

## *Dietary zinc intake and zinc status differences between male and female elderly of South Jakarta community*

Rina K. Kusumaratna\*<sup>a</sup>, Oktavianus Ch.Salim\*, and Novia I. Sudharma\*

### ABSTRAK

#### **INTRODUCTION**

*The elderly have a greater risk of zinc deficiency compared to younger adults. This condition may be reflected by a lowered zinc intake and reduced zinc absorption in the elderly. The aim of the study was to explore the dietary zinc intake and zinc status differences between male and female elderly.*

#### **METHODS**

*A cross-sectional study was conducted included eighty-nine free-living subjects, aged above 60 years, apparently healthy and ambulatory. A two day and non consecutive diet record was used to assess energy and nutrient intake of the elderly. It was combined with a semi-quantitative food frequency questionnaire (SQ-FFQ), with food model that was also used to quantify the food pattern on each food frequency item. Serum zinc concentrations were measured by using atomic absorption spectrum photometry.*

#### **RESULTS**

*The total energy intake and normal serum zinc concentration in both genders of free-living elderly were mostly below the recommended dietary allowance. The mean serum zinc concentration did not differ significantly between female (13.7  $\mu\text{mo/l}$ ) and male elderly (13.9  $\mu\text{mo/l}$ ). Mostly the intake of zinc was below two thirds of the RDA it presented on intake of zinc in males was much less compared to female. Overall, the prevalence of zinc deficiency appeared low among the free-living elderly in South Jakarta.*

#### **CONCLUSIONS**

*The prevalence of zinc deficiency was relatively low in healthy elderly. Prevalence of zinc deficiency and zinc intake were lower in female compared to male elderly.*

**Keywords:** Zinc, intakes, free-living, elderly

\*Department of Community Medicine, Medical Faculty Trisakti University

#### **Correspondence**

<sup>a</sup>dr. Rina K. Kusumaratna, M.Kes.  
Department of Community Medicine, Medical Faculty Trisakti University  
Jl. Kyai Tapa No.260 Grogol Jakarta Barat  
Phone: 021-5672731 ex. 2504  
Email : rkusumaratna@yahoo.com

Universa Medicina 2007; 26: 179-85

## Perbedaan asupan dan status seng antara laki-laki dan perempuan lanjut usia di komunitas Jakarta Selatan

Rina K. Kusumaratna<sup>\*a</sup>, Oktavianus Ch.Salim\*, dan Novia I. Sudharma\*

---

### ABSTRACT

---

\*Bagian Ilmu Kedokteran  
Komunitas  
Fakultas kedokteran  
Universitas Trisakti

#### Korespondensi

<sup>a</sup>dr. Rina K.Kusumaratna, M.Kes.  
Bagian Ilmu Kedokteran  
Komunitas, Fakultas Kedokteran  
Universitas Trisakti  
Jl. Kyai Tapa No.260 Grogol  
Jakarta Barat 11410  
Telp. 021-5672731 Eks.2504  
Email: rkusumaratna@yahoo.com

*Universa Medicina* 2007; 26: 179-85.

#### LATAR BELAKANG

Risiko terjadinya defisiensi seng pada lanjut usia (lansia) lebih besar dibandingkan usia dewasa muda. Keadaan ini direfleksikan oleh rendahnya asupan dan absorpsi seng pada lansia. Penelitian ini bertujuan untuk membedakan asupan dan status seng antara lansia laki-laki dan perempuan.

#### METODE

Sebanyak 89 lansia berusia 60 tahun ke atas berbadan sehat dan mampu melakukan aktifitas secara mandiri diikut sertakan pada studi yang menggunakan rancangan potong silang (*cross-sectional*). Asupan energi total dan kadar seng diukur menggunakan catatan diet selama dua hari berturut-turut. Pengukuran ini dikombinasi dengan *semi-quantitative food frequency questionnaire* (SQ-FFQ) dan model makanan. Kadar seng dalam serum diukur menggunakan *atomic absorption spectrum photometry*.

#### HASIL

Rata-rata kadar seng dalam serum pada lansia perempuan (13,7 µmo/l) tidak berbeda bermakna dengan lansia laki-laki (13,9 µmo/l). Asupan energi total dan kadar seng dalam serum lebih rendah dibandingkan dari jumlah yang dianjurkan baik pada lansia laki-laki maupun perempuan. Sebagian besar asupan seng besarnya duapertiga lebih rendah dari angka kecukupan gizi (AKG), asupan seng pada lansia laki-laki lebih rendah dibandingkan lansia wanita. Secara keseluruhan prevalensi defisiensi seng di antara komunitas lansia di Jakarta Selatan adalah rendah.

#### KESIMPULAN

Studi ini menunjukkan prevalensi defisiensi seng yang relatif rendah. Asupan dan status seng lebih rendah pada lansia perempuan dibandingkan lansia laki-laki.

**Kata kunci :** Seng, asupan, komunitas, lanjut usia

## INTRODUCTION

In general, the elderly due to inadequate micro-nutrient intake are susceptible to physical inactivity, infection, and chronic diseases. Inadequate nutrition intake will have an impact on an individual's health status. Nutritional disorder might also develop not just

because of inadequate intake, but also due to the body's inability to utilize nutrients; even though, the individual consumes appropriate amounts and a variety of foods. Gender differences of choice in nutrient intake among the elderly could indicate differences in values of hematological and clinical analysis. Micronutrient deficiency such as iron, vitamin

A and iodine are well-established in developing countries. Presently, zinc deficiency has also been recognized by a number of experts as an important public health issue. Clinical zinc deficiency was first described in early 1960s, and since then it has been recognized as a common deficiency in humans.<sup>(1,2)</sup> Zinc deficiency has been observed in animal and human studies that could decrease resistance to infectious diseases. Zinc as one of the essential trace element has recently been of interest because of its function in the maintenance of human health and nutrition statuses. Elderly individuals are at greater risk of zinc depletion than younger adults that might be reflected in lower zinc intake and reduced zinc absorption due to aging. Zinc deficiency has also been reported in the European ZENITH study that showed zinc deficiencies in healthy, free-living, late middle-age and older persons, even with a low prevalence.<sup>(3)</sup> Study in central Japan also found zinc deficiency in free-living of elderly.<sup>(4)</sup> Major sources of zinc are animal based products that generally are consumed in small amounts; moreover, the Asian diet which is based on whole-grain cereals and other plant foods is less bio-available due to its relatively high content of phytate, a compound that inhibits zinc absorption. The elderly who avoid flesh foods due to some reason, might be at risk of poor zinc status because of its reduced bioavailability in the daily diet.

Vitamin and mineral deficiency (VMDs) as stated in a United Nation report, includes deficiency of vitamin A, iron, iodine, zinc, folic acid that have affected over 2 billion people in the world. This condition is mostly caused by diets deficient in vitamins and minerals that the body needs, and become worse by losses or poor absorption related to illness. These situations are found in every part of the world, and the global databases report has estimated that 20% of the world's population is at risk of zinc

deficiency.<sup>(5)</sup> Zinc supplementation could be a low cost strategy in improving physiological and cognitive functions in the elderly. The aim of this study was to compare the intake and status of zinc between male and female elderly, and whether there is a difference in dietary intake based on gender.

## METHOD

### Research design

A cross-sectional study was conducted in a sub-district health center in South Jakarta.

### Subjects

Using demographic information system that contained the health center patient database, potentially eligible elderly were identified and invited to participate in the study. The participants were residents living in the district and their main occupation was pensioner or retired government employee or house wife. The number and selection of the elderly was determined by using a simple random sampling on a finite population. Three hundred persons aged 60 years and older was gathered by cluster random sampling from 7 villages health center which was under the jurisdiction of Mampang Prapatan District Health Center. These were later screened, and finally only one-hundred and fifty elderly were assessed on their dietary intake and fasting blood sample. The eligibility of subjects in the study was gender both male and female, aged 60 years above, ambulatory and apparently healthy during examination. Each of the participants was requested to fill out an informed consent form to ensure that they agreed to fully participate in the study. Data collection was conducted from November 2005 to February 2006. However, from the 150 elderly who were eligible for the study only eighty-nine subjects had complete records that

could be matched between their biological analysis sample and the dietary assessment.

### Biological measurements

All blood samples were collected after overnight fasting. For zinc analysis, samples were collected using serum of blood in a tube of zinc-free nitric acid, and diluted with zinc-free water. Samples were centrifuged at a maximum speed of 15,000 rpm for 5 minutes. Serum zinc were determined by atomic absorption spectrophotometry (AAS) with Zeeman background corrected (GBC 933 AA, with  $\lambda$  213, 9 nm).

### Dietary intake

A two day and non consecutive diet record was used to assess energy and nutrient intake of the elderly. It was combined with a semi-quantitative food frequency questionnaire (SQ-FFQ), with food model that was also used to quantify the food pattern on each food frequency item. The calculated nutrient intake of the sample was compared with the "Indonesian recommended dietary allowance" (Indonesian RDA) for the particular age and gender group, (female 1,850 kcal and male 2,200 kcal). The amount of various food consumption reported was recorded then converted into energy and nutrient intakes per day. Values less than two thirds of the recommended intake are considered as a risk of deficiency of the respective nutrients. The RDA of zinc intake was based on Recommended RDAs for zinc for Southeast Asia.<sup>(6)</sup>

### Statistical analysis

Data were reported as mean, standard deviation and frequency distribution. Food consumption analysis used nutrisurvey calculation. All statistical analysis was done with SPSS Windows version 11.5. Normal distribution of data was checked using the Kolmogorov-Smirnov test. Independent-t test was used to compare the zinc intake and concentration between male and female elderly.

### Ethical clearance

Study protocol was reviewed and sanctioned by the Medical Faculty Ethics Commission.

## RESULTS

The result of One-Sample Kolmogorov Smirnov test presented that the distribution of the data was normal. The samples were predominately females than males (69.7% vs 30.3%) and 85.4% were mostly 60–70 years in both gender. The total energy intake was mostly below of the recommended dietary allowance based on the Indonesian RDA in both gender, 57.7% females and 48.7% males respectively. The intakes of zinc between females and males were inadequate compared to the RDA. Male was twice more likely than female categorized in the less than two thirds of the RDA. There were similar findings on zinc sources intake between dietary recall and Semi-Quantitative Food Frequency (SQ-FFQ) (Table 1). No significantly difference between energy and zinc intake and gender.

Table 1. Mean daily energy and zinc intakes of free-living elderly by gender (mean  $\pm$  s.d.)

	Females (n = 62)	Males (n)
Energy (kcal/d)	1068.98 $\pm$ 313	1072.08
Zinc (mg/d)	4.11 $\pm$ 1.8	3.9 $\pm$
<2/3 KG (%)	25.8% <sup>a</sup>	70%

Note : zinc RDA/AKG (mg/day) a=4.4 ; b=6.5

Table 2. Zinc status in free-living elderly by gender (mean  $\pm$  s.d.)

<b>Females (n = 62)</b>	
Serum Zn ( $\mu$ mol/l)	13.7 $\pm$ 2.3
<10.7 $\mu$ mol/l (%) in serum	3.2%

The mean serum zinc concentration did not differ significantly between female (13.7  $\mu$ mol/l) and male elderly (13.9  $\mu$ mol/l). The percentage of subjects based on gender that showed a serum Zn concentration below 10.7  $\mu$ mol/l, which is considered as the cut-off level for zinc deficiency was 3.2% in females and 7.4% in males. There were more male subjects that had lower serum zinc concentration compare to female, almost double, with an average of 4.5% for all subjects. (Table 2)

## DISCUSSION

Zinc is an essential trace element for human and all forms of life, thus in the elderly zinc has an essential function in immunity, age related changes of bone mass, cognitive functions and oxidative stress, and a leading cause of blindness in people over the age of 65 years. One function of zinc as a micronutrient is as antioxidant that has the capability of protecting cells from the damaging effects of free radicals released in the body. Other studies of human subjects have reported that zinc deficiency in individuals has declined the sensitivity of taste bud and could be restored by zinc supplementation.<sup>(4,7-9)</sup>

This study of free living elderly showed that most of the subjects had normal serum zinc concentration. However, the mean daily intake of zinc sources was mostly below two thirds of the RDA for older people above 60 years, namely 37% females and 74% males. Based on the result as shown in Table 1, it could be reported that free-living elderly dominantly had less zinc intake. This was due to the source of zinc intake

mainly from the daily food diet, there was no indication of any other additional zinc supplements being used. The same results were shown in a study conducted by Sibai<sup>(11)</sup> and Ervin RB.<sup>(12)</sup> However, the present study showed different results compared to the study in Japan by Kogirima et al,<sup>(4)</sup> the Zenith study by Andriollo Sanchez M et al,<sup>(3)</sup> Galan P, et al<sup>(13)</sup> and Paik HY et al.<sup>(14)</sup> In the last study, the intake of zinc of the subjects was adequate.

Zinc intake of females was higher compared to males (4.11  $\pm$  1.8 mg/d vs 3.9  $\pm$  1.7 mg/d). This data could reflect the specific differences in dietary habits. From dietary assessment, female elderly consumed more animal protein as a source of zinc than males (33.38  $\pm$  15.3 mg/day vs 28.86  $\pm$  12.8 mg/day).

In the present study, serum zinc concentration in the female and male elderly were 13.67  $\pm$  2.3  $\mu$ mol/l vs 13.98  $\pm$  2.6  $\mu$ mol/l, respectively. This result was almost similar to other studies that have been conducted earlier.<sup>(3,14,16,17)</sup> Those results did not reflect the wide range of differences in serum zinc concentration values between the genders.

Percentage of elderly that were below the cut-off level for zinc deficiency showed that males were twice more lower than females. Is the risk of zinc deficiency in males much higher than females? To explore this finding further, a study should be done to prove this tendency based on the baseline data of the present study on assessing zinc status of the healthy free-living elderly.

The result of this study also showed that there was a low prevalence of zinc deficiency

in the free-living elderly. The same result was shown in The ZENITH study, that showed a low prevalence of zinc deficiency but differed in the Japanese study,<sup>(2)</sup> that reported a high prevalence of zinc deficiency among the Japanese aged, and the De Jong et al<sup>(17)</sup> study in New Zealand also reported that twelve percent among of New Zealand elderly women had zinc deficiency. The present data showed contradictive findings with the first study that was conducted in five municipalities in Jakarta that assessed the zinc concentration of free-living elderly. The study reported that 67% of free-living elderly in Jakarta had zinc deficiency.

In our samples, there were also contradictive findings between the results of zinc intake and corresponding zinc concentration. Majority of the elderly were below 2/3 of RDAs zinc intake, but had above the cutoff level of zinc concentration. There could be a bias in assessing the food intake of the elderly, such as memory bias. Because all the subjects were above 60 years aged, then they had to memorize what they had been eating in a day and the next day. For the elderly to memorize two days and non consecutively on what they had eaten could have created difficulties for the elderly. Thus, the differences of the findings could be due to lack of memory on the part of the subjects.

## CONCLUSION

The findings of the study in free-living elderly in South Jakarta showed a low prevalence of zinc deficiency but had similar results with their corresponding zinc intake daily. For further study, assessing of dietary intake should use food weighing namely what the subject actually ate daily to reduce errors caused by memory bias. Dietary assessment instruments used must also accurately capture and reflect elderly dietary intakes.

## ACKNOWLEDGEMENT

This study was conducted with the support of funding from the Medical Faculty of Trisakti University. The dietary survey was supported by SEAMEO-TROPMED nutritional field surveyor. The author would like to thank all of those who participated and assisted in the study.

## References

1. Prasad AS. Zinc: Mechanism of host defence 1-3. *J Nutr* 2007; 137: 1345-50.
2. Hambidge KM, Krebs NF. Zinc deficiency: a special challenge 1-2. *J Nutr* 2007; 137: 1101-6.
3. Andriollo-Sanchez M, Hininger-Favier I, Meunier N, Toti E, Zaccaria M, Brandolini-Bunlon M, et al. Zinc intake and status in middle-aged and older European subjects: the ZENITH study. *Eur J Clin Nutr* 2005; 59 (Suppl 2): S37-41.
4. Kogirima M, Kurasawa R, Kubori S, Sarukura N, Nakamori M, Okada S, et al. Ratio of low serum zinc levels in elderly Japanese people living in the central part of Japan. *Eur J Clin Nutr* 2007; 61: 375-81.
5. International Zinc Nutrition Consultative Group. Vitamin and mineral deficiencies technical situation analysis : a report for the ten year strategy for the reduction of vitamin and mineral deficiencies (editorial). *Food Nutr Bull* 2007; 28 (Suppl): S160-S4.
6. De Jong N. Sensible aging: impaired sensory functioning in elders (dissertation). Wageningen : Wageningen University; 1999.
7. Meunier N, M O'Connor J, Maiani G, Cashman KD, Secker DL, Ferry M, et al. Importance of zinc in the elderly: the ZENITH study. *Eur J Clin Nutr* 2005; 59 (Suppl 2): S1-4.
8. Hidayat A. Manfaat suplementasi seng (zinc) pada kelompok lanjut usia. *Universa Med* 2002; 21: 1-46.
9. Stewart-Knox BJ, Simpson EEA, Parr H, Rae G, Polito A, Intorre F, et al. Zinc status and taste acuity in older Europeans: the ZENITH study. *Eur J Clin Nutr* 2005; 59 (Suppl 2): S31-6.
10. Institute Life Science International Recommended Dietary Allowances (RDA): Harmonization in Southeast Asia. ILSI 2005.



11. Sibai AM, Zard C, Adra N, Baydoun M, Hwalla N. Variations in nutritional status of elderly men and women according to place of residence. *Gerontol* 2003; 49: 215-4.
12. Erven RB, Kennedy-Stephenson J. Mineral intakes of elderly adult supplement and non-supplement users in the third national health and nutrition examination survey. *J Nutr* 2002; 132: 3422-7.
13. Galan P, Viteri FE, Bertrais S, Czernichow S, Faure H, Arnaud J, et al. Serum concentration of  $\alpha$ -carotene, vitamins C and E, zinc and selenium are influenced by sex, age, diet, smoking status, alcohol consumption and corpulence in a general French adult population. *Eur J Clin Nutr* 2005; 59: 1181-90.
14. Paik HY, Joung H, Lee JY, Lee HK, King JC, Keen CL. Serum extracellular superoxide dismutase activity as an indicator of zinc status in humans. *Biol Trace Elem Res* 1999; 69: 45-57.
15. Hotz C, Peerson JM, Brown KH. Suggested lower cut-offs of serum zinc concentrations for assessing zinc status: reanalysis of the second National Health and Nutrition Examination Survey data (1976-1980). *Am J Clin Nutr* 2003; 78: 756-64.
16. Age-Related Eye Disease Study Research Group. The effect of five-years zinc supplementation on serum zinc, serum cholesterol and hematocrit in persons randomly assigned to treatment group in the age-related eye disease study: AREDS report No.7. *J Nutr* 2002; 132: 697-702.
17. De Jong N, Gibson RS, Thomson CD, Ferguson EL, McKenzie JE, Green TJ, et al. Selenium and zinc status are suboptimal in a sample of older New Zealand women in a community-based study. *J Nutr* 2001; 131: 2677-84.