Use of workplace foodservices is associated with reduced meal skipping in
Korean adult workers: A nationwide cross-sectional study

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Research

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Abstract

**Background**: Skipping meals is a poor eating behaviour known to result in poor diet quality and health outcomes. Nevertheless, it has become increasingly common over a past few decades in many countries. This study aimed to examine the potential association between the use of workplace foodservices and skipping meals among Korean adult workers.

**Methods**: We used data from the Korea National Health and Nutrition Examination Survey 2016–2018, a nationwide cross-sectional survey of a representative Korean population. A total of 6,845 workers aged 20–64 years were included. Dietary assessment was conducted using a 24-hour dietary recall.

**Results**: In total, 40.9% of participants skipped one meal or more per day. The percentage of workers who skipped meals was 42.9±0.8% among the participants who did not use workplace foodservices, compared to 30.9±1.7% among those who did (P<0.01). Skipping meals was significantly associated with not using workplace foodservices, after adjusting for other confounders including sociodemographic variables, health-related variables, and meal procurement source (odds ratio=3.3; 95% confidence interval=2.7–4.0; P<0.01).

**Conclusions**: We found a significant association between using workplace foodservices and skipping meals in Korean adult workers. This study suggests the importance of implementing dietary interventions, such as the provision of workplace foodservices for workers, to potentially reduce poor eating behaviours such as skipping meals.

**Background**

Skipping meals is a poor eating behaviour known to result in poor diet quality and health outcomes. Nevertheless, it has become more common over a past few decades in many countries [1, 2]. A recent national survey in Korea reported that one in four individuals skipped breakfast, with this behaviour showing steadily increasing rates [3]. Furthermore, it was shown that young adults more frequently skipped regular meals than the older people. In Korea, the estimated prevalence rates of skipping meals were 46.5% and 40.1% in male and female adults aged 19–29 years and 31.3% and 25.1% in male and female adults aged 30–49 years, respectively [3].

Skipping meals has been assessed in terms of its long-term health effects. It is associated with a lower intake of required nutrients, decreases in cognitive function, and increased risks of adverse health outcomes such as obesity, insulin resistance, and other various cardiometabolic disorders [4–7]. Moreover, it has been shown that eating all regular meals without skipping is associated with potential benefits, including increases in the rates of adequate nutrient intake, leading to improved nutritional quality and healthy dietary habits [8, 9]. As such, this dietary behaviour is an important factor for nutrition and health, and it not only helps in preventing and managing diet-related chronic diseases but also contributes to improving the quality of life, work efficiency, and productivity in economic development [10, 11].

Despite the significant health impacts of skipping meals and its high prevalence among young adults, studies on the factors associated with this poor eating behaviour are limited. The available evidence suggests that physical or social environmental factors, including housing type, family support, and household socioeconomic status, as well as individual factors, such as a sedentary lifestyle, are associated with skipping meals [12–14]. A study by Rosenrauch et al. found that perceived peer support with regards to healthy eating was associated with skipping meals in adolescents [15]. However, the association of skipping meals with the use of workplace foodservices, another potential environmental factor, has never been studied in workers, even though the workplace is where most workers spend a major part of the day with their colleagues, and the workplace may directly or indirectly affect their dietary behaviours [16].

Therefore, this study aimed to compare the sociodemographic and health-related characteristics of workers according to whether they skip meals and to identify if there is an association between using workplace foodservices and reduced meal skipping among Korean workers aged 20–64 years.

**Methods**

**Data source and study participants**

The Korea National Health and Nutrition Examination Survey (KNHANES) is a nationwide cross-sectional survey that combined interviews with physical and laboratory examinations to assess the health and nutritional status of a representative population in Korea. The survey was conducted by the Korea Centers for Disease Control and Prevention [17]. This study was based on data acquired from the KNHANES (2016–2018).

Participants were workers who completed health interviews, physical examinations, laboratory measurements, and dietary surveys. Those aged <20 years or >64 years; individuals with a history of cancer, chronic kidney disease, or thyroid disease; patients treated for tuberculosis; and pregnant women were excluded due to the potential of unexpected dietary patterns. Individuals who reported implausible total energy intakes (<500 kcal/d or >4,000 kcal/d) were also excluded considering the reliability of the analysis. Written informed consent was obtained from all participants. The KNHANES was approved by the institutional review board of the Korea Centers for Disease Control and Prevention (2018-01-03-P-A).

**Dietary assessment**

The dietary survey was conducted using a 24-hour dietary recall method by professional interviewers (two dietitians who were thoroughly acquainted with the protocols and techniques involved in the survey). Data on all foods consumed by the participants for 24 hours during the day prior to the dietary survey were collected [18]. Participants were assigned to the skipping meals group based on whether the participants had skipped at least one regular meal (breakfast, lunch, or dinner) on the day before the survey; this was assessed via “yes or no” questions. Each meal consumed by the participants was categorised into one
of three groups: workplace foodservice, eating-out, or homemade (home-cooked) meals. We classified participants into the weekday or weekend group based on the day of the dietary survey.

**Sociodemographic and health-related covariates**

Information on the participants’ sociodemographic characteristics, including age, sex, household income, marital status, educational level, and occupation, was gathered through face-to-face interviews or self-reported questionnaires. A married person was regarded as having a married status and as cohabiting. A high education level was defined as a participant having at least a college education. Occupations were classified into three groups: non-manual (general managers, professionals, or office workers), service or sales, and manual (skilled agricultural workers, forestry and fishery workers, craft and related trade workers, plant and machine operators or assemblers, or elementary workers).

The health-related behaviours evaluated in this study included cigarette smoking, alcohol consumption, and physical activity. Participants who smoked at the time of the survey or had smoked ≥ 100 cigarettes in their lifetime were regarded as current smokers. Male and female participants were considered as heavy drinkers if they consumed ≥ 7 and ≥ 5 drinks, respectively, at least twice a week. The adequate physical activity group consisted of those who engaged in moderately intense physical activities for at least 150 minutes during the week, vigorously intense activities for at least 75 minutes during the week, or an equivalent combination of moderately and vigorously intense activities [19, 20].

Health examinations were conducted by trained personnel according to standardised protocols. Body weight and height were measured while participants were dressed in minimal clothing without shoes. Body mass index (BMI) was calculated as the body weight in kilograms divided by the square of height in metres (kg/m²). A BMI ≤ 18.5 kg/m² and BMI ≥ 25 kg/m² were defined as underweight and obesity, respectively. Blood pressure was measured on each participant’s right arm after a 5-min rest using a standard sphygmomanometer (Wall Unit 33(0850), Baumanometer®, NY, US). Venous blood samples were obtained for blood glucose and lipid profile measurements after fasting for 12 hours. In this study, chronic medical conditions were defined according to the data from the health examination, laboratory examination, or self-reported medication history of the participants. Each chronic disease was defined according to the following criteria: hypertension as increased blood pressure (systolic ≥ 140 mmHg or diastolic ≥ 90 mmHg) or the use of antihypertensive medications; diabetes as a fasting blood glucose ≥ 126 mg/dL, self-reported medical diagnosis by a health professional, or the use of diabetes treatment; and dyslipidaemia as a total cholesterol level ≥ 240 mg/dL or a serum triglyceride level ≥ 200 mg/dL in fasting blood samples or the use of medications for dyslipidaemia.

**Statistical analysis**

Statistical analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC, USA). All analyses used sample weights assigned to participants to represent the Korean population, which were determined using a multistage clustered and stratified randomised sampling method based on the National Census data [7]. The participants were categorised into two groups according to whether they skipped meals, and characteristics were compared between the groups. Skipping meals was regarded as skipping at least one regular meal per day. Data are presented as means for continuous variables and as weighted percentages for categorical variables (with their standard errors). The differences in sociodemographic and health-related characteristics between participants who did or did not skip meals were assessed using weighted t-tests or χ² tests.

Multivariate logistic regression analyses were used to estimate the association between using workplace foodservices and skipping meals after adjusting for confounders including age; sex; household income; marital status; educational level; occupation; smoking status; heavy alcohol consumption; adequate physical activity; obesity; chronic diseases including hypertension, diabetes, and dyslipidaemia; meal procurement source; and the day the survey was conducted (weekday/weekend). Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for skipping meals were calculated according to the use of workplace foodservices. For these analyses, we considered P-values of < 0.05 as statistically significant.

**Results**

A total of 24,269 (8,150, 8,127, and 7,992 in 2016, 2017, and 2018, respectively) candidates had completed a health interview/examination and nutritional survey among the Korean men and women selected using a two-stage stratified cluster and complex sampling method in the KNHANES (2016–2018). Finally, a total of 6,845 Korean workers were included in the statistical analysis after excluding participants who were aged < 19 or > 64 years; were unemployed; had missing data; had a history of cancer, chronic kidney disease, or thyroid disease; were treated for tuberculosis; were pregnant; who did not report their dietary intake; or who reported implausible total energy intakes (< 500 kcal/d or > 4,000 kcal/d) (Fig. 1).

**Baseline characteristics of the study participants**

Among the 6,845 participants at baseline, the mean age was 44.6 years, and more than half of the participants were male (58.5%). A total of 40.9% of participants skipped at least one meal a day. The baseline characteristics of the study participants stratified by whether they skipped meals are shown in Table 1. Compared with workers who consumed all three meals a day, those who skipped at least one meal a day were younger; non-manual, service, and sales workers; had lower household incomes; were unmarried; had underweight and obesity; and were non-current smokers and heavy drinkers (all P < 0.05). In addition, the prevalence of chronic diseases, including hypertension, diabetes, and dyslipidaemia, was lower in workers who skipped at least one meal a day (P < 0.05). All other variables were not significantly different between the two groups.
Table 1
Baseline characteristics of study participants according to meal-skipping behaviour

<table>
<thead>
<tr>
<th>Variables b</th>
<th>Total (n = 6,845)</th>
<th>Skipping meals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No (n = 4,254)</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Number</td>
<td>59.1 ± 0.7</td>
<td>40.9 ± 0.7</td>
</tr>
<tr>
<td>Age, years</td>
<td>44.6 ± 0.1</td>
<td>46.9 ± 0.2</td>
</tr>
<tr>
<td>Male</td>
<td>58.5 ± 0.6</td>
<td>59.1 ± 0.8</td>
</tr>
<tr>
<td>Household income</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Quartile 1</td>
<td>6.4 ± 0.4</td>
<td>6.0 ± 0.5</td>
</tr>
<tr>
<td>Quartile 2</td>
<td>21.5 ± 0.7</td>
<td>20.5 ± 0.8</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>32.8 ± 0.8</td>
<td>31.7 ± 1.0</td>
</tr>
<tr>
<td>Quartile 4</td>
<td>39.3 ± 1.0</td>
<td>41.8 ± 1.2</td>
</tr>
<tr>
<td>Higher education: at least college</td>
<td>52.8 ± 1.0</td>
<td>52.9 ± 1.2</td>
</tr>
<tr>
<td>Occupation</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Non-manual worker</td>
<td>47.8 ± 1.0</td>
<td>46.6 ± 1.1</td>
</tr>
<tr>
<td>Service and sales worker</td>
<td>21.1 ± 0.6</td>
<td>19.0 ± 0.7</td>
</tr>
<tr>
<td>Manual worker</td>
<td>31.1 ± 0.8</td>
<td>34.3 ± 1.0</td>
</tr>
<tr>
<td>Maried</td>
<td>68.4 ± 0.9</td>
<td>75.8 ± 0.9</td>
</tr>
<tr>
<td>Obesity</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Underweight</td>
<td>3.8 ± 0.3</td>
<td>3.3 ± 0.3</td>
</tr>
<tr>
<td>Obesity</td>
<td>35.4 ± 0.7</td>
<td>35.1 ± 0.8</td>
</tr>
<tr>
<td>Current smoker c</td>
<td>25.8 ± 0.7</td>
<td>77.9 ± 0.8</td>
</tr>
<tr>
<td>Heavy drinker d</td>
<td>16.5 ± 0.6</td>
<td>13.7 ± 0.6</td>
</tr>
<tr>
<td>Adequate physical activity e</td>
<td>48.3 ± 0.8</td>
<td>48.4 ± 1.0</td>
</tr>
<tr>
<td>Chronic diseases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>21.0 ± 0.6</td>
<td>23.2 ± 0.8</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7.0 ± 0.3</td>
<td>7.8 ± 0.5</td>
</tr>
<tr>
<td>Dyslipidaemia</td>
<td>23.7 ± 0.6</td>
<td>24.8 ± 0.7</td>
</tr>
<tr>
<td>Day of dietary survey: weekday</td>
<td>66.7 ± 1.5</td>
<td>67.6 ± 1.6</td>
</tr>
</tbody>
</table>

P-value a

- `< 0.01`
- `0.02`
- `0.05`
- `< 0.01`
- `0.16`
- `0.89`

a Weighted t-tests or χ² tests were used to assess differences between participants who did and did not skip at least one meal a day

b Data are expressed as weighted % for categorical variables and as means for continuous variables (with their standard errors).

c Participants who smoked at the time of the survey or had smoked ≥ 100 cigarettes in their lifetime

d Male and female participants who consumed ≥ 7 and ≥ 5 drinks, respectively, at least twice a week.

e Participants who engaged in moderately intense activities for at least 150 minutes during the week, vigorously intense activities for at least 75 minutes during the week, or an equivalent combination of moderately and vigorously intense activities

Assessment of the meal procurement source according to skipping meals

The percentage of workers who skipped meals at least once a day according to the meal procurement source is presented for each meal in Table 2. It was found that the highest percentage of workers skipped their breakfasts (> 30%). Among a total of 20,535 meals (three meals a day for 6,845 participants), the rate of skipped meals was 13.8%. Workplace foodservice meals, eating-out meals, and homemade meals accounted for 6.7%, 31.9%, and 47.5% of the total meals, respectively. The percentage of workers who skipped meals one or more times a day was 42.9 ± 0.8% among the participants who did not use workplace foodservices and 30.9 ± 1.7% among those who used workplace foodservices at least once a day (P < 0.01) (Fig. 2). Of the participants who ate homemade meals, the proportion of participants who ate all three meals a day was higher than that of those who skipped meals (73.7 ± 1.4% vs. 31.6 ± 0.8%, P < 0.01). However, we found no significant differences in the rate of skipping meals on comparing the eating-out group with the other two groups (P = 0.16).
Association between using workplace foodservices and skipping meals

Table 3 shows the ORs of skipping meals according to the use of workplace foodservices. Skipping meals was significantly associated with not using workplace foodservices, after adjusting for other confounders including sociodemographic, health-related, and meal procurement variables (OR = 3.3; 95% CI = 2.7-4.0; P < 0.01).

Table 3
Odds ratios of skipping meals according to the use of workplace foodservices

<table>
<thead>
<tr>
<th>Use of workplace foodservices</th>
<th>No use of workplace foodservices</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odds ratio</td>
<td>Odds ratio</td>
<td>95% confidence interval</td>
</tr>
<tr>
<td>Unadjusted</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Model 1 a</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Model 2 b</td>
<td>1</td>
<td>3.2</td>
</tr>
<tr>
<td>Model 3 c</td>
<td>1</td>
<td>3.3</td>
</tr>
</tbody>
</table>

a Model 1: adjusted for the place of meal procurement (eating-out and homemade)
b Model 2: additionally adjusted for age, sex, household income, marital status, educational level, occupation, smoking status, heavy drinking, adequate physical activity, obesity, chronic diseases (hypertension, diabetes, and dyslipidaemia)
c Model 3: additionally adjusted for snack intake and the day of dietary survey (weekdays/weekend)

Discussion

In a nationally representative population of Korean workers aged 20–64 years, this study examined the relationship between using workplace foodservices and skipping meals. We found that skipping meals was significantly associated with not using workplace foodservices, after adjusting for potential confounders including sociodemographic and health-related covariates.
Evidence has been found regarding the association between the use of institutional foodservices at the workplace and skipping meals, with some previous studies showing the potential link between specific working hours or conditions and skipping meals [21–25]. Eating behaviour is known to be affected by a variety of factors including individual perceptions of health or nutritional benefits, physical access, and socioeconomic environmental factors [26, 27]. A previous study showed that skipping breakfast was associated with low familial socioeconomic status and sedentary lifestyles [28]. This is partly in line with our findings that workers who skipped meals had lower household incomes. In addition, our finding that those in the skipping meals group were younger is consistent with that of a recent study in Korea [3]. The association between using workplace foodservices and skipping meals in this study may be potentially explained by factors such as physical access and social environments. Workplace foodservice facilities provide workers with high accessibility and convenience, which likely contribute to the sustainability of their eating behaviours, eventually making them habitual. In addition, the workplace is considered a place where most adults spend a majority of their day, and workplace foodservice facilities are usually located in easily accessible places, which could also contribute toward a reduction in meal-skipping behaviour [29]. Previous studies have shown the relationship of specific working conditions, such as rotating shift work, temporary employment, and long working hours, with skipping meals [21–25]. These social environmental factors may provide an indirect basis for the effect of the use of workplace foodservices on meal-skipping behaviour in daily work life, which can have a great impact on maintaining regular schedules, including meal times, while spending the day with other people. Nevertheless, it is possible that workers who regularly eat three meals a day are more likely to frequently use workplace foodservices. Therefore, further research on the underlying mechanism of this eating behaviour is needed in the future.

The proportion of meal skippers was lower among users of workplace foodservices than among non-users for every meal, though we could not estimate these statistical significances; among the three meal types, the highest rate of meal skipping was seen for breakfast (74.2%) in the study participants. Eating breakfast has been extensively reported to have potential benefits, including an increase in adequate nutrient intakes, leading to improved nutritional quality and healthy dietary habits [8, 9]. Furthermore, it has been shown that diet quality was higher in workplace food service users than among individuals consuming homemade or eating-out meals [29]. Our findings suggest that using workplace foodservices may contribute to having healthy dietary behaviours and to higher nutritional quality in workers. In addition, given that previous studies reported a higher rate of meal skipping in temporary workers than in full-time employees [25], the provision of workplace foodservice meals will also help minimise food insecurity, in terms of dietary inequality, by reducing the incidence of meal skipping.

This study has some limitations. We could not conclude a temporal relationship between using workplace foodservices and skipping meals as this study was conducted with a cross-sectional design. Thus, we could not determine clearly whether the use of workplace foodservices preceded the development of dietary behaviours such as meal skipping. We analysed data collected using a 24-hour dietary recall method, which may not be appropriate to assess an individual’s habitual diet. However, this limitation is mitigated by the large sample size and the high probability of the identification of diverse dietary behaviours. There is a possibility of response bias as self-reported data were included in this study.

Despite these limitations, to the best of our knowledge, this is the first study to evaluate the association between using workplace foodservices and skipping meals using recent data collected from a large representative Korean population. This study suggests the importance of implementing dietary interventions, with the frequent use of workplace foodservices for workers, to potentially reduce poor eating behaviours such as skipping meals.

Conclusions

In conclusion, we found a significant association between using workplace foodservices and skipping meals in Korean adult workers. This study suggests the importance of implementing dietary interventions, such as the provision of workplace foodservices for workers, to potentially reduce poor eating behaviours such as skipping meals.

List Of Abbreviations

BMI Body mass index
CI Confidence intervals
KNHANES Korea National Health and Nutrition Examination Survey
OR Odds ratios

Declarations

Ethics approval and consent to participate
Written informed consent was obtained from all participants. The KNHANES was approved by the institutional review board of the Korea Centers for Disease Control and Prevention (2018-01-03-P-A).

Consent for publication
Not applicable

Availability of data and materials
The data that support the findings of this study are available from the Korea Centers for Disease Control and Prevention but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Korea Centers for Disease Control and Prevention.

**Competing interests**

The authors declare that they have no competing interests.

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**Authors' contributions**

WYS was a major contributor towards writing the manuscript. WYS and JHK contributed the analysis and interpretation of data. WYS and JHK revised the manuscript critically for important intellectual content. JHK was responsible for the study conception and design, as well as intellectual content of the paper. All authors read and approved the final version of manuscript.

**Acknowledgements**

Not applicable

**References**

Figures


Exclusion (n=15,785)
- Below the age of 20 years or aged 65 years or more (n=10,028)
- Unemployed (n=5,125)
- Missing data (n=30)
- History of cancer (n=278), chronic kidney disease (n=14), or thyroid disease (n=281)
- Receiving treatment for tuberculosis (n=2)
- Pregnant women (n=27)

\[ n=8,484 \]

Exclusion (n=1,639)
- No data on dietary intakes (n=1,311)
- Implausible total energy intake (<500 kcal/d or >4000 kcal/d) (n=328)

\[ \text{Study participants (n=6,845)} \]

Figure 1
Flowchart for the inclusion of study participants (KNHANES VII 2016–2018)
Figure 2

Comparison of the proportion of meal skippers using a weighted \( \chi^2 \) test The percentage of workers who skipped at least one meal a day was 42.9 ± 0.8% among participants who did not use workplace foodservices and 30.9 ± 1.7% among those who used workplace foodservices (P<0.01). There was a significantly high proportion of workers who did not use workplace foodservices in the skipping meal group. Data are presented as weighted % with standard errors.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- STROBEchecklistShinIJBNA.docx