72-4.
2. Tinggi U. Selenium: its role as antioxidant in human health. *Environmental Health and Preventive Medicine*. 2008;13(2):102-108.
3. Valko M, Rhodes CJ, Moncol J, Izakovic M, and Mazur M. Free radicals, metals, and antioxidants in oxidative stress-induced cancer. *Chemico-Biological*