

The Supplementation of Yam Powder Products Can Give the Nutritional Benefits of the Antioxidant Mineral (Cu, Zn, Mn, Fe and Se) Intakes

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Abstract

Yam has been recognized having the beneficial effects for the prevention of various diseases, such as cancer, immunity, infection and obesity etc. There is increasing consideration to supplement the antioxidant nutrients to make up the lack of the antioxidant nutrient intakes. No study has been reported for the analysis of antioxidant mineral contents and comparison to dietary recommended intake for the sense of health promotion. In our study, we analyzed the contents of antioxidant trace elements (Zn, Mn, Fe, Cu and Se) and Cr contents in cultivated Korean yam powders for evaluation of nutrient intake aspects. We collected the commercial yam powders from six different cultivated areas in the South Korea and measured antioxidant minerals (Zn, Mn, Fe, Cu and Se) and Cr contents using trace element-free plasma spectrometer (ICP) or atomic absorption spectrometer (AAS) after dry-ashing and then wet-acid digestion. The accuracy of mineral analysis method was confirmed by the mineral analysis of standard reference material. Each analyzed element contents in yam were compared to dietary reference intakes of Koreans (KDRIs). The average levels of trace elements (Zn, Mn, Fe, Cu, Se and Cr) in yam powders were 18.3, 11.9, 36.0, 3.7, 1.9 and 1.27 µg/g yam powder, respectively. The intakes of Zn, Fe, Cu and Se of which KDRIs is determined, are accounted as being up to 23.8%, 55.6%, 32.5% and 236% recommended intake (RI) of KDRIs, if daily yam supplementation (50 g) of commercial instruction would be considered. The intake of Mn is about 25% adequate intake (AI) of KDRIs with the daily supplementation of yam powder. Most of mineral intakes from daily yam supplementation were with the range of non-detectable to <10% upper limit (UL) level, which is very much safe. The study results show that daily supplementation of Korean yam powder is beneficial to provide the supplemental nutrient intake and also is safe, if the suggested dosage would be considered.

Key words: yam, antioxidant minerals (Cu, Zn, Fe, Mn and Se), nutritional intake, KDRIs

INTRODUCTION

The dietary yam (mainly *Dioscorea batatas*, *D. batatas*) is widely distributed and cultivated in East Asia, including Korea, China, Japan and Taiwan etc (1). Plants of the genus *D. batatas* have long been used in foods and oriental folk medicine. As the photochemical constituents, yam (*D. batatas*) components are composed of such as many polysaccharide, mannose-binding lectin, steroidal saponin, phenanthrene derivatives, and diosgenin etc (2). Many studies reported that yam (*Dioscorea alata*) has various beneficial activities and nutritional superiority compared with other tropical root crops (3). The tubers were found to have high amounts of protein with a good proportion of essential amino acids and appeared as fairly good sources or many dietary minerals (4). Yam is composed mainly of starch (75~84% of the dry weight) with small amounts of proteins, lipids and most vitamins

and is very rich in minerals (5,6). The average crude protein content of seven yam cultivars was 7.4%, which was higher than those reported for other tropical roots, and the protein from yam also showed a better amino acid balance for human nutrition (7-9). In addition all these beneficial activities of yam, our previous study suggested that yam biocompound diosgenin has the potential to increase osteogenic activity using the experimental model of mouse osteoblasts MC3T3-E1 cells (10).

Yam can be consumed as the natural food itself. There are also numbers of ways being practiced in preparing yams. Yams are generally consumed boiled, steamed, baked or fried. Since yams are found to be highly nutritious, fresh yams are difficult to store and are subject to deterioration during storage (11,12). Flours, on the other hand, are the most stable form among the yam products since it can be stored for a long period of time

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and can conveniently be used for consumption. Yam powders are found all throughout South Korea which are consumed as flour, drink, and are present in baked products.

Trace minerals such as copper (Cu), zinc (Zn), manganese (Mn), iron (Fe) and selenium (Se) act as the antioxidant biometals in our body. They do have their own antioxidant properties mainly to be component of the antioxidant enzyme proteins. Zn does have antioxidant properties in its own right (13) as well as the structural component and role of superoxide dismutase (SOD) which removes the reactive superoxide to non-harmful substance, along with Cu which is Cu/Zn SOD (14). Zn is also combining with metallothionein (MT) which shows the antioxidant capacity (15). Mn is also the component of another type of superoxide dismutase, Mn-SOD (13). Cu is a component of another type of antioxidant enzyme catalase and Se is also the component of antioxidant enzyme glutathione peroxidase (13). Antioxidant capacity of Mn is also reported in diabetes mellitus patients (14).

There are increasing interests to maintain health promotion and one of the concerns is that people would like to supplement the nutrients intake the health foods and the processed food products. In our study, we analyzed five antioxidant trace minerals (Zn, Mn, Fe, Cu, and Se) and Cr intakes from the supplemental yam powder products to assess whether this health food product could give the implication of health benefits with the assessment of the side of caution on supplementation study results would be the useful guideline for both the consumers and the industry.

MATERIALS AND METHODS

Yam powder sample collection

Six yam powdered-food products (Andong Book-hoo designated as A, Bon-Jon as B, Andong Cham-Ma as C, Nock-Jon as N, Sansam as S, Prus as P) which was cultivated and processed in South Korea were collected for the mineral analysis.

Mineral analysis using dry-ashing and wet digestion

To get the mineral contents in the samples, two steps were used: dry ashing and acid digestion. Firstly, yam powder samples were dry-ashed for obtaining mineral (ash) content only. Yam powder sample (5 g) were moisture-dried first at 105°C for 6 hours in a crucible and then were placed in the furnace at 500~600°C for another 12~14 hr until the samples turn to the white ash.

For the acid digestion for mineral analysis, the resulting ash (mineral) was dissolved in 3 mL of concentrated

nitric acid or in HNO₃/H₂O₂ and then diluted to 25 mL with deionized water. The solution obtained was used directly to determine six trace elements copper (Cu), zinc (Zn), manganese (Mn), iron (Fe), selenium (Se) and chromium (Cr) using an atomic absorption spectrophotometer (AAS, SpectrAA 220 FS, Varian, Victoria, Australia) or inductively coupled plasma emission spectrometer (ICP-ES, Flame Modula S, Spectro, Kleve, Germany).

Confirmation of the accuracy of mineral analysis method

To obtaining the real value (accuracy) of the mineral contents in the samples, the analytical accuracy of the method was tested using a standard reference material (SRM) which was obtained from National Institute of Standards and Technology (NIST SRM 1577b, Gaithersburg, MD, USA). The standard reference material 1577b was analyzed with the samples at the same time.

Comparison to Korean Dietary Reference Intake (KDRI) and nutritional intake assessment

The trace mineral intake levels in commercial yam powder products were analyzed using 2010 Korean Dietary Reference Intake (KDRI) which includes 4 reference intake values as shown below (16). First the recommended amount of yam powder daily intake was designated as 50 g on the basis of the intake instruction on the commercial instruction. Secondly, the estimated daily mineral intake was compared to reference intakes: recommended nutrition intake (RI), estimated average requirement (EAR), adequate intake (AI) and tolerable upper intake level (UL) for safety from the excess intake. The analyzed intake values were presented as % and analyzed on the basis of nutritional acceptability in terms of intake values.

Statistical analyses

All results for standard reference materials and mineral concentrations were reported as mean values with their respective standard deviations (mean ± SD) using the Statistical Package for Social Sciences (SPSS version 19, IBM corporation, Armonk, NY, USA).

RESULTS

Standard reference material mineralization analysis

Analyzed mineral values of standard reference materials (SRM) are presented in Table 1 which showed considerable percentage of analytical accuracy for the respective minerals being analyzed. It showed Zn 86.0%, Mn 83.1%, Fe 92.4%, and Cu 83.7% which is within 80~98% of the reference values. This means that the accuracy of mineral analysis is acceptable. The reference

Table 1. Standard reference material (SRM) analysis¹⁾

Mineral	SRM analysis (average in %)	
Zn	86.0±8.1 ³⁾	
Mn	83.1±6.2	
Trace mineral ²⁾	Fe	92.4±5.5
	Cu	83.7±2.5
	Se	—
	Cr	—

¹⁾Trace elements were calculated as µg/g (parts per million, ppm) and then converted to %SRM values. Se and Cr were not presented on the original SRM reference values.

²⁾Zn: zinc, Mn: manganese, Fe: iron, Cu: copper, Se: selenium, Cr: chromium.

³⁾SRM was analyzed twice in duplicate. Values are mean±SD (n=4).

values for Se and Cr was not presented on SRM information materials.

Trace mineral (Zn, Mn, Fe, Cu, Se and Cr element) contents in yam powder products

The contents of trace element nutrients (Zn, Mn, Fe, Cu, Se and Cr) found in cultivated Korean yam powder products are shown in Table 2.

Zn: On the average, 18.3±1.1 µg Zn is present for every gram of cultivated Korean yam powders with the wide range of 4.3~33.3 µg Zn/g yam powders.

Mn: Korean yam powders contain 11.9±0.4 µg/g yam powder within the range of 3.5~20.1 µg Mn/g yam powders.

Fe: Cultivated Korean yam powders have an average Fe content of 36.0±0.4 µg/g with the wide range of 6.0~89.0 µg Fe/g yam powders.

Cu: Although Cu is widely distributed in a variety of foods, it is present in cultivated yam powders of about 3.7±0.3 µg/g on average with the reasonably small range of 2.2~5.2 µg Cu/g yam powders.

Se: The average Se content in six yam powder prod-

ucts is 1.9±1.5 µg/g with the constant range of 5 products with 1.9~2.6 µg Se/g excepting 0.4 µg Se/g (product B).

Cr: Average Cr content is 1.27±0.2 µg/g yam powder with the constant range 0.33~0.70 µg Cr/g, except 4.61 µg Cr/g (product B).

Comparison of trace mineral (Zn, Mn, Fe, Cu, Se and Cr element) intakes from the daily supplementation of yam powder products to Dietary Reference Intakes for Koreans (KDRIs).

The normal daily supplemental intake of the yam powder product was recommended as 50 g powder products. Therefore, the estimated mineral intake from the daily yam powder product intake-based (50 g) was calculated from the analyzed content of each mineral in Table 2 (for Zn, Cu, Mn, Fe and Se on Table 3 and for Cr on Table 4)

Zn: The Korean yam powders give the Zn intake of 0.2~1.7 mg if 50 g yam powder (daily recommended amount of supplementation) consumed in a day (Table 3A). This amount gives the range of 18.5% for men and 23.8% for women for daily Zn recommended intake (RI) of KDRIs. This value compensates up to 1/5~1/4 of the daily Zn KDRI level. Upper limit (UL) for Zn is within the range of 0.6~4.8% which is very safety level.

Mn: Yam daily supplementation gives the Mn intake of 0.2~1.0 mg/50 g yam powder intake (Table 3B). This amount gives the range of 25.0% for men and 22.9% for women for daily Mn adequate intake (AI) of KDRIs. This value compensates up to 1/4 of the daily Mn AI level. Upper limit (UL) for Mn is with the range of 1.8~9.1% which is fairly safe level.

Fe: Fe intake from yam daily supplementation is about 0.3~4.5 mg/50 g yam powder intake (Table 3C). This amount gives the range of up to 49.4% for men and

Table 2. Trace mineral nutrients (Zn, Mn, Fe, Cu, Se and Cr) contents in the Korean yam powder products¹⁾

Yam powder samples ²⁾	Trace mineral content (µg/g yam powder product) ³⁾					
	Zn	Mn	Fe	Cu	Se	Cr
A	24.6±0.2 ⁴⁾	15.5±0.8	31.8±0.3	3.9±0.3	1.9±2.6	0.70±0.2
B	33.3±1.4	20.1±0.2	89.0±0.2	5.2±0.2	0.4±0.6	4.61±0.4
C	15.2±2.2	10.6±0.4	40.2±3.1	3.5±0.3	2.3±0.5	0.62±0.4
N	25.4±0.8	15.7±0.7	42.6±3.0	4.0±0.4	2.6±0.6	0.33±0.1
S	4.3±1.4	3.5±0.1	6.1±1.4	2.2±0.5	2.2±3.4	0.76±0.1
P	7.1±0.6	6.0±0.2	6.0±0.8	3.2±0.5	2.3±1.2	0.62±0.1
Mean	18.3±1.1	11.9±0.4	36.0±0.4	3.7±0.3	1.9±1.5	1.27±0.2

¹⁾Values are shown as on the basis of dried samples.

²⁾Yam powder product samples were collected from six different cultivated areas in South Korea. Six yam powder food products are designated for Andong Book-hoo designated as A, Bon-Jon as B, Andong Cham-Ma as C, Nock-Jon as N, Sansam as S and Prus as P.

³⁾Zn: Zinc, Mn: manganese, Fe: iron, Cu: copper, Se: selenium, Cr: chromium.

⁴⁾Trace elements were analyzed twice in duplicate. Values are expressed to the first decimal points. Values are mean±SD (n=4).

55.6% for women for daily RI Fe intake of KDRI. This value compensates more than 1/2 of the daily Fe KDRI level. Upper limit (UL) for Fe is within the range of 0.7~9.9% which is still fairly safe.

Cu: Cu intake from yam daily supplementation is 110~260 µg/50 g yam powder intake (Table 3D). This amount gives up to 32.5% for Cu RI intake of KDRI for both men and women. The upper limit for Cu is

Table 3. The expected daily intake of trace minerals (Zn, Mn, Fe, Cu and Se) from the recommended daily supplementation (50 g) of Korean yam powders and the comparison to Dietary Reference Intakes for Koreans (KDRI)¹⁾

3A. Zinc (Zn)

Yam powder samples ²⁾	Daily intake (mg/50 g yam)*	Zn %KDRI					
		Male			Female		
		%RI (RI 9~10 mg)	%EAR (EAR 7.1~8.1 mg)	%UL (UL 35 mg)	%RI (RI 7~8 mg)	%EAR (EAR 6.0~7.0 mg)	%UL (35 mg)
A	1.2	12.0~13.7	15.6~17.3	3.5	15.0~17.6	17.1~20.5	3.5
B	1.7	18.0~18.5	23.4~23.5	4.8	22.5~23.8	25.7~27.8	4.8
C	0.8	8.0~8.4	10.4~10.7	2.2	10.0~10.9	11.4~12.7	2.2
N	1.3	13.0~14.1	16.9~17.9	3.6	16.3~18.1	18.6~21.2	3.6
S	0.2	2.0~2.4	2.6~3.0	0.6	2.5~3.1	2.9~3.6	0.6
P	0.4	3.9~4.0	5.2~5.0	1.0	5.0~5.1	5.7~5.9	1.0
Intake range	0.2~1.7 (mg)	2.0~18.5 (%)	2.6~24.1 (%)	0.6~4.8 (%)	2.5~23.8 (%)	2.9~27.8 (%)	0.6~4.8 (%)
Mean	0.9 (mg)	9.3 (%)	12.1 (%)	1.9 (%)	11.9 (%)	13.9 (%)	2.4 (%)

*The expected Zn daily intake from the daily portion (50 g) of yam powder intake.

¹⁾KDRI for the comparison were used for the adults for men and women with the age 19~75 years. RI: Recommended Nutrient Intake, EAR: Estimated Average Requirement, AI: Adequate Intake, UL: Tolerable Upper Intake Level.

²⁾Six yam powder food products are designated for Andong Book-hoo designated as A, Bon-Jon as B, Andong Cham-Ma as C, Nock-Jon as N, Sansam as S and Prus as P.

3B. Manganese (Mn)

Yam powder samples	Daily intake (mg/50 g yam powder)*	Mn %KDRI			
		Male		Female	
		%AI (AI 4.0 mg)	%UL (UL 11.0 mg)	%AI (AI 3.5 mg)	%UL (UL 11.0 mg)
A	0.8	20.0	7.3	22.9	7.3
B	1.0	25.0	9.1	28.6	9.1
C	0.5	12.5	4.5	14.3	4.5
N	0.8	20.0	7.3	22.9	7.3
S	0.2	5.0	1.8	5.7	1.8
P	0.3	7.5	2.7	8.6	2.7
Intake range	0.2~1.0 (mg)	5.0~25.0 (%)	1.8~9.1 (%)	5.7~22.9 (%)	1.8~9.1 (%)
Mean	0.5 (mg)	12.5 (%)	4.6 (%)	11.5 (%)	4.6 (%)

*The expected Mn daily intake from the daily portion (50 g) of yam powder intake.

3C. Iron (Fe)

Yam powder samples	Daily intake (mg/50 g yam powder)*	Fe %KDRI					
		Male			Female		
		%RI (RI 9~10 mg)	%EAR (EAR 6.9~7.7 mg)	%UL (UL 45 mg)	%RI (RI 8~14 mg)	%EAR (EAR 5.8~10.8 mg)	%UL (UL 45 mg)
A	1.6	15.9~17.7	20.6~23.0	3.5	11.4~19.9	14.7~27.4	3.5
B	4.5	44.5~49.4	57.8~64.5	9.9	31.8~55.6	41.2~76.7	9.9
C	2.0	20.1~22.3	26.1~29.1	4.5	14.4~25.1	18.6~34.7	4.5
N	2.1	21.3~23.7	27.7~30.9	4.7	15.2~26.6	19.7~36.7	4.7
S	0.3	3.1~3.4	4.0~4.4	0.7	2.2~3.8	2.8~5.3	0.7
P	0.3	3.0~3.3	3.9~4.3	0.7	2.1~3.8	2.8~5.2	0.7
Intake range	0.3~4.5 (mg)	3.0~49.4 (%)	3.3~64.5 (%)	0.7~9.9 (%)	2.1~55.6 (%)	2.8~76.7 (%)	0.7~9.9 (%)
Mean	1.8 (mg)	18.0 (%)	22.5 (%)	4.0 (%)	17.1 (%)	21.1 (%)	4.0 (%)

*The expected Fe daily intake from the daily portion (50 g) of yam powder intake.

Table 3. Continued

3D. Copper (Cu)

Yam powder samples	Daily intake ($\mu\text{g}/50$ g yam powder)*	Cu %KDRIs		
		Male and female		
		%RI (RI 800 μg)	%EAR (EAR 600 μg)	%UL (UL 10,000 μg)
A	195	24.4	32.5	2.0
B	260	32.5	43.3	2.6
C	175	21.9	29.2	1.8
N	200	25.0	33.3	2.0
S	110	13.8	18.3	1.1
P	160	20.0	26.7	1.6
Intake range	110~260 (μg)	13.8~32.5 (%)	18.3~43.3 (%)	1.1~2.6 (%)
Mean	183 (μg)	22.9 (%)	2.1 (%)	1.8 (%)

*The expected Cu daily intake from the daily portion (50 g) of yam powder intake.

3E. Selenium (Se)

Yam powder samples	Daily intake ($\mu\text{g}/50$ g yam powder)*	Se %KDRIs		
		Male and female		
		%RI (RI 55 μg)	%EAR (EAR 45 μg)	%UL (UL 400 μg)
A	95	173	211	24
B	20	36	44	5
C	115	209	256	29
N	130	236	289	33
S	110	200	244	28
P	115	209	256	29
Intake range	20~130 (μg)	36~236 (%)	44~289 (%)	5~33 (%)
Mean	65 (μg)	195 (%)	232 (%)	24 (%)

*The expected Se daily intake from the daily portion (50 g) of yam powder intake.

Table 4. Expected daily intake of trace element chromium (Cr) from the Korean yam powders and % USA DRIs (Dietary Reference Intakes of USA)

Yam powder samples ¹⁾	Daily intake ($\mu\text{g}/50$ g yam powder) ²⁾	Cr % USA DRIs ³⁾			
		Male		Female	
		%RI (RI 30~35 μg)	%UL (ND μg)	%RI (20~25 μg)	%UL (ND μg)
A	35	100.0~116.7	—	140.0~175.0	—
B	230.5	658.6~768.3	—	922.0~1152.5	—
C	31	88.6~103.3	—	124.0~155.0	—
N	16	45.7~53.3	—	64.0~80.0	—
S	38	108.6~126.7	—	152.0~190.0	—
P	31	88.6~103.3	—	124.0~155.0	—
Intake range	16~230.5 (μg)	181.7~211.9 (%)	—	254.3~317.9 (%)	—
Mean	63.6 (μg)	196.8 (%)	—	286.1 (%)	—

¹⁾Six yam powder food products are designated for Andong Book-hoo designated as A, Bon-Jon as B, Andong Cham-Ma as C, Nock-Jon as N, Sansam as S and Prus as P.

²⁾Cr intake from daily supplementation of yam powder (50 g) was compared to Dietary Reference Intakes of USA (USA DRIs), since KDRIs doesn't provide the level for Cr.

³⁾RI: Recommended Nutrient Intake, UL: Tolerable Upper Intake Level, ND: Non-detectable.

1.1~2.6% which is safe.

Se: Se intake from yam daily supplementation is 20~130 $\mu\text{g}/50$ g yam powder intake (Table 3E). This amount gives 36~236% for daily RI Se intake of KDRIs for both men and women. This value compensates 1/3 to 2.4 fold of the daily Se RI intakes for both men and women. Upper limit (UL) for Cu is 5~33% which is

safe.

Cr: Since KDRIs which was revised in 2010 does not provide the levels for Cr, the expected Cr intake from the daily yam supplementation was compared to USA DRIs (dietary reference intakes of USA). Cr intake from yam daily supplementation gives the level of 182~212% RI for men and 254~318% RI for a woman which

is a quiet bit supplemental level without any upper limit harmful effect (Table 4).

DISCUSSION

In the present study, we analyzed the level of antioxidant minerals (Zn, Cu, Mn, Fe and Se) and Cr contents in Korean yam powder-type food products which is commercially available as nutrient supplements, and compared the expected daily intake from the yam supplementation to the dietary reference intakes of Koreans (KDRIs) to assess whether yam supplementation would give the beneficial effect for the mineral intakes.

Even though a few selected studies reported the antioxidant capacity of yam products (17) and nutritional composition of yam cultivated in Nepal (4), however there is no report for the content of antioxidant minerals in yam products cultivated in Korea where the core area of yam cultivation in Asia so far. In the present study, we reported the content of antioxidant minerals in yam products. Antioxidant minerals give the various actions and the potential of the protection from the oxidative stress. In general, Cu and Zn, Se are involved in destruction of free radicals through cascading enzyme systems. Superoxide radicals are reduced to hydrogen peroxide by superoxide dismutases which contain Cu and Zn, or Mn as cofactors. Hydrogen peroxide is then reduced to water by coupling action of Se-glutathione peroxidase (18).

Apart from this antioxidant role, zinc has a general role in many enzymes, in gene expression, and in immune function, among other physiologic functions. Wound healing, reduced immune function, dermatitis and loss of taste acuity are the effects of inadequate Zn (19), in addition to antioxidant action of being the component of Cu/Zn superoxide dismutase. Mn serves as cofactors of many important enzymes and/or proteins. Symptoms of Mn deficiency include poor reproductive performance, growth retardation, congenital malformations in offspring, abnormal function of bone and cartilage and impaired glucose tolerance (20) as well as the component of Mn superoxide dismutase. Inadequate consumption of dietary iron leads to Fe deficiency anemia which is often encountered in older adults who have chronic inflammatory diseases. Fe intake is recommended to be taken in divided doses and with meals to enhance iron absorption (21). A deficiency in Cu may manifest as hypochromic anemia, osteoporosis, arterial disease, myocardial symptoms, and decreased metabolic activity of Cu-containing enzymes (22,23). A deficiency in chromium may show symptoms of hyperglycemia or abnormal lipid levels (23,24) which may be corrected

by providing Cr supplementation.

From the our study results, all these antioxidant minerals (Cu, Zn, Mn, Fe, and Se) and Cr intakes can be supplemented by incorporating Korean yam powder supplements in addition to daily meals. With taking the daily recommended supplementation intake of Korean yam powder (50 g), Zn intake can supplemented up to 18.5 and 23.8% for men and women of recommended intake (RI) of dietary reference intakes of Korea (KDRIs) without any upper limit (UL) toxicity (only 0.6~4.8% UL intake). Mn intake can be supplemented up to 25.0% for men and 22.9% for women still without any UL consideration (only 1.8~9.1% UL intake). Fe intake from daily yam supplementation was up to 49.4% and 55.6% for men and women recommended intake (RI) of KDRIs with only 0.7~9.9% UL which is beneficial for intake-wise as well as upper limit-wise. Cu intake is very much the same beneficial with 32.5% RI intake but very low level of UL, only 1.1~2.6% UL level. The most abundant supplementation from the daily intake of yam powder supplementation was shown in Se intake which is about 195% RI with upper limit of 24% on average. For the Cr supplemental intake from yam products, average 197% (for men) and 286% (for women) of RI level was analyzed, specially product B showed a considerate level of high contents (768% and 1153% RI for men and women) which needs a special caution to take it.

From the overall results, daily intake of Korean yam powder supplementation gives 1) on average 1/5~1/2 fold of daily recommended intake of KDRIs for antioxidant mineral (Zn, Cu, Mn, Fe and Se) and Cr intakes, and 2) among these antioxidant minerals, Se supplementation is the most beneficial with almost >2 fold of Se RI of KDRIs, even without any harmful intakes for upper limit, 3) however, it would be needed to be cautious for certain mineral intake, such as Cr since one of the products (product B) gave specially high content of Cr intake (at least >659% of Cr RI). Even considering this consideration, in conclusion, the study results shows that Korean yam powder supplementation is beneficial to obtain the additional intake to supplement the antioxidant mineral intake and it is safe for daily intake for supplementation on the matter of these antioxidant minerals (Cu, Zn, Mn, Fe and Se) and Cr intakes, if the suggested dosage would be considered. The study result gives the beneficial information for the consumers who consider the health promotion as well as the industry which implies the strategies for developing health products.

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