

## Portion sizes of foods frequently consumed by the Korean elderly: Data from KNHANES IV-2

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### Abstract

The purpose of this study was to define a one-portion size of food frequently consumed by the Koreans aged 65 years or over. From the original 8,631 people who took part in the Fourth Korea National Health and Nutrition Examination Survey (KNHANES IV-2) 2008, we analyzed the data on 1,458 persons (16.9%) aged 65 and over, and selected food items consumed based on the intake frequency of 30 or more by all participants. A total of 158 varieties of food items were selected. The portion size of food items was set on the basis of the median amount (50 percentile) in a single intake by a single person. In the cereals category, 13 items were selected, of which the most frequently consumed item was well-polished rice with a portion size of 75 g. Among legumes, 7 items were selected, of which the most frequent item was dried black soybean with a portion size of 6 g. Among the 16 groups, the most varied food group (49 items) was vegetables, and among these the most frequently occurring item was garlic (5 g), while among the fruit group, only 11 items were selected, as their intake frequency was low. Fish and shellfish were more frequently consumed by the elderly than meats. The most frequently consumed meat was pork loin, with a portion size of 30 g. In fish and shellfish, the most frequently consumed item was dried and boiled large anchovy with a portion size of 2 g. Portion sizes for food items consumed regularly by the elderly may be conveniently and effectively used in dietary planning and in nutritional education programs, and in assessing the diet intake status of the elderly.

**Key Words:** Portion size, Korean elderly, foods frequently consumed

### Introduction

As the elderly population increases, public awareness about health and nutrition in the elderly is gradually increasing as well. Older people are generally more likely to have chronic diseases such as hypertension, diabetes, osteoporosis, and so on, many of which require continuous diet therapy for both prevention and treatment. Because of this, the interest in the nutritional values of food items and the desire to understand related information rise, particularly as related to the elderly population.

An effective way to obtain credible information about the nutritional values of food items is by using a food composition table. In Korea, food composition tables have been published and updated since 1970 by the Rural Development Administration (RDA), and their most recent food composition table is in its 7<sup>th</sup> edition [1]. This table can supply credible data about the various nutritional values of over 2,505 food items, but using this resource may not be easy for the general population: as the

nutrient contents in food items are expressed per 100 g of an edible portion of each food item, it is necessary to convert the contents per 100 g into those per the actual intake quantity [2].

However, in the United States (US) and Japan, there have been food composition tables created based on the portion sizes of an individual's single intake which can be easily used by the general population [3,4]. Recently, the KRDA has also begun to develop consumer-friendly food composition tables, and as a result of these efforts, they have published consumer friendly food composition tables for adults [5,6], children aged 6-11 [7] and those aged 65 or over [8]. The portion size in these tables refers to the amount of food that an individual decides to take at any one time. Energy and nutrient requirements, as well as physical status, vary according to gender, age and so on, with age being the most important factor. Portion sizes are also changing over time. It has been reported in the US that the rise in obesity over the last 30 years has been in proportion to increases in portion size [9]. Particularly, the increase in the portion sizes

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of high energy density foods as provided by restaurants, has contributed to the rise in obesity [10,11]. Therefore, portion size should be set separately for different life stages and be updated continuously.

This research was carried out in order to establish the portion sizes of frequently consumed food items, so as to develop a food composition table for the elderly using the Forth Korea National Health and Nutrition Examination Survey (KNHANES IV-2) 2008. Therefore, the purpose of this study was (1) to find which food items are typically consumed by Koreans aged 65 or over; (2) to establish the portion sizes of these food items so as to develop a consumer-friendly food composition table for the Korean elderly, and finally, (3) to address these findings in dietary planning and nutritional education for the elderly, and in assessing the diet intake status of the elderly.

## Subjects and Methods

### Subjects

We used data from 1,458 persons (16.9%) aged 65 or over, taken from the original 8,631 people who participated in the KNHANES IV-2, a nationwide dietary intake survey.

### Selecting regularly consumed food items

We selected food items with an intake frequency of 30 or more among all the consumed food items dealt with by the survey. Frequently consumed food items were classified into 16 categories, based on the food groups in the Korean food composition table [1].

### Analyzing portion size of food items and dishes of regular use

Estimation of portion sizes was carried out based on portion size analysis data and methods used to calculate reference values for nutrition labeling from the US [12,13]. The portion size of food items was set on the basis of the median (50th percentile) portion size of an individual's single intake. The median value was used rather than the mean value as a measurement of central position because the original data from KNHANES IV was not of normal distribution; diverse and extreme values cannot be eliminated and average of values measured in the units of 5 and 10 may even be subject to validity issues. Thus portion sizes were based on the median and were rounded off to units of 5 and 10 g considering the mean value and mode. For items with quantities of less than 10 g, the portion size was set in units of 1 g. For items in liquid form, portion size was set using mL. For seasonal food items, portion size was set based on the quantities used when the item is in season. For food items that include bones, skin of shell, the portion size was set based on the edible part.

## Results

A total of 160 different regularly used food items were selected. The portion size of each item in the cereals, potatoes and starches is shown in Table 1. The portion sizes for cereals ranged from a minimum of 3 g for sorghum to the maximum of 125 g for *Garaetteok* (rice cake). The most frequently consumed item among the cereals was well-polished rice, which had a portion size of 75 g. The portion sizes of both potato and sweet potato were 120 g.

Legumes, nuts and seeds is shown in Table 2. The most frequently consumed legumes was dried black soybean, with a portion size of 9 g. Tofu was the next most commonly used items, and its portion size was 50 g. Among the nuts and seeds, roasted white sesame was the most consumed, with a portion size of 1 g.

Table 3 shows the portion sizes of vegetables. This group had the largest number of items among 16 food groups. The most frequently used item in this category was garlic, with a portion size of 5 g. The portion size for welsh onion, the second most frequently used vegetable, was 2 g. *Baechukimchi* was the third most frequently used vegetable and its portion size was 30 g.

The portion sizes for mushrooms ranged from 5 g for oak mushrooms to 15 g for oyster mushrooms (Table 4). For raw fruits, portion sizes ranged from 105 g for bananas to 255 g for pears. Among the seaweeds, the most frequently consumed item was dried sea mustard, with a portion size of 5 g.

As shown in Table 5, the Korean elderly were more likely to eat fish and shellfish than meats. Among the meats, 10 varieties were included in this study; whereas 25 fish and shellfish were included the most frequently consumed food list. The most frequently consumed meat was pork loin and its portion size was 30 g. Among the fish and shellfish, boiled and dried large anchovy was the most frequently used item, with a portion size of 2 g.

The portion sizes for milk and eggs were 200 g and 50 g, respectively (Table 6). The portion size for oils was 5 g and the most frequently used variant was sesame oil. Among the sugars, the most frequently used item was white sugar, with a portion size of 1 g (Table 7).

In the beverage category, the most frequently used non-alcoholic item was coffee mix with a portion size of 120 ml, and the most frequently used alcoholic item was *Soju* with a portion size of 45 ml (Table 8). Among the seasonings, the most frequently used items were soy sauce, salt, red pepper powder, in that order. The portion sizes for these were 5 g, 1 g and 1 g, respectively.

**Table 1.** Portion sizes of cereals, potatoes and starches for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
Cereals and cereal products							
1143	Barley	1,441	10	1255	Glutinous corn	190	34
1069	Biscuits, soft	27	10	1029	Noodle, dry form	56	130
1165	Brown rice	361	7	1004	Prosimillet	94	4
1025	Flour for pan-frying	36	4	1243	<i>Sirutteok</i> (Rice cakes,)	39	75
1211	<i>Garaetteok</i> (rice cake)	87	125	1154	Sorghum	171	3
1195	Glutinous rice	529	25	1019	Wheat flour	218	45
1271	Glutinous sorghum	292	4	1173	Well polished rice	4501	75
Potatoes and starches							
2001	Potato	348	120	2016	Sweet potato	104	120
2030	Potato starch	32	4	2039	Sweet potato starch vermicelli	70	10

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 2.** Portion sizes of legumes, nuts and seeds for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
Legumes							
4011	Black soybeans, dried	1,460	9	4023	Soybean milk	60	190
4002	Kidney beans, dried	46	6	4017	Soybean curd	618	50
4033	Peas	62	5	4024	Soybean powder	40	4
4044	Small red beans, dried	91	7				
Nuts and seeds							
5028	Chestnuts	65	9	5011	Perilla seeds	135	2
5014	Peanuts	34	7	5061	White sesame, roasted	1,745	1

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 3.** Portion sizes of vegetables for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
6356	Aster scaber, wild vegetables, boiled	48	45	6241	Mungbean sprout	60	30
6063	Baechukimchi	3,290	30	6060	<i>Nabakkimchi</i>	165	95
6100	Balloom flower, root	64	15	6313	<i>Oheekimchi</i>	66	30
6027	Bracken, boiled	121	35	6285	Onion	1,318	10
6320	Burdock	39	6	6070	<i>Pakimchi</i>	51	30
6279	Cabbage	103	30	6071	Perilla, leaves	99	10
6096	Carrot	238	5	6149	Radish leaves, boiled	251	45
6186	Chinese cabbage	384	40	6226	Red lettuce	194	15
6196	Chinese chive	142	15	6030	Red pepper	82	1
6069	<i>Chongkakkimchi</i>	154	35	6037	Red pepper, pickled	54	8
6265	Crown daisy	73	3	6080	Shepherd's purse	64	8
6307	Cucumber	259	40	6367	Soybean sprout	367	25
6311	Cucumber preserved with salt	43	15	6250	Spinach	232	40
6147	<i>Danmuji</i>	77	20	6016	Sweet potato stalks, boiled	43	30
6061	Dongchimi	168	95	6376	Taro, stalks, boiled	34	15
6004	Eggplant	108	40	6379	Tomato	83	135
6121	Garlic	4,383	5	6157	Water dropwort	115	30
6057	Gatkimchi	43	20	6388	Welsh onion	3,306	2
6227	Ginger, tuber	362	1	6065	<i>Yeolmukimchi</i>	240	35
6034	Green pepper	1,205	9	6066	<i>Yeolmumulkimchi</i>	126	70
6059	<i>Kkakduki</i>	264	35	6300	Young leafy radish	34	50
6146	Korean radish	956	50	6407	Young pumpkin	568	35
6274	Mallow	41	45				

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 4.** Portion sizes of mushrooms, fruits and seaweeds for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
<b>Mushrooms</b>							
7044	Oak mushroom	57	5	7018	Pine mushroom	42	6
7003	Oyster mushroom	76	15	7038	Winter mushroom	44	7
<b>Fruits</b>							
8090	Apple	200	115	8137	Oriental melon	59	130
8063	Banana	32	105	8077	Peach	34	195
8011	Citrus fruits	138	120	8065	Pear	87	255
8158	Grape	59	105	8001	Persimmon	151	175
8050	Japanese apricot, concentrated juice	48	12	8110	Watermelon	76	165
8033	Jujube, dried	32	3				
<b>Seaweeds</b>							
12005	Laver, dried	124	2	12035	Sea mustard, dried	235	5
12033	Sea mustard	96	20	12018	Sea tangle, dried	50	1

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 5.** Portion sizes of meats and fish and shellfish for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
<b>Meats and meat products</b>							
09168	Beef feet, soup	32	250	09015	Chicken, fowl meat	32	40
09169	Beef, bone, meat soup	39	145	09016	Chicken, lean	38	55
09137	Beef, loin	88	40	09085	Pork, belly	46	75
09142	Beef, plate	61	25	09077	Pork, loin	185	30
09167	Beef, plate, meat soup	37	145	09083	Pork, shank	47	60
<b>Fishes and shellfishes</b>							
11174	Alaska pollock	121	30	11491	Little neck clam	72	8
11172	Alaska pollock, dried	123	5	11039	Mackerel, raw	112	20
11164	Anchovy, boiled and dried, large	545	2	11044	Mackerel, salted	57	30
11166	Anchovy, boiled and dried, larvae	186	4	11468	Oyster	61	15
11165	Anchovy, boiled and dried, medium	364	3	11055	Pacific saury	53	20
11167	Anchovy, salt-fermented	122	2	11612	Shrimp	34	7
11168	Anchovy, salt-fermented, liquid type	43	1	11614	Shrimp, boiled and dried	60	1
11560	Blue crab	58	9	11620	Shrimp, salt-fermented	60	3
11636	Common squid	61	30	11625	Shrimp, salt-fermented, summer prepared	181	1
11647	Common squid, dried	26	5	11092	Tuna, canned in oil	31	20
11439	Fish paste, crab flavored	30	10	11392	Yellow croaker	149	20
11442	Fish paste, fried	77	25	11393	Yellow croaker, salt-cured and dried	38	10
11032	Hair tail	76	15				

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 6.** Portion sizes of eggs, milk and milk products for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
<b>Milk and milk products</b>							
13010	Cow's milk	199	200	13028	Yoghurt, liquid	89	65
<b>Eggs</b>							
10005	Hen's egg	358	50				

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 7.** Portion sizes of sugars, oils and fats for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
<b>Oils and fats</b>							
14024	Coffee creamer	238	6	14023	Sesame oil	1,877	4
14018	Olive oil	107	4	14028	Soybean oil	767	4
14003	Perilla seed oil	373	4				
<b>Sugars</b>							
3019	Candy	40	9	3024	White sugar	1,263	1
3014	Starch syrup	527	2				

<sup>1)</sup> National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup> Intake frequency by participants

**Table 8.** Portion sizes of beverages and seasonings for Korean elderly aged 65 years and over

Item No <sup>1)</sup>	Food and description	Frequency <sup>2)</sup>	Portion size (g)	Item No	Food and description	Frequency	Portion size (g)
<b>Beverages</b>							
	Green tea, infusion	32	180	15031	Beer	36	475
	Coffee, mix	660	120	15039	<i>Soju</i>	180	45
	Coffee, power	352	2	15046	Sake	34	45
15029	<i>Takju</i>	39	340				
<b>Seasonings</b>							
	<i>Cheonggukjang</i>	98	15	16038	Salt	2,507	1
16010	<i>Gochujang</i>	751	5	16014	Sesame, roasted and ground	240	1
16025	Mayonnaise	34	10	16030	Seasoning powder	701	0.5
16049	Mixed soybean paste with red pepper paste	105	10	16001	Soy sauce	2,610	5
16058	MSG	519	1	16018	Soybean paste	1,601	10
16071	Pepper	370	0.5	16047	Vinegar	287	4
16009	Red pepper powder	2125	1				

<sup>1)</sup>National Rural Resources Development institute (2007), Food Composition Table 7the revision, Rural Development Administration, Suwon, Republic of Korea

<sup>2)</sup>Intake frequency by participants

## Discussion

In order to assist people in meeting their daily nutrient requirements, dietary intake can be interpreted by either serving size or portion size. The serving size of a food refers to the recommended amount of food to be taken according to public guidelines on dietary intake, such as those found in the Food Pyramid. However, portion size refers to the amount of food an individual consumer eats at any one time [14]. This may be smaller or larger than the serving size. Accordingly, the portion size represents the actual intake amount of foods; therefore, expressing nutritional information per portion size may be more useful than expressing it per 100 g, particularly for consumers who need information about nutritional intake and menu planning.

As mentioned in the introduction section of this work, the portion sizes of frequently consumed foods for Korean adults [2] and children aged 6-11 [15] have been established through previous studies using KNHANES data. According to these studies, children's portion sizes for every food group were different to those for adults. The portion sizes of foods were thus different relative to age group, and a difference was also shown in the most frequently consumed food items. Therefore, portion sizes should be established for each different age group.

In this study, we selected 158 varieties of food items based on their usage frequency in Koreans of 65 and over, and established the portion sizes of these items. This study is very significant because it sets portion sizes for the Korean elderly for the first time on the basis of nationwide data about food intake quantities. These included foods comprise 13 varieties of cereals and cereal products, 4 of potatoes and starches, 3 of sugars and sugar products, 7 of legumes, 4 of nuts and seeds, 45 of vegetables, 4 of mushrooms, 11 of fruits, 10 of meats and meat products, 1 of eggs, 25 of fish and shellfish and related products, 4 of seaweeds, 3 of milk and milk products, 5 of oils and fats, 7 of beverages (alcoholic and non-alcoholic), and 13 of

seasonings.

Among these items, the most frequently consumed food was well-polished rice, with a portion size of 75 g. Rice is the most representative traditional Korean staple dish, which can be proposed as the reason for which rice was the food item most frequently consumed by the Korean elderly. When we compared rice portion sizes for the elderly with those for adults (80 g) using previously reported data [2], the portion size for elderly was 5 g lower than that for adults. The Korean Nutrition Society has set the serving size white rice as 90 g (16).

Among the potatoes and starches category, the portion sizes of both potato and sweet potato were 120 g, which were 85% and 71% higher, respectively, than those for adults. The Korean Nutrition Society has set the serving size for potato and sweet potato as being 130 g and 90 g [16], respectively. The vegetable category contained the most varied food items among the 16 food groups. With the exceptions of garlic and welsh onion, which are commonly used as basic spices in Korean cooking, the most frequently consumed vegetable was *Baechukimchi*, and its portion size was 30 g, which is 10 g lower than that for adults. The Korean Nutrition Society has set the serving size for *Baechukimchi* at 40 g [16].

Items in the food groups which contain sources of protein, i.e. legumes, meats, fish and shellfish and eggs, had smaller portion sizes and less variety in the elderly group data than in that for adults. This suggests that the Korean elderly have a predominantly plant-based diet and a higher risk of protein deficiency. Insufficient protein intake in the Korean elderly has, in fact, been reported by previous studies [17,18].

Among the meats and meat product items, just 10 were included as frequently consumed by the Korean elderly, and three of these were soups made from beef bone or meat. However, 25 types of fish and shellfish were included. The Korean elderly thus appear more likely to eat fish and shellfish than meats and meat products. According to the several studies, fish consumption

has positive effects on the prevention of chronic diseases, particularly cardiovascular diseases and cancer [19-21]. Virtanen *et al.* [22] assessed lifestyle and other risk factors every two years and diet every four years in US male health professionals aged 40-75 during an 18 year period. They reported that modest fish consumption (1 serving/week and 2-4 servings/ week) was associated with a lower risk of total cardiovascular disease, consistent with mortality benefits. However, concern has been raised about the fact that consumption of some fish can lead to an increased risk of organochlorine or mercury contaminants in diet [23,24]. Therefore, further studies are needed to establish the recommended serving sizes and intake frequency of fish for the elderly.

Milk and milk products are good calcium source, but just two items (cow's milk and liquid yoghurt) were found to be frequently consumed foods. Given the insufficient calcium intake and high prevalence of osteoporosis in the Korean elderly [25], efforts are urgently needed to increase milk and milk product consumption in this group and to find further calcium sources.

To assess the portion sizes of regularly consumed food items actual-size photographs and nutritional values of food items per portion size have been added to this study's findings, thus enhancing the usefulness of the data. With this pictorial information, a food composition table for the elderly was published in 2010 [8]. Older people are more likely to suffer from chronic diseases, which may require on-going diet therapy for prevention and treatment. To counter this, these data and the results of this study can be conveniently and effectively used by the elderly themselves or their dietary planners when making food selections for a nutritionally balanced diet. In addition, these data can be used for setting single intake quantities in nutrition labeling of processed food items and the appropriate quantities for a single meal outside the home, e.g. in restaurants and nursing facilities. These established portion sizes can also be used in national nutritional education guidelines.

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