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Research Article

DETERMINATION OF SELENIUM CONCENTRATION IN DIFFERENT SPECIES OF RICE CONSUMED IN BANDUNG INDONESIA

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Abstract: Selenium deficiency may lead to the development of several diseases, including cardiovascular diseases and cancer. Due to body selenium concentration is solely depend to its daily intake, monitoring the selenium level of daily consumed foods is critical for the prevention of selenium deficiency-related diseases. In this study, we investigate the selenium concentration of daily consumed rice as the staple food in Bandung City of West Java Province of Indonesia. Twenty different species of rice were collected from the local market, wet digested, and analyzed for selenium concentration using Atomic Absorption Spectrophotometry. The results showed that the selenium concentration of rice consumed in Bandung were varied with the lowest was 0.011 µg/g given by IR64 species growth in Sumedang area, while the highest was 0.071 µg/g given by HD species growth at Cianjur area. Meanwhile, the mean selenium concentration of rice consumed in Bandung was 0,035 µg/g. To our knowledge, this is the first report on the selenium level of rice in Indonesia. Altough it only reported the result from Bandung, however, as it is one of the largest city in Indonesia with the daily consumed foods mainly originated from outside of the city, this result may describe the picture of selenium concentration of Indonesian rice.

Key**words:** Selenium, Atomic Absorption Spectrometry, Rice.

Introduction

Selenium was originally known as toxic and carcinogenic element, but after 1957 it is known that these elements was an essential in a variety of proteins and functional organic compounds for health [1]. Selenium deficiency may lead to to the development of several diseases, including cardiovascular diseases and cancer, while excess of selenium consumption resulting in pulmonary edema, abdominal pain, jaundice, chronic gastrointestinal diseases, hair loss and fatigue [2].

Daily need of selenium is 70 µg for adult men, 55µg for women, and 65-75 µg for pregnant and lactating women[3]. WHO recommendation for seleniumconsumption is maximum 400 µg/day and the minimum limit is 10 µg/day[4].

Most of the world's population consumed rice as their staple food as well as Indonesian population.

Due to body selenium concentration is solely depend to its daily intake, monitoring the selenium level of daily consumed foods is critical for the prevention of selenium deficiency-related diseases.In this case, the research conducted on rice consumed in Bandung City of West Java Province of Indonesia.

Materials and Methods

Material

Rice, Nitric acid (Merck), centifur (Merck), distilled water, sodium borohydride ($NaBH_4$)(Merck), hydrochloric acid (Merck), and peroxide (Merck), Atomic Absorption Spectrometer AA 280 FS (Varian)

Methods

Rice samples were collected from local market in Bandung.

Table 1. 20 Rice species were collected for this study

No.	Rice species
1.	Rojolele Cianjur
2.	Pandan wangi Cianjur
3.	Tunas Sumedang
4.	Jembar Garut
5.	Kurmo Solo
6.	Rojolele Solo
7.	Mentik wangi Surabaya
8.	Jembar Cianjur
9.	Jembar Ciparay
10.	Jembar Rancaekek
11.	IR 64 (setra ramos) Solo
12	C4 Sumedang
13.	IR 42 Solo
14.	IR 64 Cianjur
15.	HD Cianjur
16.	MJ Ciawi
17.	PN Pamanukan
18.	IR 64 Karawang
19.	IR 64 Sumedang
20.	Jembar Soreang

Sample Digestions

Rice crushed and weighed as much as 0,2 g. Furthermore destructed rice powder diluted with 10% nitric acid and peroxide then heated to dry.

Analysis of Selenium Levels

The destruction results were analyzed by the AAS at a wavelength of 196 nm.

Results and Discussion

Results collected material

Rice samples collected from severalrice trader in Bandung, list of rice species can be seen in table 1.

The results of the analysis of selenium levels are shown in the following tables:

Table 2. The results of the selenium content in rice

No	Sample	Selenium concentration (µg/g)
1	Rojolele Cianjur Rice	0,026±0,003
2	Pandan wangi Cianjur Rice	0,015±0,002
3	Tunas Sumedang	0,021±0,004
4	Jembar Garut	0,016±0,005
5	Kurmo Solo	0,013±0,003
6	Rojolele Solo	0,03±0,002
7	Mentik wangi Surabaya	0,033±0,004
8	Jembar Cianjur Rice	0,033±0,004
9	Jembar Ciparay	0,037±0,009
10	Jembar Rancaekek	0,02±0,001
11	IR 64 (setra ramos) Solo	0,06±0,018
12	C4 Sumedang	0,05±0,009
13	IR 42 Solo	0,06±0,012
14	IR 64 Cianjur Rice	0,062±0,012
15	HD Cianjur Rice	0,071±0,006
16	MJ Ciawi	0,04±0,01
17	PN Pamanukan	0,046±0,01
18	IR 64 Karawang	0,03±0,002
19	IR 64 Sumedang	0,011±0,004
20	Jembar Soreang	0,014±0,002

The results showed that the selenium concentration of rice consumed in Bandung were varied with the lowest was 0.011 µg/g given by IR64 species growth in Sumedang area, while the highest was 0.071 µg/g given by HD species growth at Cianjur area. Meanwhile, the mean selenium concentration of rice consumed in Bandung was 0,035 µg/g. Research on the content of selenium in rice in China expressed levels of selenium in rice of 0,025±0,011 µg/g. In China the selenium is addedinto fertilizer. The addition of selenium to the fertilizer as much as 20 g of selenium per hectare of rice. For rice grown using fertilizers its selenium content increased from 0,025 to 0,640 µg/g. Since rice is the staple food in China, selenium-enriched rice with biological enrichment processes is expected to be a good source of selenium to residents in selenium deficient areas [5].

There are also some other countries who have studied the levels of selenium in rice such as Croatia with levels of selenium in rice 0,04 µg/g [6], Pakistan with the levels of selenium in rice 0,094 µg/g [7], Slovakia with levels of selenium in rice of 0,029 µg/g [8], Spain with levels of selenium in rice of 0,018 µg/g [9], and New Zealand with levels of selenium in rice of 0,072 µg/g as well as the levels of selenium in rice amounted to 0,026 µg/g [10]. In addition to New Zealand, there are also other countries that conduct research content of selenium in rice as Thailand's got levels of selenium in rice yield of 0,05 µg/g [11], England with levels of selenium in rice at 0,13 µg/g [12], Australia of 0,025 µg/g [13], North Dakota USA more precisely with levels of selenium in rice amounted to 0,094 µg/g [14], and Japan with levels of selenium in rice amounted to 0,013 µg/g [15].

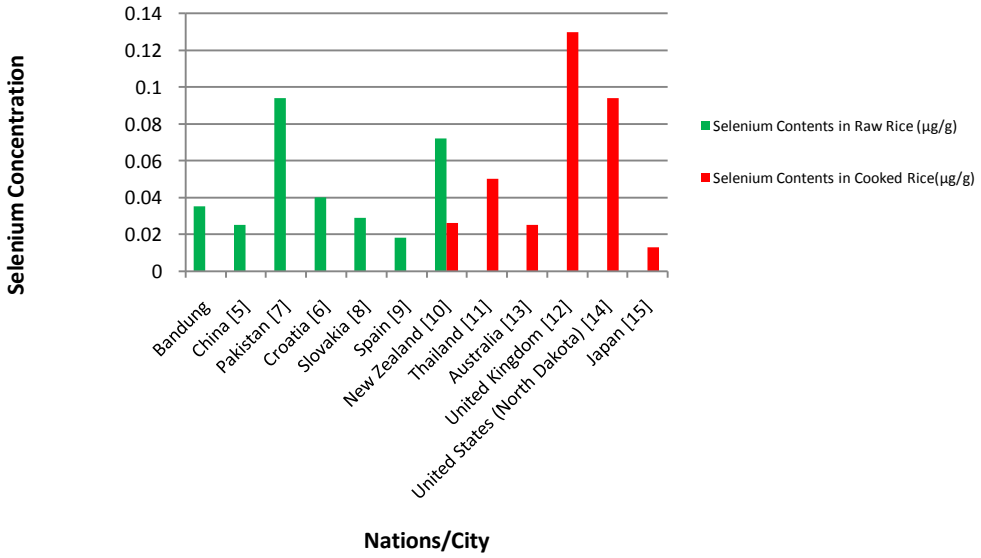

Figure 2. Comparison chart levels of selenium in raw rice/cooked rice in some countries

Comparison of this study with the data content of raw rice and cooked rice in some countries can be seen in Figure 2. From Figure 2, it can be seen that the content of selenium in rice in Pakistan, while the levels of selenium in rice was found in the UK. According to Muftisany [16], the current consumption of rice in Indonesia 316 grams per capita per day. So it can be known that selenium intake of rice amounting to 13.272 µg/day. While the daily intake of selenium was observed in the area with keshan diseasewas 7µg/day[17].

The content of selenium in the soil is an important factor affecting the levels of selenium in plant foods [18,19,20,21]. It is also supported by Fordyce *et al.*[22]which states that the differences in the various concentrations of selenium in plants from different geographical areas, primarily mainly due to the variation of the total content of selenium in the soil, but also affected the soil composition and pH. According to Barclay *et al.*[12], low levels of selenium in plants because plants do not require selenium for growth.

Table 3. Recommended Nutrient Intake of Selenium (µg/day)[4]:

Age Group	Assumed Weight	RNI, µg/day
Infants and Children		
0-6 months	6	6
7-12 months	9	10
1-3 years	12	17
4-6 years	19	22
7-9 years	25	21
Adolescents		
Female,10-18 years	49	26
Male, 10-18 years	51	32
Adults		
Female,19-65 years	55	26
Male, 19-65 years	65	34
Female, 65+ years	54	25
Male, 65+ years	64	33
Pregnancy		
2nd trimester		28
3rd trimester		30
Lactation		
0-6 months post-partum		35
7-12 months post-partum		42

RNI=Recommendednutrientintake

Conclusion

To our knowledge, this is the first report on the selenium level of rice in Indonesia. Altough it only reported the result from Bandung City, however, as it is one of the largest city in Indonesia with the daily consumed foods mainly originated from outside of the city, this result may describe the picture of selenium concentration of Indonesian rice.

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