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□Original Article□

Living Arrangements Affect Nutritional Status of the Elderly*

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ABSTRACT

With a continuous and steep increase in life expectancies, Korean society is expected to enter the aged society by year 2020. And as the number of elderly increases, the burden of medical and health care expenses for them becomes greater in every developed society. Hence, the preventive approach for chronic degenerative diseases remains to be the best solution for the above-mentioned problem and warranting optimal nutrition would be one of the most important approaches. We performed a nutrition survey on 585 older adults of 50 years of age and older, residing in 3 metropolitan areas including Daejun, Daeku and Kwangju. Anthropometry, including body composition analysis based on the bioelectrical impedance analysis using InBody 3.0 and dietary intake survey by semi-quantitative food frequency questionnaires, were used in collecting data. As one of the most important factors affecting the health and nutritional status of the elderly, we focused on living arrangements. Analyses were performed on the data from 550 subjects only, after excluding statistical outliers. Three hundred and sixty-eight of them(66.9%) were female and the number of elderly(65 years of age and older) was 485. According to the statistical analyses, the female elderly were more vulnerable to malnutrition than the male elderly. And the older they became, the less adequate they were in nutrient intake. In addition to this, the elderly living alone showed the poorest patterns of nutrient intake and anthropometry. Although the exact effect of living alone could differ among different sex-age groups, the fact that the elderly living alone is vulnerable to malnutrition would remain concrete. This raises the utmost necessity of nutrition intervention to be devised and directed to the targeted population, namely the living-alone elderly from the government level. The intervention may include nutrition education, nutrition counseling and support in forms of meal service by networking the efforts of central as well as local governments to ensure the good health of the Korean elderly. (*J Community Nutrition* 3(2) : 103~109, 2001)

KEY WORDS : elderly · living arrangements · nutrient intake · anthropometry.

Introduction

As of the year 2000, there were a little over 3.2 million people of age 65 or older in the Republic of Korea, accounting for 6.9% of the total population (KNSO 2000). The older population is expected to double over the next 20 years and to increase up to 14.3% of the total population by the year 2022, entering into the aged society(MOHW 2000).

Meanwhile, rapid industrialization and urbanization in Korea during last three decades has caused a gradual downsizing in families. A steady increase in the labor force participation of women during the same period has weakened the ability of families to support elders in traditional ways. As a consequence, the number of elderly persons living alone, or living with spouse only, has increased with the decrease in the number of the elderly living with children and/or grand children in Korea. In 1995, the proportion of the elderly living alone was 13.3% of the total households with elderly, and that of the elderly living with a spouse was 16.4%(KOSIS 2001).

With such a dramatic increase in the number of elderly and a change in living arrangements, it has become more important to monitor and to evaluate the nutritional status of the elderly in terms of maintaining reasonably fair health conditions. Good health of the elderly would contribute to lessening the burden of national medical expenses and to increase the proportion of healthy years in the ever-increasing life expectancies.

One of the best possible approaches to increase the

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healthy portion of life expectancy would be the improvement and maintenance of health and nutrition status of the elderly. The most fundamental cause of malnutrition among the elderly must be the limited nutrient intake resulting from a limited food intake due to various causes associated with aging.

In this study, therefore, we attempted to evaluate the nutritional status of the self-mobile elderly residing in the metropolitan area and to look into the differences in nutrient intake and anthropometry according to their living arrangements.

Subjects and Methods

Five hundred and eighty-five elders residing in the 3 metropolitan cities of Daejun, Daeku and Kwangju, volunteered to participate in the study. We included young elders aged 50 to 64 in addition to elders of 65 and up to cover a 'getting-old' period. They were self-mobile and had no major health condition problems. Most of them were interviewed twice at several elderly centers in each city during their visit for social activity. The survey period was from October to December 2000.

At the first interview, height, weight and body composition using bioelectrical impedance analysis(InBody 3.0, Biospace Co. Ltd., Korea) were measured and a short consultation was given on problems noted from anthropometry. An individual interview by a trained interviewer(licensed dietitian) on demography, living condition, lifestyle and usual food intake during the past year, using semi-quantitative food frequency questionnaire(FFQ), was performed at the second interview. The development of the food frequency questionnaire was based on the food intake data of the Korean population, derived from the 1998 National Health and Nutrition Survey(NHNS)(MOHW 1999) in the following manner. Most frequently consumed foods and foods consumed most by amounts of older Koreans(50 years and older) were considered in selecting foods for the questionnaire. The serving size of each food was determined, based on the 24 hour recall data and recipes obtained from about 4,000 households which had participated in the 1998 NHNS. Actual size photographs of prepared dishes for one serving size were used to aid the subjects response in terms of quantification.

The nutrient intake of each subject was calculated with a program developed for the food frequency questionnaire utilizing the food composition table(NRLSI-RDA 1996) and database(KIFH-MOHW 1998). Intake was compared to the recommended dietary allowances (RDA) for Koreans(Korean Nutrition Society 2000) to evaluate nutritional adequacy. Statistical analysis was performed on data from 550 subjects whose energy intake fell within the range of the mean±2SD of the total subjects using the SAS program. One-way analysis of variance(ANOVA), Duncan's multiple range test and Student's t-test, were used to test the significance of differences among the group means(Snedecor & Cochran 1980).

Results and Discussion

1. Nutritional status of elderly

Out of 550 subjects, 368 were women, accounting for 2/3 of the total. The daily intake of nutrients calculated from the food frequency questionnaire is listed in Table 1. For every nutrient examined, there was a statistically significant difference between the values for male and female subjects. This difference persisted even after conversion of intake to the percentage of the RDA, as shown in Table 2. Although the level of significance of the differences became lessened for en-

Table 1. Mean daily intakes of energy and nutrients

Nutrients	Male	Female	p*
N	182	368	
Energy(kcal)	1842 ± 495	1483 ± 454	< 0.0001
Protein(g)	69.3 ± 25.3	53.8 ± 22.2	< 0.0001
Fat(g)	44.5 ± 21.1	31.4 ± 17.1	< 0.0001
CHO(g)	278.5 ± 74.3	247.9 ± 67.4	< 0.0001
Ca(mg)	502 ± 223	432 ± 238	< 0.0001
P(mg)	1054 ± 353	859 ± 344	< 0.0001
Fe(mg)	13.5 ± 5.0	10.6 ± 4.4	< 0.0001
Sodium(mg)	6511 ± 2576	5304 ± 2256	< 0.0001
Potassium(mg)	2949 ± 1007	2419 ± 1004	< 0.0001
Vit. A(RE)	765 ± 364	597 ± 321	< 0.0001
Thiamin(mg)	1.32 ± 0.54	1.00 ± 0.41	< 0.0001
Riboflavin(mg)	1.23 ± 0.50	0.95 ± 0.46	< 0.0001
Niacin(mg)	15.9 ± 5.8	11.8 ± 4.9	< 0.0001
Vit. C(mg)	129.2 ± 64.5	113.8 ± 65.8	< 0.01

mean ± SD
* : Significance of difference between the values of male & female subjects by Student's t-test

ergy, protein, and calcium intake, those for other nutrients remained similar. Also, as pointed in other studies(MOHW 1999 ; Lee et al. 2001), calcium was the nutrient of the utmost importance in the aspects of low intake. Similiarly, iron, vitamin A, riboflavin and niacin intakes were lower than the RDA in the female elderly. Since the Korean RDA is set differently for the age groups of the elderly, we grouped the data of subjects according to the age and sex and looked into them for age-related differences.

Table 2. Nutrient intake expressed in the percentage of RDA

Nutrients	Male	Female	*p**
N	182	368	
Energy	94.7 ± 26.3	87.0 ± 26.1	< 0.002
Protein	109.6 ± 40.2	97.8 ± 40.3	< 0.002
Ca	71.7 ± 31.8	61.7 ± 34.0	< 0.001
P	150.6 ± 50.5	122.7 ± 49.1	< 0.0001
Fe	112.7 ± 41.2	88.3 ± 36.7	< 0.0001
Vit. A	109.3 ± 52.0	85.3 ± 45.8	< 0.0001
Thiamin	130.5 ± 54.3	100.3 ± 41.5	< 0.0001
Riboflavin	102.0 ± 41.6	79.1 ± 38.2	< 0.0001
Niacin	121.2 ± 45.0	90.4 ± 37.7	< 0.0001
Vit. C	184.6 ± 92.4	162.6 ± 94.0	< 0.01

mean ± SD
* : Significance of difference between the values of male & female subjects by Student's t-test

As shown in Table 3 and 4, there was a significant age effect in some nutrients intake. The kind of nutrient and level of significance differed between the male and female elderly, reflecting different facets of nutritional problems between them. Among the male subjects, the group aged 50 to 64 showed the lowest mean for every nutrient intake, although some of them were not significantly different from the means of the other age groups. And the other 2 age groups were in fairly good condition with nutrient intake higher than the RDA, except calcium. This result raises the question about the appropriateness of the RDA set for this 50 to 64 year group again, as pointed out be-

Table 3. Nutrient intake of the male subjects by age group(% RDA)

Nutrients \ Age	50 – 64	65 – 74	75 and up	*p**
N	13	107	62	
Energy	70.8 ± 16.4[a]	94.6 ± 25.4[b]	100.1 ± 27.1[b]	0.001
Protein	79.9 ± 20.5[a]	111.0 ± 40.5[b]	113.4 ± 40.7[b]	0.019
Ca	58.7 ± 26.1	73.9 ± 32.7	70.5 ± 31.1	NS
P	124.3 ± 30.2[a]	155.6 ± 51.9[b]	147.4 ± 50.1[a,b]	NS
Fe	96.3 ± 31.1	116.1 ± 41.8	110.4 ± 41.7	NS
Vit. A	92.0 ± 54.2	110.3 ± 51.5	113.3 ± 52.7	NS
Thiamin	96.1 ± 25.1[a]	135.8 ± 59.1[b]	128.6 ± 47.3[b]	0.041
Riboflavin	75.3 ± 24.6[a]	104.3 ± 40.3[b]	103.9 ± 44.7[b]	0.036
Niacin	89.3 ± 19.8[a]	126.4 ± 46.8[b]	119.0 ± 43.3[b]	0.017
Vit. C	150.6 ± 58.8	191.5 ± 100.0	179.7 ± 83.3	NS

mean ± SD * : Significance of F value by one-way ANOVA
a, b : Values in a row with different superscripts are significantly different from each other at p < 0.05 by Duncan's multiple range test

Table 4. Nutrient intake of the female subjects by age group(% RDA)

Nutrients \ Age	50 – 64	65 – 74	75 and up	*p**
N	52	220	96	
Energy	87.8 ± 25.1	88.5 ± 25.9	83.3 ± 26.9	NS
Protein	112.5 ± 45.4[a]	99.3 ± 39.0[b]	86.3 ± 37.4[c]	0.0005
Ca	70.9 ± 37.0[a]	64.2 ± 34.5[a]	51.0 ± 28.7[b]	0.0006
P	142.4 ± 56.0[a]	125.2 ± 48.2[b]	106.2 ± 41.9[c]	< 0.0001
Fe	101.5 ± 41.8[a]	90.6 ± 35.7[b]	76.0 ± 32.6[c]	< 0.0001
Vit. A	102.7 ± 53.1[a]	85.4 ± 45.0[b]	75.7 ± 40.9[b]	0.003
Thiamin	119.8 ± 46.2[a]	101.2 ± 39.0[b]	87.6 ± 40.2[c]	< 0.0001
Riboflavin	98.1 ± 45.5[a]	80.1 ± 36.9[b]	66.5 ± 32.2[c]	< 0.0001
Niacin	110.6 ± 45.6[a]	91.2 ± 35.9[b]	77.8 ± 32.2[c]	< 0.0001
Vit. C	230.5 ± 145.0[a]	162.6 ± 80.0[b]	125.8 ± 64.6[c]	< 0.0001

mean ± SD * : Significance of F value by one-way ANOVA
a, b, c : Values in a row with different superscripts are significantly different from each other at p < 0.05 by Duncan's multiple range test

fore(Lee et al. 2001).

On the other hand, the female elderly showed a totally different pattern of intake from the male elderly (Table 4). For most of the nutrients, the mean intake was lower than the RDA for both of the 65 – 74 group and the 75 and up group. And, the older they became, the worse they ate. The 75 and up group showed the mean intakes far below the RDA for most of the nutrients, except phosphorus and vitamin C. Calcium intake reached only 51% of the RDA, signifying the importance of bone loss among the female elderly, which is rather serious due to a change in hormone balance after menopause and to a decrease in activity. In addition to the role and importance of the estrogen receptor gene polymorphism and interaction (Kwon et al. 2000), such low intake of calcium for a long period, especially after menopause, could worsen and result in more significant bone loss in the female elderly.

Table 5. Anthropometric parameters of subjects

Parameters	Male	Female	p^*
N	182	368	
Height(cm)	164.1 ± 5.6	150.2 ± 5.7	< 0.0001
Weight(kg)	63.0 ± 9.5	56.5 ± 8.1	< 0.0001
BMI	23.36 ± 3.09	24.98 ± 2.97	< 0.0001
Body fat(%)	23.4 ± 5.3	33.3 ± 5.1	< 0.0001
Muscle mass(kg)	45.2 ± 5.7	35.2 ± 4.2	< 0.0001
Fat mass(kg)	15.1 ± 5.0	19.1 ± 4.8	< 0.0001
Body water(L)	33.1 ± 4.2	25.7 ± 3.2	< 0.0001

mean ± SD
* : Significance of difference between the values of male & female subjects by Student's t-test

Anthropometric data is shown in Table 5. The mean weights and heights for men and women were 63.0 ± 9.5kg/164.1 ± 5.6cm, and 56.5 ± 8.1kg/150.2 ± 5.7cm respectively. For each parameter, the means were significantly different between the sexes. BMI, body fat%, and fat mass were higher in the female than in the male elderly. When we grouped the data by age, some interesting results were noted(Table 6 and 7). Although the stature and weight decreased as they got older, body fat% increased in the male elderly with age and no change was seen among the female elderly. While a steady decrease in muscle mass and volume of body water was evident among both male and female elderly, fat mass decreased among the female elderly only(Table 7). The high significance of the age effect on the volume of body water would emphasize the importance of drinking sufficient amounts of water daily in the elderly(NHMRC 1994).

Table 6. Anthropometric parameters of the male subjects by age

Nutrients	50 – 64	65 – 74	75 and up	p^*
N	13	107	62	
Height(cm)	165.9 ± 5.5^a	164.8 ± 5.3^{a,b}	162.6 ± 6.0^b	0.028
Weight(kg)	67.0 ± 8.1^a	63.5 ± 9.3^{a,b}	61.4 ± 9.8^b	0.111
BMI	24.41 ± 3.07	23.36 ± 3.14	23.15 ± 3.00	NS
Body fat(%)	22.6 ± 5.2	22.5 ± 5.1	25.2 ± 5.2	0.005
Muscle mass(kg)	48.8 ± 4.3^a	46.1 ± 5.5^a	43.0 ± 5.4^b	< 0.0001
Fat mass(kg)	15.4 ± 5.0	14.7 ± 4.9	15.9 ± 5.3	NS
Body water(L)	35.7 ± 3.2^a	33.8 ± 4.1^a	31.5 ± 4.0^b	< 0.0001

mean ± SD
a, b : Means with different superscripts in a row are significantly different from each other at $p < 0.05$ by Duncan's multiple range test

Table 7. Anthropometric parameters of female subjects by age

Nutrients	50 – 64	65 – 74	75 and up	p^*
N	52	220	96	
Height(cm)	153.3 ± 4.9^a	151.1 ± 5.2^b	146.5 ± 5.3^c	< 0.0001
Weight(kg)	60.3 ± 8.0^a	57.7 ± 7.5^b	51.7 ± 7.4^c	< 0.0001
BMI	25.61 ± 2.91^a	25.24 ± 2.95^a	24.07 ± 2.87^b	0.0013
Body fat(%)	33.1 ± 4.4	33.4 ± 5.1	33.2 ± 5.4	NS
Muscle mass(kg)	37.7 ± 3.9^a	35.9 ± 3.7^b	32.1 ± 3.6^c	< 0.0001
Fat mass(kg)	20.2 ± 4.9^a	19.6 ± 4.8^a	17.5 ± 4.7^b	< 0.0005
Body water(L)	27.3 ± 3.8^a	26.3 ± 2.7^b	23.6 ± 2.6^c	< 0.0001

mean ± SD * : Significance of F value by one-way ANOVA
a, b, c : Means with different superscripts in a row are significantly different from each other at $p < 0.05$ by Duncan's multiple range test

2. Nutritional status of the elderly by living arrangements

The data was analyzed according to the living arrangements of the elderly and compared to each other within a given sex-age group to compensate for the differences in nutrient requirements or RDA, due to sex and age. The income was not considered in the analysis due to the lack of information, and/or the low credibility of the elderly's answers. The proportion of the elderly living alone was 22.2% of the total subjects. Also, 9.3% of the male elderly and 28.5% of the female elderly were living alone. Although these values were much lower than those of the American elderly, which were 17.3% and 41.3% for the male and female respectively(FIFARS 2000), the proportion of the female elderly living alone was about 3 times higher than the male elderly. On the other hand, the proportion of women living with a spouse was less than half that of men. These together imply a longer life expectancy of women in Korea.

In Tables 8-10, some results with statistical significance are shown for certain sex-age groups. Among the male elderly of 65 – 74 years of age, those living alone had the lowest means for all parameters except height(Table 8). Although it was only niacin intake which had a statistically significant(at $p < 0.05$) F value from one-way ANOVA, the mean intakes of the living alone group for some other nutrients(protein, phosphorus, iron and potassium) were also significantly differed from those of groups living with someone else. This finding is similar to the one noted by Weimer(1998) of the United States. In addition to this, body fat% of the living alone group was significantly lower than others and the value was categorized as slightly over-fat by Niemans definition(Nieman 1995). From this result, we are tempting to postulate that living arrangements, especially for those living alone, make a big difference in terms of nutrient intake and related anthropometry leading into a change in the health status and well-being of the elderly.

As can be seen in Table 9, the female elderly were somewhat different from the male elderly. Anthropometry was not different at all among the 3 living arrangement groups. However nutrient intake, except calcium and vitamin A, showed a statistically significant living arrangement effect by one-way ANOVA. Although the living alone group had the lowest values for every parameter, as seen in the male elderly, living with a spouse and/or relatives group showed the higher values for some nutrients, such as thiamin and nia-

Table 8. Anthropometry and nutrient intake of the male subjects age 65 to 74 by living arrangement

	Living alone	Living with spouse	Living with spouse and/or relatives	p^*
N	10	69	28	
Height(cm)	163.0 ± 7.6	165.8 ± 5.2	162.9 ± 3.8	0.025
Weight(kg)	58.3 ± 5.5^a	64.6 ± 9.9^b	62.6 ± 8.2^{a,b}	0.113
BMI	21.92 ± 1.46	23.46 ± 3.25	23.61 ± 3.24	NS
Body fat(%)	19.2 ± 3.8^a	22.5 ± 5.2^b	23.5 ± 5.0^b	0.074
Energy(Kcal)	1714 ± 626	1866 ± 487	2017 ± 503	NS
Protein(g)	59.3 ± 23.7^a	71.5 ± 25.7^{a,b}	78.3 ± 27.6^b	0.139
Fat(g)	38.9 ± 19.5	44.6 ± 21.8	51.6 ± 25.1	NS
CHO(g)	267.4 ± 85.0	281 ± 71	298.1 ± 80.8	NS
Ca(mg)	428 ± 191	530 ± 228	519 ± 241	NS
P(mg)	909 ± 342^a	1090 ± 355^{a,b}	1151 ± 382^b	NS
Fe(mg)	11.2 ± 4.8^a	13.9 ± 5.1^{a,b}	15.0 ± 4.7^b	0.107
Sodium(mg)	5704 ± 2237	6849 ± 2729	7137 ± 2698	NS
Potassium(mg)	2424 ± 970^a	3048 ± 1026^{a,b}	3213 ± 1041^b	0.116
Vit. A(RE)	641 ± 313	771 ± 382	822 ± 317	NS
Thiamin(mg)	1.18 ± 0.54	1.33 ± 0.58	1.49 ± 0.62	NS
Riboflavin(mg)	1.05 ± 0.52	1.25 ± 0.46	1.34 ± 0.51	NS
Niacin(mg)	12.5 ± 4.7^a	16.3 ± 5.9b	18.1 ± 6.4^b	0.044
Vit. C(mg)	123.7 ± 100.0	135.7 ± 68.0	133.7 ± 64.8	NS

mean ± SD   * : Significance of F value by one-way ANOVA

a, b : Means with different superscripts in a row are significantly different from each other at $p < 0.05$ by Duncan's multiple range test cin, which differed from the living with spouse group.

The data from the female elderly of 75 years and older(Table 10) also showed a similar result with the former age group in terms of the lowest value in the living alone group. However, the comparison of group means revealed that the living with spouse group showed a significantly higher intake of almost all nutrients than that of the other 2 groups. This means that, for the female elderly of 75 years and up, living with a spouse makes a difference in addition to the difference resulting from living with someone else in intake status. This result is similar to the one pointed

Table 9. Anthropometry and nutrient intake of the female subjects age 65 to 74 by living arrangement

	Living alone	Living with spouse	Living with spouse and/or relatives	p*
N	59	55	106	
Height(cm)	151.3 ± 5.0	151.4 ± 5.5	150.9 ± 5.2	NS
Weight(kg)	59.1 ± 7.0	57.5 ± 7.5	56.9 ± 7.8	NS
BMI	25.86 ± 2.96	25.04 ± 2.59	24.99 ± 3.09	NS
Body fat(%)	34.5 ± 4.5	32.9 ± 4.5	33.1 ± 5.6	NS
Energy(Kcal)	1371 ± 432^{a}	1488 ± 419^{a,b}	1589 ± 440^{b}	0.0085
Protein(g)	47.3 ± 19.0^{a}	53.0 ± 19.8^{a,b}	59.5 ± 22.5^{b}	0.0017
Fat(g)	27.5 ± 15.2^{a}	30.1 ± 15.5^{a,b}	35.6 ± 17.4^{b}	0.0065
CHO(g)	235.0 ± 69.9^{a}	254.3 ± 229.3^{a,b}	259.2 ± 63.7^{b}	0.0767
Ca(mg)	398 ± 217	447 ± 229	480 ± 257	0.1105
P(mg)	773 ± 299^{a}	866 ± 305^{a,b}	940 ± 361^{b}	0.0088
Fe(mg)	9.2 ± 3.7^{a}	10.6 ± 4.1^{a,b}	11.9 ± 4.4^{b}	0.0005
Sodium(mg)	4341 ± 2017^{a}	5647 ± 2203^{b}	5712 ± 2263^{b}	0.0004
Potassium(mg)	2125 ± 859^{a}	2505 ± 952^{b}	2657 ± 938^{b}	0.0021
Vit. A(RE)	533 ± 317	584 ± 323	641 ± 306	NS
Thiamin(mg)	0.87 ± 0.35^{a}	0.98 ± 0.38^{a}	1.11 ± 0.39^{b}	0.0006
Riboflavin(mg)	0.84 ± 0.41^{a}	0.94 ± 0.42^{a,b}	1.04 ± 0.46^{b}	0.0173
Niacin(mg)	10.1 ± 4.4^{a}	11.4 ± 4.4^{a}	13.0 ± 4.7^{b}	0.0004
Vit. C(mg)	97.6 ± 52.8^{a}	114.6 ± 60.3^{a,b}	122.4 ± 53.9^{b}	0.0232

mean ± SD * : Significance of F value by one-way ANOVA
a, b : Means with different superscripts in a row are significantly different from each other at $p < 0.05$ by Duncan's multiple range test

Table 10. Anthropometry and nutrient intake of the female subjects age 75 and up by living arrangement

	Living alone	Living with spouse	Living with spouse and/or relatives	p*
N	35	11	50	
Height(cm)	147.0 ± 4.5	147.6 ± 5.4	145.8 ± 5.8	NS
Weight(kg)	52.0 ± 7.8	53.4 ± 6.6	51.2 ± 7.4	NS
BMI	24.05 ± 3.37	24.49 ± 2.68	23.98 ± 2.56	NS
Body fat(%)	33.0 ± 6.2	34.3 ± 4.9	33.1 ± 5.0	NS
Energy(Kcal)	1239 ± 298^{a}	1653 ± 687^{b}	1327 ± 414^{a}	0.0190
Protein(g)	43.2 ± 15.8^{a}	64.6 ± 34.2^{b}	46.7 ± 18.1^{a}	0.0085
Fat(g)	24.7 ± 13.4^{a}	41.8 ± 29.6^{b}	25.7 ± 14.4^{a}	0.0088
CHO(g)	212.2 ± 46.1^{a}	254.3 ± 87.2^{b}	225.7 ± 65.1^{a,b}	0.1450
Ca(mg)	342 ± 206^{a}	483 ± 274^{b}	340 ± 171^{a}	0.0850
P(mg)	689 ± 249^{a}	979 ± 444^{b}	729 ± 262^{a}	0.0130
Fe(mg)	8.8 ± 4.1^{a}	11.9 ± 5.8^{b}	8.7 ± 3.1^{a}	0.0467
Sodium(mg)	4613 ± 2373^{a}	6153 ± 2635^{b}	4790 ± 2080^{a}	0.1358
Potassium(mg)	1888 ± 795^{a}	2541 ± 1121^{b}	1930 ± 680^{a}	0.0464
Vit. A(RE)	529 ± 329	624 ± 274	510 ± 256	NS
Thiamin(mg)	0.80 ± 0.31^{a}	1.16 ± 0.68^{b}	0.87 ± 0.36^{a}	0.0294
Riboflavin(mg)	0.75 ± 0.36^{a}	1.03 ± 0.54^{b}	0.78 ± 0.35^{a}	0.0944
Niacin(mg)	9.1 ± 3.3^{a}	13.4 ± 7.2^{b}	10.1 ± 3.5^{a}	0.0107
Vit. C(mg)	86.3 ± 48.2	105.7 ± 66.0	85.4 ± 37.3	NS

mean ± SD * : Significance of F value by one-way ANOVA
a, b : Means with different superscripts in a row are significantly different from each other at $p < 0.05$ by Duncan's multiple range test

out by Dalaker(1999) that older persons who live alone are more likely to be living in poverty than older persons who reside with their spouses are. Poverty, especially in the elderly years, usually results in malnutrition. Even though the male elderly of the same age group showed a similar trend, the difference did not reach statistical significance(data not shown).

Based on the aforementioned results and findings, it seems to be reasonable to say that the living arrangements affect the nutritional status of the elderly. Although the exact pattern of this effect could be somewhat different among different sex-age groups, the fact that the elderly living alone are vulnerable to malnutrition would remain concrete. This raises the utmost necessity of nutrition intervention for the living-alone elderly from the government level. The intervention may include education, consultation and support in the form of meal services.

Conclusions

In this study, we attempted to evaluate the nutritional status of the self-mobile elderly residing in the metropolitan areas and to look into the differences in nutrient intake and anthropometry according to their living arrangements. As a result, this study revealed that living arrangements considerably affect nutritional status of the older Koreans. Although the exact pattern of effect could be somewhat different among different sex-age groups, the fact that the elderly living alone are vulnerable to malnutrition would remain concrete. This raises the utmost necessity of nutrition intervention devised and directed to the targeted population, namely the living-alone elderly, from the government level to ensure the good health of the Korean elderly. The intervention may include nutrition education, nutrition counseling and support in the form of meal services by networking the efforts of central as well as local governments and non-governmental organizations(NGOs).

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