Energy intake and snack choice by the meal patterns of employed people

Seok-Young Kim[1][§] and Se Min Kim[2]

[1]Department of Food and Nutrition, Gyeoungsang National University, 900-Gajwa-dong, Jinju,, Gyeongnam 660-701, Korea
[2]Major of Nutrition Education, Graduate School of Education, Gyeoungsang National University Gyeongnam 660-701, Korea

Abstract

The aim of this study was to provide descriptive information on meal and snack patterns and to investigate snacks in relation to energy intake and food choice according to the meal patterns of employed people in Korea. 683 employed people (292 males, 391 females) were interviewed to collect one day dietary data by using 24-h dietary recall. A recorded day was divided into 3 meal and 3 snack periods by the respondent's criteria and the time of consumption. To analyze the eating pattern participants were divided as the more frequent snack eaters (MFSE) and the less frequent snack eaters (LFSE). They were also categorized into 6 groups according to the frequency of all eating occasions. The common meal pattern in nearly half of the subjects (47.6%) was composed of three meals plus one or two snacks per day. A trend of an increasing the number of snacks in between main meals emerges, although the conventional meal pattern is still retained in most employed Korean adults. Women, aged 30-39, and urban residents, had a higher number of being MFSE than LFSE. Increasing eating occasions was associated with higher energy, protein, and carbohydrate intakes, with the exception of fat intakes. 16.8% of the total daily energy intake came from snack consumption, while the 3 main meals contributed 83.2%. Energy and macronutrient intakes from snacks in the MFSE were significantly higher than the LFSE. Instant coffee was the most popular snack in the morning and afternoon, whereas heavy snacks and alcohol were more frequently consumed by both of the meal skipper groups ($\leq$2M+2,3S and $\leq$2M+0,1S) in the evening. In conclusion, meal pattern is changing to reflect an increase of more snacks between the three main meals. Meal and snack patterns may be markers for the energy and macronutrient intakes of employed people in Korea.

Key Words: Snack, meal, energy intake, meal pattern

Introduction

Recently the number of daily eating times has increased, while the number of cooked meals has declined in developed countries. This is probably a result of the increased availability of snack foods and snacking occasions [1]. The frequency of snacking has increased due to urbanization, industrialization and the convenience provided by food processing [2-4]. Among adult Finns more than half of them consumed only one or two meals [5]. In elderly Greeks, all subjects had at least one cooked meal a day, however only 50% of subjects had two cooked meals [6]. Although only 12.5% of the subjects do not eat snacks, the majority of US adults (62.3%) consumed two or more snacks [7].

Most snacks in the industrialized world have a high energy density and people do not fully compensate their energy intake after the consumption of snacks [8,9]. Therefore, a more frequent consumption of high energy density snacks leads to an increase in daily energy intake [10], and the prevalence of obesity [11]. From previous studies, the average contribution of snacks to the daily energy intake was about 20-30% in western developed countries [12-14]. Food choices for a snack may facilitate an increase in energy intake. High fat desserts and salty snacks

remain the most popular snack items [1,15]. However, there is very little information regarding the contribution of energy intake from snacks and choice of snack foods for Korean adults.

One of the major social trends in present society is the increased participation of women in the labor force. As incomes rise and pressure on available time increases, working people want to do less cooking. Thus, there is a growing demand for snacks instead of conventional meals to provide nutrition and pleasure. Breakfast is most likely to be skipped among time-pressured employed people, which is associated with continuous snacking or frequent, light eating behavior [16]. Moreover, working adults more and more want to buy ready-to-eat take away dinners or home-delivered fast foods. Then, as a reward for making it through a tough day, some have heavy snacks while watching television at night. To the extent that people who work spend more time away from home, this trend is likely to continue [3]. As a result, the fundamental eating patterns of families with employed people are changing dramatically. Therefore, there is value in exploring eating patterns of employed people.

The aim of this study was to provide descriptive information on meal and snack patterns and to investigate snacks in relation to energy intake and food choice according to the meal patterns

of employed people in Korea.

Subjects and Methods

Subjects

Data was collected from a total of 683 subjects (292 males, 391 females) aged 20-65 from one large city (Pusan), two urban areas (Chanwon and Jinju city), and one rural area (Sancheong Gun). Participants were interviewed at their work place where the 24-hour dietary recall was administered during lunch time. Surveys were carried out from February to August 2008 by three dieticians trained in dietary interview techniques. All subjects were healthy, not taking medication and not dieting.

Dietary assessment

Daily nutrients of employed people in Korea were assessed by the one day 24 hours recall method, carried out in February 2008 and June 2008. Each participant was asked to record all foods and beverages consumed for the 24-hour time period from afternoon snack time on the previous day to lunch on the testing day. Then, detailed descriptions of all foods and beverages consumed as well as estimated food portion sizes were recorded by well-trained interviewers using food models as memory aids. Nutrient intake was calculated using a computerized nutrient database, which was a compilation of nutrient data mainly from the KNS Nutrient Database (The Korean Nutrition Society, version 8).

Meal patterns

Contrary to the definition of the conventional meal pattern, meals and snacks were defined according to the respondents subjective criteria and the time of consumption. A recorded day was divided into 6 periods: breakfast between 4 and 10 AM, a snack in the morning between 10 AM and 12 PM, lunch between 12 and 2 PM, a snack in the afternoon between 2 and 6 PM, dinner between 6 and 8 PM, and a snack in the evening between 8 PM and 12 AM.

Eating patterns were analyzed in two different ways: firstly, participants were classified into 2 types based on the frequency of snack eating occasions, regardless of the frequency of meals. The "more frequent snack eaters (MFSE)" consumed snacks 2 to 3 times whereas, the "less frequent snack eaters (LFSE)" consumed snacks one or zero times during the day; secondly, all meals and snacks consumed by participants were categorized into 6 patterns. The most frequent eaters consumed 3 meals with 3 snacks (3M+3S). The 5 times eaters consumed 3 meals with 2 snacks (3M+2S) and the 4 times eaters consumed 3 meals with one snack (3M+1S). Non snack eaters consumed 3 meals with no snack (3M). The meal skippers were divided into two groups. One group consumed snacks frequently (≤2M+2,3S) and the

Table 1. Major food and beverage items included in the snack categories

Snack category	Food items
Fruit/Vegetable	Apple, tomato, melon, strawberry, watermelon, grape, etc.
Coffee	Instant coffee, coffee, etc.
Tea/Beverage	Green tea, orange juice, tomato juice, vegetable juice, etc.
Milk/Dairy product	Milk, ice cream, yogurt, etc.
Carbohydrate-rich food	Sweet potato, bread, rice cake, Ddeokpokki, ramen, etc.
Light snack	Candy, Choco-pie, chocho chip, Saewookkang, etc.
Heavy snack	Tigim, roast chicken, roast or steamed pork, pizza, dried beef, etc.
Alcohol	Beer, Soju, etc.

other group consumed snacks only one time or rare during the day, thus they were the least frequent eaters (≤2M+0,1S).

Snack categories

The 1681 foods and beverages consumed as snacks by participants were assigned to one of the 8 categories: Fruit/ Vegetable, Coffee, Tea/Beverage, Milk/Dairy product, Carbohydrate rich food, Light snack, Heavy snack, and Alcohol. Snack foods consumed were grouped in terms of category, energy density, and eating frequency (Table 1). Food items could appear more than once in one snack period. For example, tomato and apple represented two frequencies in the same eating occasion.

Statistical analysis

All analyses were performed with the Statistical Analysis System (version 9.1, 2002-2003, SAS Institute, Cary, NC). Chi-square test was employed to examine the difference in frequency of meal patterns in gender, region and age groups and the difference of frequency of snack foods according to meal pattern. Descriptive statistics were generated as means and standard deviations for continuous variables. To analyze difference among the 6 meal patterns, Duncan's multiple range test was performed regarding intakes of energy and macronutrient from all eating occasions and snack eating occasions. Student's t-test was used to analyze differences between the MFSE and the LFSE regarding intake of energy and macronutrient from all eating occasions and snack eating occasions. Morning, afternoon, and evening snacks in 5 meal patterns and 8 snack food categories were plotted by multiple correspondence analysis (Fig. 1).

Results

Prevalence of meal patterns by gender, region, and age groups

When all subjects were classified according to the frequency of snack consumption, 341 subjects were classified in the "more

frequent snack eater (MFSE)" group, and 342 subjects were classified as less frequent snack eater (LFSE)". The proportion of the MFSE was higher in women, aged 30 to 39 years old, and urban resident groups than those of the LFSE (Table 2).

When the meals of subjects were categorized into six meal patterns based on the number of eating occasions of meals and snacks, the most common meal pattern observed in 165 subjects was the three meals plus one snack (3M+1S). The next common meal pattern was the three meals plus two snacks (3M+2S). Therefore, nearly half of the subjects (47.6%) had a meal pattern composed of three main meals with one or two snacks. While the number of subjects consuming three meals with no snack (3M) was the lowest (n=82), 187 subjects were meal skippers who consumed less than 3 meals during a day. Among the meal skippers, 92 subjects were frequent snack eaters (≤2M+2,3S) and 95 subjects were infrequent snack eaters (≤2M+0,1S), respectively.

Energy and macronutrients intakes according to the meal patterns

The average daily energy intake was 2010.4 kcal, and the protein, fat, and carbohydrate intakes were 86.2 g, 58.6 g and 325.9 g, respectively (Table 3). The energy intake of the MFSE was 2091.0 kcal which was significantly higher than the value of the LFSE (1,929.9 kcal). Protein and fat intakes of the both MFSE and LFSE were not significantly different from each other. However, the carbohydrate intake of the MFSE was significantly higher than that of the LFSE.

The daily energy intake in the meal pattern of "3M+3S" was the highest, with that of the "3M+2S" following. However, energy intakes of the two meal pattern groups were not significantly different from each other. While the lowest energy intake was shown in the "≤2M+0,1S", the energy intake of the 4 times

eaters (3M+1S) or the 3 times eaters (3M), and the meal skippers consuming snacks frequently (≤2M+2,3S) fell between those of the most frequent eaters (3M+3S) and the least frequent eaters (≤2M+0,1S). Protein intakes of all three meals consuming patterns ("3M+3S", "3M+2S", "3M+1S", and "3M") were higher than those of the meal skippers ("≤2M+2,3S") and the least frequent eaters ("≤2M+0,1S"). However, fat intakes were not significantly different from each other. Carbohydrate intake in the "3M+3S" was the highest with the figures from the "3M+2S"

Table 3. Energy and macronutrient intakes according to the meal patterns

Meal pattern	Energy (kcal)	Protein (g)	Fat (g)	Carbohydrate (g)
Total (n=683)	2010.4 ± 689.3	86.2 ± 39.4	58.6 ± 35.1	325.9 ± 83.2
Meal pattern I [1]				
MFSE (n=341)	2091.0 ± 673.6**[3]	88.3 ± 40.0	59.6 ± 33.0	279.0 ± 84.3***
LFSE (n=342)	1929.9 ± 696.4	84.2 ± 38.7	57.6 ± 37.0	238.5 ± 77.1
Meal pattern II [2]				
3M+3S (n=89)	2267.9 ± 588.6[a4]	92.5 ± 43.7[a]	63.1 ± 28.9[a]	315.3 ± 80.5[a]
3M+2S (n=160)	2095.9 ± 573.7[ab]	90.7 ± 35.3[ab]	55.7 ± 25.9[a]	284.4 ± 70.5[b]
3M+1S (n=165)	2068.1 ± 607.1[b]	87.8 ± 31.0[ab]	61.4 ± 34.1[a]	267.3 ± 76.0[b]
3M (n=82)	1919.3 ± 629.9[b]	90.9 ± 41.8[ab]	56.1 ± 38.4[a]	232.9 ± 54.3[c]
≤2M+2,3S (n=92)	1911.6 ± 849.7[b]	80.0 ± 43.0[bc]	63.0 ± 45.3[a]	234. 4 ± 91.0[c]
≤2M+0,1S (n=95)	1699.2 ± 828.7[c]	72.1 ± 45.3[c]	52.5 ± 40.3[a]	193.2 ± 73.2[d]

3M: three main meals, 2M: two main meals, S: snack
[1] All subjects were separately classified as "more frequent snack eaters (MFSE)" who consumed snacks 2 to 3 times and "less frequent snack eaters (LFSE)" who consumed snack one or zero times during the day.
[2] All meals were separately categorized into 6 patterns: 3M+3S; 3 meals with 3 snacks, 3M+2S; 3 meals with 2 snacks, 3M+1S; 3 meals with one snack, 3M; 3 meals with no snack, ≤2M+2,3S; less than 3 meals with 2 or 3 snacks, ≤ 2M+0,1S; less than 3 meals with one snack or no snack.
[3] Significantly higher than the value of LFSE by t-test at ** P<0.01, *** P<0.001
[4] Means with the different superscripts are significantly different at P<0.05 by Duncan's multiple range test within a column.

Table 2. The frequency of meal patterns by gender, region and age groups

	Sex			Region				Age				
	Men	Women	χ^{2} [3]	LC	Urban	Rural	χ^2	20s	30s	40s	≥50	χ^2
Total (n=683)	292	391		229	238	216		198	192	224	69	
Meal pattern I [1]												
MFSE (n=341)	121	220	14.7***	107	152	82	31.8***	95	112	97	37	10.0*
LFSE (n=342)	171	171		122	6	134		104	80	126	32	
Meal pattern II [2]												
3M+3S (n=89)	29	60		23	42	24		25	30	23	11	
3M+2S (n=160)	62	98		61	61	38		36	46	56	22	
3M+1S (n=165)	68	97	26.8***	60	46	59	49.9***	49	40	60	16	34.7**
3M (n=82)	45	37		37	12	33		17	19	37	9	
≤2M+2,3S (n=92)	30	62		23	49	20		34	36	18	4	
≤2M+0,1S (n=95)	58	37		25	28	42		37	21	30	7	

LC:Large city, 3M: three main meals, 2M: two main meals, S: snack
[1] All subjects were separately classified as "more frequent snack eaters (MFSE)" who consumed snacks 2 to 3 times and "less frequent snack eaters (LFSE)" who consumed snack one or zero times during the day.
[2] All meals were categorized into 6 patterns. 3M+3S: 3 meals with 3 snacks, 3M+2S: 3 meals with 2 snacks, 3M+1S: 3 meals with one snack, 3M: 3 meals with no snack, ≤2M+2,3S: less than 3 meals with 2 or 3 snacks, ≤2M+0,1S: less than 3 meals with one snack or no snack.
[3] The number of subjects among 2 genders, 3 regions or 4 age groups were significantly different by Chi-Square test, at * P<0.05, ** P<0.01, *** P<0.001.

Table 4. Energy and macronutrient intakes from snacks according to the meal patterns

Meal pattern	Energy (kcal)	%[1]	Protein (g)	E%[2]	Fat (g)	E%	Carbohydrate (g)	E%
Total (n=683)	337.3 ± 427.0	16.8	10.6 ± 21.6	12.3	10.5 ± 18.6	17.9	45.5 ± 48.5	14.0
Meal pattern I								
MFSE[3] (n=341)	506.3 ± 461.5***[5]	24.2	15.7 ± 23.7***	17.8	15.4 ± 20.7***	25.8	70.1 ± 50.7***	25.1
LFSE[4] (n=342)	168.8 ± 308.5	8.7	5.6 ± 18.0	6.7	5.7 ± 14.8	9.9	21.1 ± 30.7	8.8
Meal pattern II								
3M+3S (n=89)	631.3 ± 412.6[a6]	27.8	18.2 ± 23.2[a]	19.7	18.5 ± 18.7[a]	29.3	89.9 ± 54.4[a]	28.5
3M+2S (n=160)	349.6 ± 287.2[b]	16.7	10.1 ± 15.0[b]	11.1	9.8 ± 11.8[b]	17.6	53.6 ± 36.2[b]	18.8
3M+1S (n=165)	202.1 ± 227.0[c]	9.8	5.7 ± 13.2[b]	6.5	6.5 ± 11.7[b]	10.6	30.6 ± 29.6[c]	11.4
3M (n=82)	0[d]		0[c]		0[c]		0[d]	
≤2M+2,3S (n=92)	658.0 ± 636.6[a]	34.4	22.7 ± 32.9[a]	28.4	22.2 ± 30.1[a]	35.2	79.6 ± 59.1[a]	34.0
≤2M+0,1S (n=95)	256.5 ± 470.0[bc]	15.1	10.4 ± 28.6[b]	14.4	9.1 ± 22.8[b]	17.3	22.8 ± 36.5[c]	11.8

3M: three main meals, 2M: two main meals, S: snack
[1] Percentage of the energy intakes from snacks to the daily energy intakes in meal patterns.
[2] Energy percent of macronutrients from snacks to daily energy intake in meal patterns
[3] All subjects were classified as "more frequent snack eaters (MFSE)" who consumed snacks 2 to 3 times and "less frequent snack eaters (LFSE)" who consumed snack one or zero times during the day.
[4] All meals were separately categorized into 6 patterns: 3M+3S; 3 meals with 3 snacks, 3M+2S; 3 meals with 2 snacks, 3M+1S; 3 meals with one snack, 3M; 3 meals with no snack, ≤2M+2,3S; less than 3 meals with two or three snacks, ≤2M+0,1S; less than 3 meals with one snack or no snack.
[5] Significantly higher than the value of LFSE by t-test at *** P<0.001
[6] Means with the different superscripts are significantly different at P<0.05 by Duncan's multiple range test within a column.

and "3M+1S" groups following. The carbohydrate intake was the lowest in the "≤2M+0,1S".

Energy and macronutrient intakes from snacks according to the meal patterns

The average energy intake from snack was 337.3 kcal, and the protein, fat, and carbohydrate intakes were 10.6 g, 10.5 g and 45.5 g, respectively (Table 4). Energy intake from snack in the MFSE was 506.3 kcal which was significantly higher than 168.8 kcal of the LFSE. Protein, fat, and carbohydrate intakes from snacks in the MFSE were also significantly higher than those in the LFSE.

While energy intake from snacks in the meal pattern of "3M+3S" was the highest, the value was not significantly different from that of the "≤2M+2,3S" group. Meanwhile, snack energy intake in the "3M+1S" was the lowest and the values in the "3M+2S" and the "≤2M+0,1S" were in the intermediate range. Energy intake from snacks was an average of 16.8%, ranging from 34.4% to 0% of the subjects' daily energy intakes. Average protein, fat, and carbohydrate intakes were 10.6 g, 10.5 g, and 45.5 g respectively. The energy contribution of protein, fat, and carbohydrate intakes from snacks were 12.3%, 17.9%, and 14.0% of their daily energy intakes, respectively. Average protein and fat intakes in the "≤2M+2,3S" were the highest and average carbohydrate intake in the "3M+3S" was highest among the 6 meal patterns. However, the energy percent of protein (28.4%), fat (35.2%), and carbohydrate intakes (34.0%) from snacks to daily energy intakes were the highest in the "≤2M+2,3S".

Frequency of snack foods consumed during morning, afternoon, and evening according to the six meal patterns

1,681 food items were consumed by 683 participants as snacks during morning, afternoon, and evening. Table 5 offers the frequency of 8 food categories in the morning snack by the meal patterns. A total of 422 food items were consumed during snack time in the morning. The most popular snack item was "coffee" -mostly instant coffee- followed by "fruits/vegetables". "Alcohol" was not consumed in the morning. The frequency of each snack food was not significantly different among the 5 meal patterns. Meanwhile, 768 food items were consumed during snack time in the afternoon. The number of food items was higher than that in the morning. However, the other characteristics of snacks were not different from those in the morning. For instance, the popular snack items were "coffee", and "fruits/vegetables". In addition, "alcohol" was not consumed and just like the results from the morning snack, the frequency of snack foods was not significantly different among the 5 meal patterns (Table 6).

During snack time in the evening, 491 food items were consumed. The number of food items was lower than that of the afternoon and higher than the number from the morning. The most popular snack item was "fruits/vegetables" followed by "heavy snack". In addition, "alcohol" was frequently consumed and instant coffee was rarely consumed in the evening. Moreover, the frequency of snack foods was significantly different among the 5 meal patterns (Table 7).

Table 5. Frequency of snack foods consumed in the morning according to the meal patterns[1]

Snack foods	3M+3S	3M+2S	3M+1S	3M	≤2M+2,3S	≤2M+0,1S	Total, N(%)	χ^2
Fruit/Vegetable	34	22	4	0	15	3	78 (18)	
Coffee	46	57	9	0	35	5	152 (36)	
Tea/Beverage	15	17	2	0	10	1	45 (11)	
Milk/Dairy product	13	21	6	0	19	3	62 (15)	
Carbohydrate-rich food	8	13	10	0	9	3	43 (10)	35.5[2]
Light snack	11	8	4	0	11	2	36 (9)	
Heavy snack	1	3	1	0	0	1	6 (1)	
Alcohol	0	0	0	0	0	0	0 (0)	
Total	128	141	36	0	99	18	422 (100)	

[1] All meals were separately categorized into 6 patterns: 3M+3S; 3 meals with 3 snacks, 3M+2S; 3 meals with 2 snacks, 3M+1S; 3 meals with one snack, 3M; 3 meals with no snack, ≤2M+2,3S; less than 3 meals with two or three snacks, ≤2M+0,1S; less than 3 meals with one snack or no snack.
[2] The numbers were not significantly different among meal patterns at $P<0.05$ by Chi-Square test.

Table 6. Frequency of snack foods consumed in the afternoon according to the meal pattern[1]

Snack foods	3M+3S	3M+2S	3M+1S	3M	≤2M+2,3S	≤2M+0,1S	Total, N(%)	χ^2
Fruit/Vegetable	39	49	33	0	26	8	155 (20)	
Coffee	55	73	63	0	54	22	267 (35)	
Tea/Beverage	15	30	11	0	16	1	73 (10)	
Milk/Dairy product	15	35	20	0	16	4	90 (12)	
Carbohydrate-rich food	20	35	26	0	27	7	115 (15)	28.7[2]
Light snack	12	20	11	0	7	2	52 (7)	
Heavy snack	2	1	5	0	7	1	16 (2)	
Alcohol	0	0	0	0	0	0	0 (0)	
Total	158	243	169	0	153	45	768 (100)	

[1] All meals were separately categorized into 6 patterns: 3M+3S; 3 meals with 3 snacks, 3M+2S; 3 meals with 2 snacks, 3M+1S; 3 meals with one snack, 3M; 3 meals with no snack, ≤2M+2,3S; less than 3 meals with two or three snacks, ≤2M+0,1S; less than 3 meals with one snack or no snack.
[2] The numbers were not significantly different among meal patterns at $P<0.05$ by Chi-Square test.

Table 7. Frequency of snack foods consumed in the evening according to the meal pattern[1]

Snack foods	3M+3S	3M+2S	3M+1S	3M	≤2M+2,3S	≤2M+0,1S	Total, N(%)	χ^2
Fruit/Vegetable	58	44	16	0	23	4	145 (30)	
Coffee	15	8	4	0	3	1	31 (6)	
Tea/Beverage	10	8	2	0	11	5	36 (7)	
Milk/Dairy product	17	6	1	0	7	0	31 (6)	
Carbohydrate-rich food	14	13	10	0	14	2	53 (11)	74.5*[2]
Light snack	18	13	2	0	16	2	51 (10)	
Heavy snack	16	10	7	0	32	14	79 (16)	
Alcohol	18	13	5	0	19	10	65 (13)	
Total	166	115	47	0	125	38	491 (100)	

[1] All meals were separately categorized into 6 patterns: 3M+3S; 3 meals with 3 snacks, 3M+2S; 3 meals with 2 snacks, 3M+1S; 3 meals with one snack, 3M; 3 meals with no snack, ≤2M+2,3S; less than 3 meals with two or three snacks, ≤2M+0,1S; less than 3 meals with one snack or no snack.
[2] The numbers were significantly different among meal patterns at $P<0.001$ by Chi-Square test.

Correspondence of meals and snack foods

Morning, afternoon, and evening snacks in the 5 meal patterns and 8 snack categories were plotted by multiple correspondence analysis (Fig.1). Evening snacks in the "≤2M+2,3S" and "≤ 2M+0,1S" were grouped with the "heavy snack (7)" on the upper right-hand part of the figure. It represents the evening snacks for the two groups which mainly consisted of heavy snacks. The evening snacks in the "3M+3S", "3M+2S", and "3M+1S" were gathered together on the middle left-hand part. These figures are

closely located with the snack categories of "fruit/vegetable" and "light snack". Therefore, it shows that the evening snacks for the 3 groups consisted of those food categories. Most of the morning and afternoon snacks in the 5 meal patterns were clustered together on the lower part of the figure. "Coffee", "Milk/Dairy product", "Tea/Beverage" and "carbohydrate rich food" were also gathered together with them.
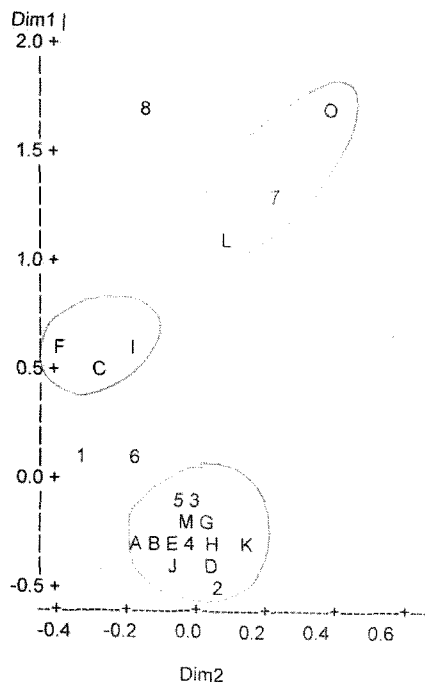
Fig. 1. Correspondence analysis plot of eight snack categories and snack foods consumed in the morning, afternoon, and evening. A: Morning snack of the 3M+3S, B: Afternoon snack of the 3M+3S, C: Evening snack of the 3M+3S, D[1] : Morning snack of the 3M+2S, E: Afternoon snack of the 3M+2S, F: Evening snack of the 3M+2S, G: Morning snack of the 3M+1S, H: Afternoon snack of the 3M+1S, I: Evening snack of the 3M+1S, J: Morning snack of the ≤2M+2,3S, K: Afternoon snack of the ≤2M+2,3S, L: Evening snack of the ≤2M+2,3S, M: Morning snack of the ≤2M+0,1S, N: Afternoon snack of the ≤2M+0,1S, O: Evening snack of the ≤2M+0,1S, 1: Fruit/Vegetable, 2: Coffee, 3: Tea/Beverage, 4: Milk/Dairy product, 5: Carbohydrate-rich food, 6: Light snack, 7: Heavy snack, 8: Alcohol. [1] The position of the "D" covers that of the "N" which was not shown on the figure.

Discussion

The results of this study provide descriptive information regarding meal and snack patterns and reveal specific meal and snack patterns associated with energy and macronutrient intakes of employed people in Korea. Our results showed that the number of eating occurrences per day varies roughly between 1 and 6, with an average above 4. However, a majority of the subjects (72.6%) adhere to the eating pattern of three meals per day regardless of the consumption of snacks. The common meal pattern in nearly half of the subjects (47.6%) was composed of three meals plus one or two snacks per day. This implies that a trend of an increasing number of snacks in between main meals emerges, although the conventional meal pattern is still retained by most employed Korean adults.

The proportion of three-meal eaters was 44% in Finns [5]. The majority of Swedes consumed only one hot meal and only 32% of Swedes consumed more than one cooked meal [17]. In elderly Greeks, all subjects had at least one cooked meal a day, however the proportion of people who consumed two meals per day was only 50% [6]. French adults had 2.7 meals and one or more extra-prandial eating events per day [18], Therefore, the

proportion of 3 main meal eaters in this study was higher than majority of other western countries. Almost half of the subjects (49.9%) in our study tended to consume 2 or 3 snacks besides their main meals. The number of multiple-snackers was still low compared to the US and other western countries [7,19]. Meanwhile, when our findings are compared with the results from an earlier study in Korea [16], the proportion of snackers who consume one or two snacks per day was 72.2%, which is higher than the figure in the present study. However, the proportion of multiple snackers who consumed snacks more than two times was only 0.5%. Moreover, the prevalence of non-snackers was higher in that study than ours. Thus, snacking has recently increased in Korean adults.

A specific meal pattern is often associated with certain demographic characteristics. The meal skippers who consume snacks frequently (≤2M+2,3S) and the most frequent eaters (3M+3S) were more likely to be female, urban residents, and 20 to 39 years old (Table 2). By comparison, the least frequent eaters (≤2M+0,1S) were more frequently male, rural residents, and between the ages of 20-29, or 40-49. Non-snack eaters (3M) could be observed in males, aged 40-49, and rural residents or residents of the large city. The prevalence of the MFSE was higher in women, aged 30-39, and urban residents than the LFSE. From these results, women aged 20-39 living in urban areas may possibly prefer snacks more than men, which is consistent with reports from other cultures [11,19].

The results in our study show that increasing meal and snack eating occasions may be associated with higher energy, protein, and carbohydrate intakes, with the exception of fat intake (Table 3). The most frequent eaters (3M+3S) had 6 eating occasions per day, revealing the highest energy, protein, and carbohydrate intakes, followed by the values of the 5 times eaters (3M+2S). The least frequent eaters (≤2M+0,1S) had the lowest amounts of energy, protein and carbohydrates intakes. The results reported here are in agreement with other studies regarding energy and macronutrient intakes according to eating occasions [20,21].

An important issue for research on the nutritional importance of snacks is the relationship between increasing snack frequency and energy intakes. The data presented in Table 4 indicates that 16.8% of the total daily energy intake came from snack consumption, while meals contributed 83.2%. The contribution of snack intake to total energy intake from northern European countries varies from 32-34% in Finland [5] to 22-23% in Sweden [12]. The British middle aged group consumed 21.4% (female) and 25.8% (male) of their total energy intake from snacks [13], while the contribution of snack intake to daily energy intake in young French adults ranged from 12% to 17%. Therefore, the proportion of snack energy intake in this study was lower than that found in the studies of other countries, although our data was similar to the result from France.

Energy and macronutrient intakes from snacks in the MFSE were significantly higher than those in the LFSE (Table 4). When the energy, and macronutrient intakes from snacks are compared

with the 5 meal patterns, the values do not change proportionally despite an increase in eating occasions. This is because the proportion of the macronutrients in the meals and snacks were different from each other. Snacks are higher in carbohydrates and lower in protein and fat when compared with meals [13,18]. Gatenby [22] reported that snacks were higher in carbohydrates and energy than meals although there is no difference in total fat content. Data from the United States [23] also show that snacks contain more carbohydrates but less protein and fat than main meals. Therefore, energy, protein, and fat intakes from snacks in the meal pattern of "≤2M+2,3S" were highest followed by the values of the "3M+3S" (Table 4) even though those values were not significantly different. Similarly, the energy, protein, and fat intakes from snacks in the "2M+0,1S" were higher. However, they were not significantly higher than the "3M+1S".

Another element in the discussion of the contribution of snacks to energy intake is the nature of the snack. Certain food groups are frequently consumed as snacks. The 3 most frequently consumed foods for the morning snack were coffee, milk/dairy product, and fruit/vegetable, which were the same as the foods for the afternoon snack. In addition, more carbohydrate rich foods like bread, rice cake, buchimgae, and sweet potato were consumed in the afternoon than in the morning. Although, food items consumed at main meals may differ by country, the type of snack foods consumed is not much different between countries [24]. Usually, coffee, tea, beverage, sweet bakery goods, and fruits are common snack items in various countries [11,19,20]. However, the item consumed by our subjects which varied the most from other countries was instant coffee. The contribution of the number of all tea and beverage consumed to the total frequency of snack foods in the morning and the afternoon was 11% and 10%, respectively. On the contrary, the frequency of instant coffee, as a single food item, contributes 36% in the morning and 35% in the afternoon. In other words, instant coffee was the most popular snack during day time in the present study. It is well known that instant coffee mix is the top sales item at "E-mart", which is one of the biggest supermarket chains in Korea [25]. This might be a specific cultural phenomenon in Korea. The majority of Koreans are accustomed to drinking hot soups and a bowl of hot rice tea during and after meals. Therefore, the hot temperature of coffee might be favorable to many Koreans. Besides a few factors like reasonable price and taste, convenience, and high availability may also contribute to the high popularity of instant coffee.

However, the kind of food eaten for snacks in the evening was quite different from that of the morning or afternoon. Instant coffee, which was the most popular item during the day time, was rarely consumed in the evening. Instead, alcohol and soft drinks were more frequent in the evening. Although the most common snack item was "fruits & vegetables", certain food items,for example, beer and roast chicken- were consumed mainly in the evening. In addition, these items are frequently high energy dense foods, for example, Tigim, roast or steamed

pork, pizza, Ddockbokgy, and ramen. The typical explanation for the reason of consuming energy dense snacks in the evening is that people are used to relaxing with their family, and sharing preferred foods in a greater quantity after a long, stressful day. One other reason is that the omission of breakfast and lunch is likely to be compensated by overeating later in the day [26]. This is similar with other countries. Alcohol was mainly consumed with dinner by young French adults [27] and by elderly Greek rurals [6]. Therefore, it is common that energy intake increases when it is later in the day [28,29]. A meal pattern shifted to later in the day is considered a possible causative factor for obesity [17,21].

Moreover, the frequency of snack foods was significantly different among the 5 meal patterns (Table 7). Heavy snacks and alcohol were more frequently consumed in the two meal skipper groups (≤2M+2,3S and ≤2M+0,1S). On the contrary, fruit/ vegetable and various snacks were frequently consumed in the three meal eating groups (3M+3S, 3M+2S, and 3M+1S). It means that meal skipping affected the frequency and type of evening snack. A lower eating frequency results in large fluctuations in blood glucose levels [30]. Moreover, skipping meals has been related to the consumption of higher energy and carbohydrate snacks in the afternoon and evening [26,31]. Therefore, skipping a meal and eating snacks frequently could be classified as unhealthy food habits. The meal skippers who consume snacks frequently (≤2M+2,3S) in this study could be classified as one of the bad habit groups. Their energy and macronutrient intakes from snacks were the highest among all meal patterns (Table 4). Meal patterns have received little attention in nutrition studies. Therefore, further studies are needed on the effect of a meal pattern of three regular main meals and of the avoidance of frequent snacking in the prevention of obesity.

Findings from this study suggest that a trend of an increasing number of snacks in between main meals emerges, although the conventional three meal pattern is still retained by most employed Korean adults. Women aged 20-39 living in urban areas possibly prefer snacks more than men. 16.8% of their total daily energy intake came from snack consumption, which is not much higher than other western countries. Increasing meal and snack eating occasions is associated with higher energy, protein, and carbohydrate intakes, but not fat intake. Foods for the evening snack were significantly different by the meal and snack eating occasion. High energy dense foods were used as snacks in the evening by meal skippers. In conclusion, meal and snack patterns may be markers for the energy and macronutrient intake of employed people in Korea.

References

1. Zizza C, Siega-Riz AM, Popkin BM. Significant increase in young adults' snacking between 1977-1978 and 1994-1996

represents a cause for concern! Prev Med 2001;32:303-10.

2. Giskes K, Turrell G, van Lenthe FJ, Brug J, Mackenbach JP. A multilevel study of socio-economic inequalities in food choice behaviour and dietary intake among the Dutch population: the GLOBE study. Public Health Nutr 2006;9:75-83.

3. Jabs J, Devine CM. Time scarcity and food choices: An overview. Appetite 2006;47:196-204.

4. Wang Z, Zhai F, Du S, Popkin B. Dynamic shifts in Chinese eating behaviors. Asia Pac J Clin Nutr 2008;17:123-30.

5. Roos E, Prattala R. Meal pattern and nutrient intake among adult Finns. Appetite 1997;29:11-24.

6. Wahlqvist ML, Kouris-Blazos A, Wattanapenpaiboon N. The significance of eating patterns: An elderly Greek case study. Appetite 1999;32:23-32.

7. Kerver JM, Yang EJ, Obayashi S, Bianchi L, Song WO. Meal and snack patterns are associated with dietary intake of energy and nutrients in US adults. J Am Diet Assoc 2006;106:46-53.

8. De Graaf C. Effects of snacks on energy intake: An evolutionary perspective. Appetite 2006;47:18-23.

9. Mazlan N, Horgan G, Stubbs RJ. Energy density and weight of food effect short-term caloric compensation in men. Physiol Behav 2006;87:679-86.

10. De Castro JM. The time of day and the proportions of macronutrients eaten are related to total daily food intake. Br J Nutr 2007;98:1077-83.

11. Berteus Forslund H, Torgerson JS, Sjostrom L, Lindroos AK. Snacking frequency in relation to energy intake and food choices in obese men and women compared to a reference population. Int J Obes 2005;29:711-9.

12. Andersson J, Nydahl M, Gustafsson K, Sidenvall B, Fjellstrom C. Meals and snacks among elderly self-managing and disabled women. Appetite 2003;41:149-60.

13. Summerbell CD, Moody RC, Shanks J, Stock MJ, Geissler C. Sources of energy from meals versus snacks in 220 people in four age groups. Eur J Clin Nutr 1995;49:33-41.

14. Zizza CA, Tayie FA, Lino M. Benefits of snacking in older Americans. J Am Diet Assoc 2007;107:800-6.

15. Neuhouser ML, Patterson RE, Kristal AR, Rock CL, Neumark-Sztainer D, Thornquist MD, Cheskin LJ. Do consumers of savory snacks have poor-quality diets? J Am Diet Assoc 2000;100: 576-9.

16. Choi MK, Kim JM, Kim JG. A study on the dietary habit and health of office workers in Seoul. Korean Journal of Food Culture 2003;18:45-55.

17. Berg C, Lappas G, Wolk A, Strandhagen E, Torén K, Rosengren A, Thelle D, Lissner L. Eating patterns and portion size associated with obesity in a Swedish population. Appetite 2009;

52:21-6.

18. Bellisle F, Dalix AM, Mennen L, Galan P, Hercberg S, De Castro JM, Gausseres N. Contribution of snacks and meals in the diet of French adults: a diet-diary study. Physiol Behav 2003;79: 183-9.

19. Ovaskainen ML, Reinivuo H, Tapanainen H, Hannila ML, Korhonen T, Pakkala H. Snacks as an element of energy intake and food consumption. Eur J Clin Nutr 2006;60:494-501.

20. Basdevant A, Craplet C, Guy-Grand B. Snacking patterns in obese French women. Appetite 1993;21:17-23.

21. Berteus Forslund H, Lindroos AK, Sjostrom L, Lissner L. Meal patterns and obesity in Swedish women- a simple instrument describing usual meal types, frequency and temporal distribution. Eur J Clin Nutr 2002;56:740-7.

22. Gatenby SJ. Eating frequency: methodological and dietary aspects. Br J Nutr 1997;77:7-20.

23. Nicklas TA, O'Neil CE, Berenson GS. Nutrient contribution of breakfast, secular trends, and the role of ready- to-eat cereals: a review of data from the Bogalusa Heart Study. Am J Clin Nutr 1998;67:757-63.

24. Haveman-Nies A, De Groot LPGM, Van Staveren WA. Snack patterns of older Europeans. J Am Diet Assoc 1998;98:1297-1302.

25. Park JW [Internet]. The top of the sales-item was the "Coffeemix" at E-mart; [cited 2009 September 10]. Available from: http://sports.hankooki.com/Article.

26. Dubois L, Girard M, Potvin Kent M, Farmer A, Tatone-Tokuda F. Breakfast skipping is associated with differences in meal patterns, macronutrients intakes and overweight among pre-school children. Public Health Nutr 2009;12:19-28.

27. Bellisle F, Dalix AM, De Castro JM. Eating patterns in French subjects studied by the "Weekly Food Diary" method. Appetite 1999;32:46-52.

28. De Castro JM. The time of day of food intake influences overall intake in humans. J Nutr 2004;134:104-11.

29. Schlettwein-Gsell D, Barclay D. Longitudinal changes in dietary habits and attitudes of elderly Europeans. SENECA investigators. Eur J Clin Nutr 1996;50:56-66.

30. Carlson O, Martin B, Stote KS, Golden E, Maudsley S, Najjar SS, Ferrucci L, Ingram DK, Longo DL, Rumpler WV, Baer DJ, Egan J, Mattson MP. Impact of reduced meal frequency without caloric restriction on glucose regulation in healthy, normal-weight middle-aged men and women. Metabolism 2007;56:1729-34.

31. Sjoberg A, Hallberg L, Hoglund D, Hulthen L. Meal pattern, food choice, nutrient intake and lifestyle factors in the Göteborg Adolescence Study. Eur J Clin Nutr 2003;57:1569-78.