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

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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 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 (<2M+2.3S and <2M+0.18) 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 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 (1929.9 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) 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 2. The frequency of meal patterns by gender, region and age groups

| Meal pattern | Men | Women | χ² | LC | Urban | Rural | χ² | 20s | 30s | 40s | ≥50 | χ² |
|--------------|-----|-------|-----|----|-------|-------|-----|-----|-----|-----|-----|-----|
| Total (n=683) | 292 | 391 |     | 229 | 238 | 216 | 198 | 192 | 224 | 69  |     |
| MFSE (n=341) | 121 | 220 | 14.7 | 107 | 152 | 82  | 31.9 | 95  | 112 | 97  | 37  | 10.0 |
| LFSE (n=342) | 171 | 171 |     | 122 | 6   | 134 | 104 | 80  | 126 | 32  |     |

| Meal pattern | 3M+3S (n=89) | 3M+2S (n=160) | 3M+1S (n=165) | ≤2M+2,3S (n=92) | ≤2M+0,1S (n=95) |
|--------------|--------------|--------------|----------------|----------------|----------------|
| χ² | 29 | 60 | 23  | 42  | 24  | 25  | 30  | 23  | 11  |     |
|  68  | 97  | 60  | 46  | 59  | 49.9 | 49  | 40  | 60  | 16  | 34.7 |
|  45  | 37  | 37  | 12  | 33  | 17  | 19  | 37  | 9   |     |     |
|  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 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) 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.

4) Means with the different superscripts are significantly different at P < 0.05 by Duncan’s multiple range test within a column.
Table 4. Energy and macronutrient intakes from snacks according to the meal patterns

| Meal pattern | Energy (kcal) | Protein (g) | Fat (g) | Carbohydrate (g) |
|--------------|---------------|-------------|---------|------------------|
|              | %1) E%2) E%3) |              |         |                  |
| 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 |              |             |         |                  |
| MFSE4) (n=341) | 506.3 ± 461.5*** | 24.2    | 15.7 ± 23.7*** | 17.8 | 15.4 ± 20.7*** | 25.8 | 70.1 ± 50.7*** | 25.1 |
| LFSE5) (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 |              |             |         |                  |
| 3M+3S (n=89) | 631.3 ± 412.6a | 27.8 | 18.2 ± 23.2a | 19.7 | 18.5 ± 18.7a | 29.3 | 89.9 ± 54.4a | 28.5 |
| 3M+2S (n=160) | 349.6 ± 287.2a | 16.7 | 10.1 ± 15.0a | 11.1 | 9.8 ± 11.8a | 17.6 | 53.6 ± 36.2a | 18.8 |
| 3M+1S (n=165) | 202.1 ± 227.0a | 9.8 | 5.7 ± 13.2a | 6.5 | 6.5 ± 11.7a | 10.6 | 30.6 ± 29.6a | 11.4 |
| 3M (n=82) | 0d | 0d | 0d | 0d | 0d |
| ≤2M+2,3S (n=92) | 658.0 ± 636.6a | 34.4 | 22.7 ± 32.9a | 28.4 | 22.2 ± 30.1a | 35.2 | 79.6 ± 59.1a | 34.0 |
| ≤2M+0,1S (n=95) | 256.5 ± 470.0a | 15.1 | 10.4 ± 28.6a | 14.4 | 9.1 ± 22.8a | 17.3 | 22.8 ± 36.5a | 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.

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

| Snack foods                | 3M+3S | 3M+2S | 3M+1S | 3M   | ≤2M+2,3S | ≤2M+0,1S | Total, N(%) | χ² |
|----------------------------|-------|-------|-------|------|----------|----------|-------------|----|
| 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)     | 35.5² |
| 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

| Snack foods                | 3M+3S | 3M+2S | 3M+1S | 3M   | ≤2M+2,3S | ≤2M+0,1S | Total, N(%) | χ² |
|----------------------------|-------|-------|-------|------|----------|----------|-------------|----|
| 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)    | 28.7² |
| 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

| Snack foods                | 3M+3S | 3M+2S | 3M+1S | 3M   | ≤2M+2,3S | ≤2M+0,1S | Total, N(%) | χ² |
|----------------------------|-------|-------|-------|------|----------|----------|-------------|----|
| 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)     | 74.5² |
| 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.
Meal and snack patterns

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-snacker 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

**Fig. 1. Correspondence analysis plot of eight snack categories and snack foods consumed in the morning, afternoon, and evening.**

A: Morning snack of the ≤2M+2,3S; B: Afternoon snack of the 3M+3S, C: Evening snack of the 3M+3S, D: Morning snack of the ≤2M+0,1S, 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 ≤2M+2,3S; I: Morning snack of the ≤2M+0,1S, J: Afternoon snack of the ≤2M+2,3S, K: Afternoon snack of the ≤2M+0,1S, L: Evening snack of the ≤2M+2,3S, M: Morning snack of the ≤2M+2,3S, 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. The position of the "D" covers that of the "N" which was not shown on the figure.
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]. Gatesby [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, banchimgae, 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 with the least price [24].

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].

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Meal and snack patterns

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