

Evaluation of the Serving Sizes of Packaged Processed Food in Korea*

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ABSTRACT

This study was carried out to evaluate the adequacy of serving sizes of those packaged processed foods in Korea which are designed to provide one meal or snack for one person. There is a lack of data on reference serving sizes which are essential components in the nutrition information provided on food labels. After compiling the average weight of packaged processed foods available in the market in Korea, a questionnaire was formulated to evaluate the adequacy of the serving sizes on 56 packaged processed food items of 188 products using 25 female university students as a consumer group. The results showed that 65.5% of the packaged processed foods had adequate serving sizes. In general, current packaged sizes for bread and carbonated drinks were found to be too large. The proposed reference serving sizes in this research appear to be somewhat different from the ones suggested by the Korean Nutrition Society's 7th Recommended Dietary Allowances for Koreans and by the Food and Drug Administration (USFDA) in the U.S. The serving sizes suggested by the USFDA appear to be too large for beverages and too small for snack foods when these are applied to the Korean population. It is suggested that the size of beverages in the Korean market should be reduced, and smaller sub-packets of snacks (each for one serving) should be packaged in a larger pack, for ease of use of nutrition information by consumers as well as for the reduction of food waste. In the future, other representative population groups should be included in the determination of reference serving sizes.

KEY WORDS: serving size, nutrition labeling, packaged processed foods.

INTRODUCTION

The nutrition information presented on food labels is intended to serve as a powerful tool of nutrition education for the population.¹⁾ The food labeling system is a means of coordinating food policy and nutrition policy. At the national level, effective food labeling can ultimately improve national food consumption behavior and contribute to maintaining a healthy population by preventing chronic diseases.²⁾

The author emphasized in previous publications^{3,6)} the advantages of using serving sizes instead of current 100 g or 100 ml for the unit for nutrient content information. When consumers understand the nutrient content of the quantity of food they actually consume, it will help them with food choices and meal planning. In addition, officially approved serving sizes will be a useful tool for the general public as well as for professionals in meal planning and food frequency questionnaires.^{7,8)} In Korea there have been several attempts to determine serving sizes. The Korean Nutrition Society proposed serving sizes which are based on similar calorie contents of foods in

the same food group. The main purpose is to guide the public to achieve their daily nutrients needs more easily. Another array of serving sizes was developed for food frequency questionnaires for the evaluation of nutritional status. The study by Paik *et al.* presented serving sizes for most common 65 foods based on the daily intake of 132 adults in rural areas.¹⁰⁾ Kim and Yang also reported on serving sizes of 105 food items by using 73 female adults.¹¹⁾ In addition, there are the food exchange units suggested by the Korean Dietetic Association.¹²⁾ However, most of the above data are for meal planning or nutrition evaluation, not for the nutrition labeling. Above all the data for processed foods are limited to milk, milk products, and beverages, and there are discrepancies in the data. There is a definite need for developing serving sizes for packaged processed food.

The Korean Institute of Food Development proposed serving sizes of 100 Korean indigenous foods and dried food items in order to support the export of Korean food to the USA.¹³⁾ These data were based on the standard food preparation methods and the recipes used by food caterers: both serving sizes and nutrient content per serving were presented. However, processed foods were not included in those data. The Korean Food Research Institute (1993) reported weights of packages and serving sizes of processed food using food labels,¹⁴⁾ but only 30 item processed foods packaged as serving sizes were in-

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cluded. The present study was conducted to compile weights of, and to evaluate the serving size of, ready-to-eat packaged processed foods which are ever-increasing in importance in the Korean market. Young female adults were recruited to fill out a questionnaire for the evaluation of current serving sizes to propose desirable serving sizes. The results of present study would be useful in determining reference serving sizes for nutrition labeling.

MATERIALS AND METHODS

1. Materials

Among the ready-to-eat foods available in the market, 188 processed foods whose packages were suitable for one reference serving were purchased. They were classified into 10 main food groups following the classifications used by The Korean Institute of Food Development¹³⁾ and The Korean Food Research Institute,¹⁴⁾ and they were further classified into 30 subgroups as shown in Table 1.

2. Methods and data analysis

A questionnaire was used to evaluate the adequacy of sizes in the packaged units and to propose desirable serving sizes. Subjects used for this study were 25 female students in the Department of Foods and Nutrition, who were able to respond numerically and who understood the purpose of the present research. The questionnaire referred to the different sizes and brand names of 188 food products namely 56 food items (shown in Table 3, 4 and 5) in 30 subgroups belonging to the 10 main groups identified in Table 1. Using the scale presented in Table 2, subjects expressed their responses. The scale ranged from 1 to 7 where 1 was very insufficient (50% or less of the proper amount) and 7 was highly surplus (150% or more of the proper amount). The subjects also suggested the desirable amount of the test foods in metric unit. The subjects were pre-trained and made aware of the importance of this study. The results of the 7-point scale responses were given as mean \pm SD, median, and mode. The desired serving size was expressed as mean \pm SD. Data analysis was performed using SPSS/PC⁺ Win 7.5.

RESULTS

1. Classification of food groups

The foods chosen for the present study were limited to processed foods, which were ready-to-eat or were simple to prepare by adding water or heating, and whose packaged weights were close to one serving. One hundred and eight food samples were divided into 10 main groups and 30 subgroups as presented in Table 1. Everyday food can be classified into a wide range of groups depending

Table 1. Classification of the examined processed foods and the numbers of products studied

Main group	Classification of food group		Number of products (number of manufacturers)
		Sub group	
Milk		Liquid	8 (5)
		Flavored Liquid	5 (4)
Yogurt		Liquid type	5 (4)
		Semi-liquid	5 (5)
		Paste type	5 (5)
Ice cream		Cone	5 (3)
		Bar	5 (2)
Cheese		Processed	8 (3)
Beverages		Tonic	3 (3)
		Cola	4 (4)
		Carbonated drinks	10 (5)
		Indigenous Korean drinks	6 (5)
		Fruit juice	9 (3)
Snacks		Chips	15 (5)
		Biscuits, Crackers	8 (4)
		Cookies (Chocolate, Butter)	13 (4)
Rice		Standard size	1 (1)
		Large size	1 (1)
		With curry or other sauces	2 (1)
Bread and cake		Bread	3 (3)
		Sponge cake	4 (4)
		Cream or red bean paste inside etc.	18 (3)
Ramyon		General type	7 (4)
		Flavored with curry or other sauce	3 (2)
		Large bowl	3 (3)
		Cup type	2 (2)
		Noodle or Woodong type	5 (5)
Retort pouched (ready to eat)		Curry, Black noodle sauce	16 (4)
		Meat balls	4 (2)
		Soup	5 (1)

Table 2. Scale for the evaluation of the amount of each food used in the questionnaire

Scale	1	2	3	4	5	6	7
% of proper	50%	75%	90%	100%	110%	125%	150%
Level of sufficiency	Very insufficient	Somewhat insufficient	Slightly insufficient	Proper	Slightly surplus	Somewhat surplus	Highly surplus

on the basis of classification: 5–6 groups by main nutrients, 20 groups by code for food processing in Korea,¹⁵⁾ and 139 groups for the purpose of food labeling in the USA.¹⁸⁾ This study used 30 food groups which are similar to the classification used by the USA. The Korean Food Research Institute classified processed food including preserved food into 15 main groups, but the present study is using 10 main food groups for the serving size

packaged foods.

2. Evaluation of the size of packages for adequacy of serving sizes

A total of 56 food items were evaluated and the results are shown in Tables 3, 4, and 5. Sixty-one percentage of total, 34 food items had median value of 4 and 71% had a mode value of 4 (in the scale of 1 to 7), which means al-

Table 3. Evaluation of the packaged amounts as serving sizes of processed foods: milk and milk products

Classification of food group		Amount of packaged product	Evaluation of the packaged amount as a serving size ¹⁾			Desired serving size (Mean \pm SD) ²⁾
Main group	Sub group		Mean \pm SD	Median	Mode	
Milk	Liquid	185 ml	3.2 \pm 0.7	3	3	199.2 \pm 20.5
		200 ml	3.9 \pm 0.7	4	4	203.2 \pm 20.1
		240 ml	4.8 \pm 0.6	5	5	206.8 \pm 20.5
Yogurt	Flavored Liquid	225–244 ml	4.8 \pm 0.5	5	5	209.6 \pm 19.2
		Liquid type	65 ml	2.2 \pm 0.9	2	3
	Semi-liquid	80 ml	3.2 \pm 0.8	4	4	95.6 \pm 25.8
		125 ml	4.1 \pm 0.9	4	4	121.4 \pm 22.5
		140–150 ml	4.6 \pm 0.9	4	4	132.5 \pm 21.3
Paste type	100 ml	3.4 \pm 0.8	4	4	116.4 \pm 28.0	
	110 ml	3.9 \pm 0.8	4	4	116.6 \pm 26.1	
	Ice cream	Cone	135–140 g	4.4 \pm 0.7	4	4
Ice cream	Cone	150 g	4.8 \pm 0.8	5	5	132.8 \pm 19.2
		177 g	4.8 \pm 0.8	5	5	147.6 \pm 28.8
		Bar	65–70 g	3.7 \pm 0.4	4	4
	Bar	80 g	4.0 \pm 0.7	4	4	79.8 \pm 7.7
		Cheese	Processed	17–20 g	3.8 \pm 0.8	4

1) Evaluation made by 25 female adults responding to a 7-point scale where 1: very insufficient, 2: somewhat insufficient, 3: slight insufficient, 4: proper, 5: slight surplus, 6: somewhat surplus, 7: highly surplus

2) desired amount expressed in metric units: gram or ml (n = 25)

Table 4. Evaluation of the packaged amounts as serving sizes of processed foods: beverages and snacks

Classification of food group		Amount of packaged product	Evaluation of the packaged amount as a serving size ¹⁾			Desired serving size (Mean \pm SD) ²⁾
Main group	Sub group		Mean \pm SD	Median	Mode	
Beverages	Tonic	250 ml	4.4 \pm 0.7	4	4	229.6 \pm 30.4
		330–355 ml	5.5 \pm 0.8	4	4	248.4 \pm 39.6
	Cola	200 ml	3.8 \pm 0.8	4	4	205.0 \pm 28.0
		250 ml	4.8 \pm 0.7	5	4	217.6 \pm 29.4
	Carbonated drinks	330 ml	6.1 \pm 0.7	6	6	223.8 \pm 44.5
		250 ml	4.7 \pm 0.7	5	4	223.0 \pm 28.5
		330–355 ml	5.6 \pm 0.9	6	6	246.1 \pm 45.3
	Indigenous Korean drinks	180–215 ml	3.9 \pm 0.7	4	4	202.3 \pm 29.5
		238 ml	4.2 \pm 1.0	4	4	231.7 \pm 51.2
	Fruit juice	180–200 ml	3.8 \pm 0.7	4	4	198.4 \pm 23.4
240 ml		4.3 \pm 0.5	4	4	227.6 \pm 18.3	
Snacks	Chips	45–60 g	4.1 \pm 0.9	4	4	50.2 \pm 10.3
		65–75 g	4.6 \pm 0.9	5	4	58.3 \pm 11.4
		90 g	5.4 \pm 1.0	6	6	59.8 \pm 16.2
	Biscuits, Crackers, Cookies (Chocolate, Butter, etc)	35–40 g	3.6 \pm 1.0	4	4	43.7 \pm 17.2
		55–70 g	4.6 \pm 0.9	5	4	49.0 \pm 13.5
	Butter, etc)	75–90 g	5.0 \pm 1.1	5	4	51.2 \pm 18.2
		95–115 g	5.6 \pm 1.1	6	7	57.7 \pm 22.9
		130–155 g	5.6 \pm 1.2	6	7	69.1 \pm 33.0

1) Evaluation made by 25 female adults responding to a 7-point scale where 1: very insufficient, 2: somewhat insufficient, 3: slight insufficient, 4: proper, 5: slight surplus, 6: somewhat surplus, 7: highly surplus

2) Desired amount expressed in metric units: gram or ml (n = 25)

most two thirds of the foods tested had adequate serving sizes. Five percentage of the products were evaluated to be insufficient, and 23% to 34% were considered to be excessive. An average assessment of 3.5–4.5 was found in 30 food items, which was 56% of all the food items evaluated. Respondents tended to overestimate the desired serving sizes in the case of the bigger food packages.

1) Milk and milk products

Table 3 shows the results of the evaluation of milk and milk products. Plain milk comes in 185–240 ml packages and flavored milk comes in 225–244 ml sizes. The adequacy test placed the 200 ml size on the scale at 3.9. Liquid type yogurt packaged in 65 ml and 80 ml sizes were considered insufficient, and the desired serving size was suggested to be 100 ml, which is 25 to 50% bigger than the regular sizes. The size of ice cream cones is evaluated to be excessive and 90% of its regular size was proposed to be desirable.

2) Beverage and snacks

Table 4 shows the results obtained from beverages and snacks. Carbonated or tonic drinks come in 200–355 ml sizes, and these are much larger than the Korean traditional drinks and fruit juices which come in 180–240

ml sizes. The subjects suggested approximately 220 ml was the desired serving size for beverage in general. The amount is more than double the 100 ml, a serving size for beverage presented by the Korean Nutrition Society. Snack foods had a wide range of varieties as well as package sizes; the package weights varied from 35 to 155 g, which is 2–4 times the “desirable” serving size which ranged from 45–69 g. The snack food in general appeared to be sold in a quantity sufficient for 2 to 3 persons. The USFDA and the Korean Nutrition Society suggest a serving size of 30 g, which is only half of the proposed serving size in the present study.

3) Cooked rice, bread, instant noodles, and ready to eat Ramyon (instant noodles), and ready-to-eat food

Table 5 lists packaged processed foods which can be used as staple foods or main dishes. There was only one company which produced packaged cooked rice, which came in two sizes, a large size suitable for men and a small for women. The consumer panel in the study proposed a proper serving size of the cooked rice as 220 g, which is 5% higher than the 210 g suggested by the Korean Nutrition Society. Koreans use bread for a main food or for snacks, thus the range is large in the desired serv-

Table 5. Evaluation of the packaged amount as serving size of processed foods: rice, bread, ramyon, and ready to eat foods

Classification of food group		Amount of packaged product	Evaluation of the packaged amount as a serving size ¹⁾			Desired serving size (mean±SD) ²⁾
Main group	Sub group		Mean ± SD	Median	Mode	
Rice	Standard size	210 g	3.8 ± 0.8	4	4	213.6 ± 32.6
	Large size	300 g	5.2 ± 0.9	5	6	225.4 ± 41.3
	With curry or other sauces	340g	5.0 ± 0.9	5	5	290.0 ± 51.8
Bread and cake	Bread	220–240 g	5.5 ± 1.3	6	6	111.0 ± 52.1
	Sponge cake	100 g	4.5 ± 0.7	4	4	92.2 ± 12.4
	Cream or red bean paste inside, etc.	55–70 g	3.4 ± 0.8	4	4	74.2 ± 15.1
		75–85g	4.0 ± 0.5	4	4	80.8 ± 9.0
Ramyon	General type	110–115 g	4.5 ± 0.8	4	4	93.8 ± 14.9
		110 g	3.8 ± 0.5	4	4	113.8 ± 9.7
	Flavored with curry or other sauce	120 g	4.1 ± 0.6	4	4	118.4 ± 9.8
		125–145 g	3.9 ± 0.9	4	4	134.2 ± 18.7
	Large bowl	110–115 g	3.8 ± 0.5	4	4	114.6 ± 9.5
		120–125 g	4.2 ± 0.6	4	4	118.8 ± 6.9
	Cup type	65–70 g	2.9 ± 0.9	3	3	90.8 ± 23.3
Noodle or Woodong type	230–250	4.4 ± 0.6	4	4	216.4 ± 44.5	
Retort Pouched (Ready to eat)	Curry, Black noodle sauce	350 g	5.5 ± 1.0	5	4	273.2 ± 77.1
		170 g	4.0 ± 0.5	4	4	155.6 ± 42.4
	Meat ball	200–230 g	4.5 ± 0.6	4	4	190.5 ± 47.8
		150–180 g	3.7 ± 0.9	4	4	164.5 ± 42.1
	Soup	200 g	4.2 ± 1.0	4	5	179.2 ± 49.7
		500 g	5.0 ± 1.2	5	4	316.4 ± 141.8

1) Evaluation made by 25 female adults responding to a 7-point scale where 1: very insufficient, 2: somewhat insufficient, 3: slight insufficient, 4: proper, 5: slight surplus, 6: somewhat surplus, 7: highly surplus

2) Desired amount expressed in metric units: gram or ml (n = 25)

ing size. The panel suggested half of the size of regular packaged bread as the desired serving size. For cakes or bread with cream or red bean paste, 75–95 g is suggested as the desired serving size. The panel was satisfied with the serving size of instant noodles except cup noodles. The panel suggested increasing the quantity of cup ramyon by 20%. The serving size of retort-pouched ready-to-eat products was considered adequate except for the soup for 2 persons, where a 5% decrease in the size was suggested.

DISCUSSION

Nutrients content information on food labels is the most demanded one by consumers.² In processed food, nutrients content has been expressed on the basis of the unit such as 100 g or 100 ml which is required by the international food standard, Codex. However, the Nutrition Labeling and Education act in the USA requires nutrition information based on the unit of serving size. Japan uses both. The use of the serving size unit enables consumers to apply the information easily, as it is similar to portion size which has been traditionally used in food guides or dietary assessments. Also, it is more rational and consistent to use serving sizes which are comparable to usual intake, rather than the unit of 100 g or 100 ml, in meal planning. In the case of Korea, it is mandatory to describe nutrient content in food for special dietary use or health foods whose usual intake amounts to be several grams, thus, using serving size is a more reasonable approach.³

There is no scientific agreement on the definition and methodology for establishing serving sizes. According to the definition used in the USA, 'it is a reasonable quantity of food suited for or practicable of consumption as part of a meal by an adult male engaged in light physical activity' or simply 'the amount of food customarily eaten at one time'.¹⁷ At present, the USFDA provides 139 official serving sizes.¹⁸ This was based on the average food consumption of the population obtained in the Nationwide food consumption survey (1977–78, and 1987–88), and was expressed in household measures and metric units. In Korea unfortunately the raw data of national nutrition survey is not opened to the nutrition professionals, the attempt as USFDA only could be made by government affiliated institute. USFDA also requires food manufacturers to describe the % Daily Reference Value (DV) of one serving.

The present study is confined to processed foods which are designed to provide one meal or one snack for one person. These are the food items which can be consumed

in one serving size on the spot. The present study also tentatively classified foods into 30 groups. It is critical for food manufacturers to classify their foods into certain food group that would be the basis for reference serving size. Since consumer's food choice may be determined by the description of nutrient content and the difference in % DV per serving, and so the sale of food products can be affected.¹⁷ Consumers normally want to take a low amount of Na⁺, cholesterol, and fat, and a high amount of Ca, Fe, and Dietary fiber²¹; thus the nutrition information on those nutrients can become the basis for choice of a certain food.¹⁹ All marketed foods need to be analyzed and evaluated by food and nutrition professionals in terms of classification for serving sizes, as is practiced in the USA.

This research was undertaken to evaluate the adequacy of the serving sizes in packaged foods by using a consumer group. Other studies conducted on serving sizes^{9–11}

Table 6. Comparison of typical serving sizes for the packaged processed foods

Classification of food group		Reference values for serving sizes (ml, gram)		
Main group	Sub group	This study	7 th Korean RDA	FDA/ USA
Milk	Liquid	200	200	240
	Flavored liquid	210	–	240
Yogurt	Liquid type	100	150	225
	Semi-liquid	130	–	–
	Paste type	120	110	–
Ice cream	Cone	140	100	125
	Bar	75	–	85
Cheese	Processed	22	40	30
	Beverages	Tonic	230	–
	Cola	230	100	240
	Carbonated drinks	230	100	240
	Indigenous Korean drinks	230	–	–
	Fruit juice	230	100	240
Snacks	Chips	60	30	30
	Biscuits, Crackers	70	–	30
	Cookies (Chocolate, Butter)	50	–	–
Rice	Standard size	220	210	1 cup
	With curry or other sauces	300	–	–
Bread and cake	Bread	110	90	–
	Sponge cake	110	100	–
	Cream, or red bean paste inside, etc.	90	80	–
Ramyon	General type	120	–	–
	Flavored with curry or other sauce	135	–	–
	Large bowl	120	–	–
	Cup type	90	–	–
	Noodle or Woodong type	250	–	–
Retort pouched	Curry, Black noodle sauce	180	–	–
	Meat balls	200	–	–
(Ready to	Soup	320	–	245

in Korea utilized different sections of the general population. It could be argued that the use of young female adults in the present study is not a fair representation of the population. Recently the Korean FDA, in coordination with the Korean Nutrition Society used the recommended dietary allowances for female adults as the reference values for nutrient contents labeling; this is consistent with the present research. However, more research is needed in establishing reference serving sizes using a more diverse population group.

Table 6 lists 30 categories of food and their proposed serving sizes as identified in this study, compared with the data from the Korean Nutrition Society and USFDA. The Korean Nutrition Society designated 100ml for serving size beverage that is less than half the amount of present study and current container size. The serving size for milk and beverages in the USA and the packages currently found in Korean markets is 10–20% more than our suggested value. It can be recommended that the serving size for beverages should be reduced by 10% for the marketed products and be doubled for that determined by the Korean Nutrition Society. Both the Korean Nutrition Society and the USFDA designated 30 g as the serving size for snack foods, while the panels in the present research proposed double this amount (50 to 70 g). Further research is needed to verify whether the larger amount proposed as a desirable serving size for snack food in this research is simply a result of the non-representative sampled population of this study or it reflects the average preferences of the Korean population. When snack foods are packaged as 2–3 times the serving size, each serving could be packaged individually in a big package for convenience in using nutrition information. Increases in package sizes are recommended for liquid type yogurt, cup ramyon, and package soups.

The present research will serve as a basis for more extensive research needed for deciding the official reference serving size. Establishing reference serving size will serve consumers as well as producers for valid and better utilization of nutrition information. Further research is warranted on the methodology for the determination of serving sizes and the comparative examination of serving sizes using different population segments.

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