

Assessment of Nutritional Status by Estimation of Nutrients and Food Intakes of Korean Elderly Women Living in Residential Homes*

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ABSTRACT

The purpose of this study was to evaluate the nutritional status of elderly women living in residential homes by estimating nutrients and food intakes. Food consumption survey was conducted by 3-day 24hr recall method with 99 elderly women aged 65 to 90 years from three residential homes in Seoul, Choonchun and Chunan and 46 free-living elderly women aged 65 to 88 years from Chunan as control group. Food intake data was converted into nutrient intake using computer aided nutritional analysis program. Mean energy intake and percentage of recommended daily allowance (RDA) of residential home residents were 1696kcal and 101% of RDA while those of control were estimated as 1939kcal and 119% of RDA. On average, absolute amount of nutrient intakes of residential home residents were slightly higher than control group. Subjects in control group showed significantly lower carbohydrate and vitamin A intake, while vitamin C intake was higher. However, nutrient intake quality determined by INQ (Index of nutritional quality) was significantly higher among control subjects in most nutrients except vitamin A than residential home residents. Intakes of calcium, vitamin A and riboflavin of all subjects in this study were less than 75% RDA meaning that nutritional status of calcium, vitamin A and riboflavin was insufficient and could possibly result in nutritional deficient. Some food groups such as milk or other dairy products must be strongly suggested to improve nutritional status of elderly women in this study. According to the results of this study, meal plans of residential homes are quite adequate in quantity of macronutrients, but need to be improved in both quantity and quality of micronutrients. (*J Community Nutrition* 6(1) : 12~17, 2004)

KEY WORDS : dietary intake · nutritional status · elderly women · residential home.

Introduction

Korean aging population, along with the increasing prevalence of nuclear families, increases the likelihood of older adults being admitted to some forms of institutional care (Ministry of Health and Welfare 2001). The main welfare facilities for the aged are currently residential homes, of which there were 106 in Korea in 1999 (Ministry of Health and Welfare 2001). The maintenance of health for the institutionalized older adults can be hindered by a lack of exercise, poor nutrition, and chronic disabling conditions (Grove, Spier 1999).

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The rapid increase in the elderly population and less opportunities to become beneficiaries of better quality of life in residential facilities will lead to a corresponding increase in the prevalence of older adults suffering from chronic diseases.

Since many nutritional factors contribute to risk for chronic diseases, recent changes in diet and life style have been repeatedly suggested to be the important causes for increase of the major chronic diseases among Koreans (National Statistical Office of Korea 2000). Recent data in Korea shows that chronic diseases are 2.4 times more prevalent in older adults than in other age groups (Byun 1999). The primary reason of higher incidences of chronic diseases among elderly would be attributable to physiological changes. However, since most of these chronic conditions and risk factors of chronic disease prevalent in older adults are modulated by behavioral modification, especially by dietary changes (Drewnowski, Evans 2001), the increased number of the institutionalized older adults and lack of individual nutrition care would

be another cause of increasing proportion of chronic disease cases among Korean older adults. Therefore, an understanding of nutrition and its role in short-term and long-term health and thorough nutritional care can significantly minimize risk for chronic diseases. This means that regular nutrition monitoring and intervention for older adults are important to prevent the progression of disease, or enhance the quality of life for the older adults to keep their health.

Better nutritional care to maintain adequate nutritional status can therefore contribute to an increase in life expectancy and improved health for older adults (Amarantos et al. 2001). There are, however, only a few previous reports concerning the nutritional status of older adults living in residential homes for health promotion. The objectives of the present study were to assess the nutritional status of Korean older adults living in residential homes using 24-hr recall method and to establish not only the dietary guideline of nutrients intakes relative to health promotion and disease prevention for Korean older adults living in residential homes but also information on imbalances among food groups and excessive intake of food components deleterious to health.

Materials and Methods

1. Subjects

Three residential homes for older adults from three Korean cities, Seoul, Choonchun and Chunan, were selected with the following characteristics : 1) free-of-charge for the residents, 2) more than 20 of the residents were able to perform daily living activities without assistance. All residents of the residential homes were reviewed based on the inclusion criteria prior to the study, with permission from the home managers. A total of 99 elderly women aged from 65 to 90 years who were literate and willing to sign the consent form were recruited from the three residential homes. On average the subjects had spent more than 3 years at a residential home. Forty six control subjects aged from 65 to 88 who are living with more than one family member, without any chronic disease conditions, literate and willing to sign the consent form were recruited from among those visited of Health Promotion Center of Soonchunhyang University Hospital at Chunan for a medical health examination.

2. Nutrient intake assessment

The food-consumption surveys were conducted by trained

interviewers using a 24-h recall method for 3 consecutive days. Plastic food models, standard household measures, and life-size colored photographs were used as memory aids by the interviewers to obtain detailed descriptions of all foods and beverages consumed, and estimations of the food portions. A weekly meal planner provided by the residential homes was also used to assist the subjects in recalling the food consumed. These food-consumption records were converted to nutrient intake using a computer-aided nutrient analysis program (CAN-pro, The Korean Society of Nutrition, 1998, Seoul, Korea). For mixed dishes, participants were asked for all of the ingredients that they knew about ; and then the meal manager at the residential home provided the details. Nutritional intake from nutritional supplements was not assessed because brand names and dosages were not known with sufficient accuracy. The nutrient intakes were evaluated on the basis of the nationally recommended daily dietary allowances (RDA) for the Korean population (The Korean Society of Nutrition 2000). Index of nutritional quality (INQ) was also calculated for each nutrient intake as formula shown below.

$$\text{INQ} = \frac{\text{Percent of each nutrient intake per RDA of each nutrient}}{\text{Percent of energy intake per RDA of energy}}$$

3. Statistical analysis

All statistical analyses were conducted using SPSS statistical software (Version 10.0). Students' t-test was used to compare values between groups.

Results

General characteristics of subjects are shown in Table 1. The subjects were aged from 65 to 90 years old (n = 145). Age range of residential home residents was from 65 to 90 while that of control group was from 65 to 88. Mean age of control group was significantly lower than that of residential home residents (74 years vs. 78 years, p < 0.001). There were significant differences (p < 0.01) between two groups in height, weight and body mass index (BMI).

Table 2 shows the average daily nutrient intakes of the subjects. Energy intake of control group (1696kcal/day) was lower than that of residential home residents (1940kcal/day) although the difference was not statistically significant. Control group showed less than 75% of RDA in vitamin A, riboflavin and calcium intake. Residential home residents, however, sho-

Table 1. General characteristics of the subjects¹⁾

Characteristics	Free-living subjects (n = 46)	Residential home residents (n = 99)	t-value
Age	73.5 ± 5.8	78.0 ± 5.9	-4.67***
Weight (kg)	59.6 ± 8.2	48.9 ± 8.9	5.58***
Height (cm)	150.3 ± 5.8	145.2 ± 7.4	3.48**
Body Mass Index (BMI)	26.4 ± 3.0	23.0 ± 3.9	4.01***
Duration of residency (month)	-	43.0 ± 54.8	

1) values are mean ± SD, ** : p < 0.01, *** : p < 0.001

Table 2. Nutrient intake and percentages of Korean recommended daily allowances (RDAs)¹⁾

	Free-living subjects		Residential home residents		t-value
	Mean	%RDA	Mean	%RDA	
Energy (kcal)	1695.9 ± 680.6	101	1939.5 ± 605.7	119	- 2.17
Fat (g)	32.3 ± 26.5		32.6 ± 12.2		- 0.77
Protein (g)	60.0 ± 23.4	109	66.1 ± 22.3	120	- 1.48
Carbohydrate (g)	278.8 ± 85.7		343.6 ± 112.3		- 3.47**
Vit. A (μgRE)	390.5 ± 260.3	56	544.5 ± 267.8	78	- 3.25**
Vit. C (mg)	131.5 ± 77.5	188	58.2 ± 32.6	83	52.56***
Riboflavin (mg)	0.71 ± 0.35	59	0.72 ± 0.28	60	- 0.17
Thiamin (mg)	1.10 ± 0.52	110	0.98 ± 0.33	98	1.59
Calcium (mg)	454.9 ± 220.7	65	486.9 ± 255.2	70	- 0.74
Iron (mg)	10.3 ± 5.1	86	10.4 ± 3.6	87	- 0.16

1) values are mean ± SD, * : p < 0.05, ** : p < 0.01, *** : p < 0.001

Table 3. Index of nutritional quality (INQ) of the subjects

	Free-living subjects (n = 46)	Residential home residents (n = 99)	t-value
Protein	1.10 ± 0.28	1.01 ± 0.17	2.03*
Vit. A	0.56 ± 0.34	0.67 ± 0.30	-1.81
Vit. C	1.96 ± 1.21	0.70 ± 0.35	6.95***
Riboflavin	0.64 ± 0.23	0.51 ± 0.14	2.53*
Thiamin	1.10 ± 0.31	0.83 ± 0.15	5.59***
Calcium	0.67 ± 0.31	0.57 ± 0.21	2.15*
Iron	0.85 ± 0.25	0.73 ± 0.17	2.94**
Mean INQ	0.98 ± 0.25	0.72 ± 0.14	6.56***

1) values are mean ± SD, * : p < 0.05, ** : p < 0.01, *** : p < 0.001

wed only insufficient riboflavin intake (less than 75% of RDA). Intakes of carbohydrate and vitamin A of control group were significantly lower while vitamin C intake was significantly higher than that of residential home residents (p < 0.01).

The quality of diet determined by INQ was different from the result observed in Table 2. Mean INQ value was significantly higher in control group (p < 0.001) and INQ of all individual nutrients analyzed in this study except vitamin A were higher in control group than in residential home residents unlike the absolute amount of nutrients intakes. Although the

energy intake values of two groups were not statistically different, INQ of free-living subjects were higher.

Table 4 shows the types of food groups as sources of daily energy, carbohydrate, protein and fat. Five mostly contributed food groups for Ca, Fe, vitamin A and riboflavin, which were analyzed as insufficiently consumed nutrients in both groups, are in Table 5. Since there are many food groups, only the selected food groups are listed according to the amount taken by subjects. In order to compare, nutrient intake amount from each food group was divided by number of subject in each group because the numbers of subjects in control group and institutionalized subjects were different. According to Table 4, residential home residents consumed more sugar or other monosaccharide products than free-living subjects. Sugar or other monosaccharide food group was second mostly contributed food group for energy and carbohydrate intake of residential home residents. Control group, however, showed different tendency in food selections. Contribution of fruits to carbohydrate intake was higher while animal fat consumption was higher than from plant sources. According to Table 5, the subjects in this study received most Fe was mainly from plant foods than from animal foods. Most Ca intake was from either

Table 4. Five mostly contributed food groups for each macronutrient intake

Nutrients	Rank	Free-living subjects (n = 46)		Residential home residents (n = 99)	
		Food groups	Intake amount n	Food groups	Intake amount n
Energy (kcal)	1	Cereal	963	Cereal	792
	2	Beans	106	Sugar or other monosaccharides	170
	3	Meat, pork, poultry	102	Beans	143
	4	Fruits	92	Meat, pork, poultry	89
	5	Vegetables	66	Vegetables	73
Carbohydrate (g)	1	Cereal	205	Cereals	172
	2	Fruits	24	Sugar or other monosaccharides	26
	3	Vegetables	12	Vegetables	13
	4	Beans	9	Seasonings	8
	5	Potato and other starch	8	Beans	8
Protein (g)	1	Cereal	19	Cereal	16
	2	Beans	10	Meat, pork, poultry	10
	3	Meat, pork, poultry	9	Beans	9
	4	Fishes, shellfish	8	Fishes, shellfish	7
	5	Vegetables	5	Vegetables	5
Fat (g)	1	Meat, pork, poultry	7	Beans	7
	2	Cereal	6	Fats or oils	6
	3	Fat or oil	5	Cereal	3
	4	Beans	4	Meat, pork, poultry	3
	5	Fishes, shellfishes	2	Eggs and products	2

vegetable or fishes or shellfish in both groups and consumption of milk or milk products were very limited.

Discussion

The current study evaluated nutritional status of the older women living in residential homes by assessing food intake. Subjects were recruited from three residential homes in three Korean cities. These residential homes were not representative of all residential homes for older people in Korea, since they served residents who had no family or other person to live with, were homeless, or financially insecure. Only one residential home was mixed gender, but male subjects were excluded due to their low number (seven male residents in total).

The overall amount of nutrient intake assessed by food intake of the residential home residents was at least as good as free-living Korean older women (Kim et al. 2001a ; Yim 1998), better than that of other residential-home residents living in other areas of Korea (Kim et al. 2000 ; Lee 2002 ; Song et al. 1995) and better than the free-living control group in this study (Table 2). However, compared to the previous data conducted three years prior to this study in the same

institutions with less number of subjects, the amount of nutrient intake was lower this time than the previous study (Kim et al. 2001b). Calcium intake was increased slightly, but the absolute intake was still very low (70% RDA). Low calcium and riboflavin intakes represent one of Korea's most serious nutritional problems (Song, Kim 2001 ; Korea Health Industry Development Institute 2002), and efforts to improve calcium and riboflavin intake should be conducted nationally. Although the absolute amount of nutrient intake of institutionalized subjects was higher than that of the control group, nutritional quality of free-living control was better than institutionalized subjects. As shown in Table 5, one of the major energy and carbohydrate sources for institutionalized subjects was sugar or other monosaccharides while major food groups for energy intake of the control group were cereal, beans, meat group, fruits and vegetables. Cereal consumption was higher in free-living control group meaning that institutionalized subjects consume more simple carbohydrate and less complex carbohydrate than control group. However, despite the higher quality of nutrient intake and better food consumption patterns, the control group showed higher animal fat intake. Overall food consumption pattern of this study showed that older adults in residential homes consume higher amounts of food

Table 5. Five mostly contributed food groups for each micronutrient intake

Nutrients	Rank	Free-living subjects (n = 46)		Residential home residents (n = 99)	
		Food groups	Intake amount n	Food groups	Intake amount n
Calcium (mg)	1	Vegetables	110	Fishes, shellfish	137
	2	Fishes, shellfish	96	Vegetables	71
	3	Beans	91	Beans	40
	4	Cereal	22	Cereal	24
	5	Potato and other starch	6	Seasonings	18
Iron (mg)	1	Beans	2.3	Vegetables	3.6
	2	Vegetables	2.1	Cereals	2.9
	3	Cereal	1.8	Beans	1.3
	4	Fishes, shellfish	0.8	Fishes, shellfish	0.8
	5	Fruits	0.8	Seasonings	0.4
Vitamin A (μ g)	1	Vegetables	204	Vegetables	276
	2	Fruits	13	Seasonings	54
	3	Fishes, shellfish	6	Eggs and products	23
	4	Meat, pork, poultry	5	Meat, pork, poultry	17
	5	Cereal	2	Sea weeds	13
Riboflavin (g)	1	Vegetables	0.17	Vegetables	0.23
	2	Meat, pork, poultry	0.08	Cereal	0.11
	3	Cereal	0.07	Meat, pork, poultry	0.08
	4	Fishes, shellfishes	0.06	Eggs and products	0.07
	5	Beans	0.05	Fishes, shellfish	0.07

than the free-living control but the quality of food was not as good as control group. In both groups, food consumption pattern for Ca, Fe, vitamin A and riboflavin need to be improved since these nutrients should be supplied from good food sources with better bioavailability.

When the current results are compared with other papers conducted with free-living subjects (Kim et al. 2000 ; Lee et al. 1998 ; Lee 2002), total food consumption was increased for the last few years. Since nutrient intake of Korean older adults was very low in the past, increased energy intake could be a good sign. However, the micronutrient intake such as calcium and riboflavin was still less than 75% of RDA. Nutritional education or policies to improve the nutritional intake quality of older adults are strongly and continuously recommended. Compared to the previous data of the same institutions (Kim et al. 2001b), overall nutrient intake was not improved. It could be attributable to the increased number of residents. Increased number of institutionalized older adults reflects current states of the Korean elderly population. The rapid increase in the elderly population will lead to a corresponding increase in the prevalence of older adults suffering from chronic diseases and the importance of nutritional care for older adults will be increased since healthy eating beha-

viors contribute to the health, productivity, self-sufficiency, and quality of life of older adults (Drewnowski, Evans 2001).

There are two major points that may have contributed to misclassification or measurement errors in this study. First, a 24-h recall method is not a perfect tool for measuring dietary intake, since the menus on the study day may have been unrepresentative of the average diet during the study period, resulting in false data of low dietary intake in certain nutrients. Secondly, the underreporting tendency of the 24-h recall method (Johansson et al. 2000) may have contributed to measurement errors. However, the probability of technical errors, or information bias, is not high in this study ; it is unlikely that the subjects had altered their diets during this period since all institutionalized subjects consumed meals provided by their residential homes. Moreover, we obtained the menus of the study day to check the accuracy of the subjects' memories. Although these measures may not have avoided all the problems associated with the 24-h recall method, it is unlikely that the associations we observed could be fully attributable to measurement errors because these errors would generally bias the associations toward null. The results of free-living control subjects, however, were totally up to the memory of the individual. The lower nutrient intake of control group could be

attributable to the lack of memories of the subjects and/or the underreporting tendency of older subjects in 24 hr recall method. Therefore, the interpretation of nutrient intake amount in this study should be conducted cautiously.

In conclusion, the findings from the present study suggest that meal plans of residential homes are quite adequate in quantity of macronutrients, but need to be improved in both quantity and quality of micronutrients. In addition, some food groups such as milk or other dairy products must be strongly suggested to improve the nutritional status of elderly women in general.

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