
Original Article

Relationship between breakfast consumption and health-related habits among university students in JapanMie MATO* and Keiko TSUKASAKI^{2*}

Objectives The aim of the present study was to describe the current state of health-related habits and examine their association with breakfast consumption habits and other health-related habits among university students in Japan.

Methods A cross-sectional survey was conducted with 1,755 third and fourth year university students in 17 academic departments from 14 universities in metropolitan areas or regional cities of Japan using a self-administered questionnaire. The survey included items addressing the participants' demographic characteristics and health-related habits (nutrition and dietary habits, physical activity and exercise, rest, alcohol drinking, smoking, and oral health). The relationships between breakfast consumption and other health-related habits were examined using a multiple logistic regression analysis.

Results Significant gender-dependent differences were found in the students' health-related habits. Logistic regression models found that breakfast consumption habits were positively associated to better nutritional balance, fruit and vegetable consumption, simple exercises for health, physical activity in daily life, enough sleep quantity, sleep quality, not staying up late, lower alcohol consumption, and lesser smoking.

Conclusion The present study elucidated the current state of unhealthy lifestyles among university students. It appeared that students who regularly consume breakfast had healthier behaviors in various other health-related habits. Accordingly, these students' breakfast consumption status could be used as a core indicator for identifying those with high-risk health-related habits and could help identify them as potential targets for support.

Key words : breakfast consumption habits, skipping breakfast, health-related habits, sleep, university students

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I. INTRODUCTION

Although it currently has the highest average life expectancy (at birth) worldwide, Japan is rapidly becoming a super-aged society¹⁾. For this reason, prevention of the onset of noncommunicable diseases (NCDs) to extend healthy life expectancy is of the utmost importance²⁾. To prevent the onset of NCDs in younger generations, it is important to improve health-related behaviors that may be risk factors for the onset of NCDs. In other words, to assist in the primary prevention of NCDs, it is extremely important to pro-

mote the continuation of a healthy lifestyle in younger generations.

To help solve this problem, food education has been promoted in Japan at both the nation and local levels in accordance with the Basic Act on Dietary Education and the Basic Plan for the Promotion of Dietary Education^{3,4)}. However, the younger generation (those in their twenties) still have many problems in terms of their consciousness about health and dietary habits, including a higher prevalence of skipping breakfast and worse nutritional balance compared with other generations⁴⁾. During the years spent as a university student, in contrast to the period prior to entering university, when life is typically managed more by parents or schools, it is important for young adults to have greater autonomy and starting controlling their own lifestyle. However, previous studies from both inside and outside of Japan have reported that more university students are engaged in unhealthy lifestyles, which includes poor dietary habits^{5~12)}.

Based on this background, “decreasing the preva-

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lence of breakfast skipping in the younger generation' has been established as one of the specific targets to extend healthy life expectancy in Japan. The results of several previous studies have indicated that breakfast consumption is an essential habit for maintaining a healthy lifestyle. Skipping breakfast has been shown to be related to fatigue, depressive symptoms, body mass index, bone mineral density among university students^{11,13~15}), heartbeat and out of breath, risk factors for cardiovascular disease (serum cholesterol, blood pressure), diabetes mellitus among employees or residents^{16~19}), and intellectual performance among men²⁰).

On the other hand, previous studies among university students have reported an association between breakfast consumption habits and other health-related habits; i.e., fruit and vegetable consumption^{21~23}), sleeping^{24~27}), smoking^{27,28}), and physical activity²⁹). Furthermore, an association has been reported between breakfast consumption habits and alcohol drinking in the population aged 12–80 years³⁰). Based on the results of those previous studies, breakfast consumption habits appear to play a central role among various health-related habits and to be associated with multiple healthy behaviors. That is, focusing on breakfast consumption habits among university students may be useful toward estimating individuals' overall lifestyle habits. However, there has been insufficient study on the associations between breakfast consumption habits and other health-related habits among university students. Furthermore, to our knowledge, no studies have comprehensively examined the association of breakfast consumption with multiple other health-related habits. Determining these associations would enable demonstration of both the importance of comprehending the status of breakfast consumption as an indicator of healthy lifestyle habits and a specific focus on the improvement of university students' lifestyle habits.

The present study aimed to examine the comprehensive association among breakfast consumption and multiple other health-related habits among university students.

II. METHODS

1. Participants and procedures

The study participants were 1,755 third- and fourth-year university students (including postgraduate students who had recently finished their undergraduate program) from among 17 academic departments in 14 universities in the Kanto, Kinki, Hokuriku, and Kyushu regions of Japan. The universities involved in this study were selected from the Listing of Universities Across Japan for 2013 (Association of Education), and are located in metropolitan areas or regional cities. Specifically, the survey request and questionnaire were sent by postal mail to universities located in four

regions; 14 universities agreed to participate in the study. After receiving consent from the universities, the survey request form and questionnaires for the corresponding number of students were sent by postal mail, and either the person in charge of the department or the researcher distributed an anonymous, self-administered questionnaire to the students at the universities. Participants were assured of their anonymity and the fact that they could withdraw from the study at any time without penalty. The self-completed anonymous questionnaires were either collected by the university and mailed to the researcher, or directly collected by the researcher. This study, which was conducted between May and October 2014, was approved by the Kanazawa University Medical Ethics Committee (April 28, 2014).

2. Measurements

Demographic variables. Data on the following demographic characteristics were collected: gender, age, affiliated department (science, humanities, medical), family constitution (two-generation, three-generation, other), number of siblings, number of years in residence, living with family members (yes or no), residence area (metropolitan areas: e.g., Kanto or Kinki region; regional cities: e.g., Hokuriku or Kyushu region).

Health-related habits. This study referred to the National Health and Nutrition Survey implemented by the Ministry of Health, Labour and Welfare³¹). Six elements that constitute a fundamental lifestyle for health promotion³²) were examined—nutrition and dietary habits, physical activity and exercise, rest, alcohol drinking, smoking, and oral health—and the following 15 items associated with six elements were formulated: four items, including breakfast (I usually try to have breakfast), nutritional balance (I have meals considering the nutritional balance), fruit and vegetable consumption (I try to consume fruits and vegetables), and snacking (I have a snack [including late-night snacks]); four items, including sports clubs (I exercise in sports clubs or circles), simple exercise for health (I try to do simple exercise for health.), physical activity in daily life (I try to move my body in daily life), and going out (I try to go out regularly); four items, including sleep quantity (I get enough sleep), sleep quality (I sleep well), staying up late (I stay up late), and rest (I try to relieve stress by resting). Responses were provided on a five-point scale ranging from 5) “always” to 1) “never”. Frequency of drinking alcohol was ranked as “every day”, “5–6 days a week”, “3–4 days a week”, “1–2 days a week”, “1–3 days a month”, or “1 day a month or less (never)”. Frequency of smoking was ranked as: “never smoker”, “nonsmoker”, “sometimes”, “1–10 cigarettes a day”, “11–20 cigarettes a day”, or “more than 21 cigarettes a day”. Frequency of tooth brushing was ranked as: “never”, “sometimes”, “once a day”,

“twice a day”, or “three times a day or more”.

3. Statistical analysis

Descriptive statistics were conducted to determine the participants' characteristics. The current state of health-related habits by gender was determined using descriptive statistics and the chi-square test. The relation between attribute variables and breakfast consumption was determined using the Student's *t*-test and the chi-square test. Breakfast consumption was divided into a high group, i.e., those who regularly consumed breakfast (“always” and “almost always”), and a low group, i.e., those who skipped breakfast (from “sometimes” to “never”). Sports clubs and exercise for health were divided into a high group, i.e., those who regularly engaged in physical activity (from “always” to “sometimes”), and a low group (“rarely” and “never”). Snacking and staying up late were divided into a high group (from “sometimes” to “never”) and a low group (“always” and “almost”). Similar to breakfast consumption, all other items were divided into a high group (“always” and “almost”) and a low group (from “sometimes” to “never”). In addition, frequency of drinking alcohol was classified as: “1 day a month or less (never)”, “1–3 days a month”, or “more than 1 day a week”. Frequency of smoking was classified as: “never smoker” or “smoker or nonsmoker.” Frequency of tooth brushing was classified as: “once a day or less”, “twice a day”, or “three times a day or more”.

Next, we conducted a multiple logistic regression analysis with breakfast consumption as the dependent variable to determine the relationships between breakfast consumption and various health-related habits. First, in the attributes adjustment model, which inputted age, gender, and attributes (i.e., affiliated department, living with family members, and residence area; “number of years in residence” was excluded because of the confirmed variance inflation factor for “living with family members”) that were significantly correlated with breakfast consumption as adjustment variables based on univariate analysis, the relation between breakfast consumption and one of the other health-related habits as the independent variable was analyzed respectively. Finally, the all variables adjustment model, which used all health-related habits except breakfast consumption as the independent variable, was analyzed. All analyses were conducted using SPSS 22.0 for Windows (IBM Inc., Tokyo, Japan). The significance level was set at $P < .05$.

III. RESULTS

In total, responses were received from 1,532 individuals (response rate: 87.3%). Of these, data from 1,408 participants were used in the analysis (valid response rate: 91.9%). The participants' demographic characteristics are shown in Table 1.

Table 1 Demographic characteristics of the sample population

	Total <i>n</i> = 1,408	Males <i>n</i> = 849	Females <i>n</i> = 559
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
	mean (SD)	mean (SD)	mean (SD)
Age	21.3(1.0)	21.4(1.1)	21.1(0.9)
Affiliated department			
Science	710(50.4)	613(72.2)	97(17.4)
Humanities	385(27.3)	200(23.6)	185(33.1)
Medical	313(22.2)	36(4.2)	277(49.6)
Family constitution (<i>n</i> = 1,392)			
Two-generation	959(68.9)	591(70.4)	368(66.5)
Three-generation	358(25.7)	201(24.0)	157(28.4)
Others	75(5.4)	47(5.6)	28(5.1)
Number of siblings			
None	134(9.5)	76(9.0)	58(10.4)
One	649(46.1)	376(44.3)	273(48.8)
Two	500(35.5)	315(37.1)	185(33.1)
Three or more	125(8.9)	82(9.7)	43(7.7)
Living with family members			
Yes	552(39.2)	280(33.0)	272(48.7)
No	856(60.8)	569(67.0)	287(51.3)
Number of years in residence (<i>n</i> = 1,405)			
4 years or less	854(60.8)	558(65.7)	296(53.2)
5–19 years	215(15.3)	118(13.9)	97(17.4)
20 years or more	336(23.9)	173(20.4)	163(29.3)
Residence area			
Metropolitan areas	451(32.0)	262(30.9)	189(33.8)
Regional cities	957(68.0)	587(69.1)	370(66.2)

Note. SD = standard deviation.

1. Current state of health-related habits based on gender (Table 2)

Regarding breakfast consumption habits, 197 (23.2%) males responded with “always”, 197 (23.2%) with “almost”, 180 (21.2%) with “sometimes”, 161 (19.0%) with “rarely”, and 114 (13.4%) with “never”, whereas 222 (39.7%) females responded with “always”, 165 (29.5%) with “almost”, 80 (14.3%) with “sometimes”, 53 (9.5%) with “rarely”, and 39 (7.0%) with “never”.

Considering the results of “sports clubs” and “simple exercise for health”, the prevalence of participants reporting no physical activity and exercise habits was 29.3% for males and 53.3% for females. Table 2 shows current states of other health-related habits by gender.

Table 2 Current state of health-related habits based on gender

	Total <i>n</i> = 1,408	Males <i>n</i> = 849	Females <i>n</i> = 559	<i>P</i> -value
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Nutrition and dietary habits				
Breakfast				
High (always or almost)	781 (55.5)	394 (46.4)	387 (69.2)	< .001
Low (sometimes or rarely or never)	627 (44.5)	455 (53.6)	172 (30.8)	
Nutritional balance				
High (always or almost)	414 (29.4)	229 (27.0)	185 (33.1)	.014
Low (sometimes or rarely or never)	994 (70.6)	620 (73.0)	374 (66.9)	
Fruit and vegetable consumption				
High (always or almost)	615 (43.7)	335 (39.5)	280 (50.1)	< .001
Low (sometimes or rarely or never)	793 (56.3)	514 (60.5)	279 (49.9)	
Snacking				
High (sometimes or rarely or never)	857 (60.9)	525 (61.8)	332 (59.4)	.358
Low (always or almost)	551 (39.1)	324 (38.2)	227 (40.6)	
Physical activity and exercise				
Sports clubs				
High (always or almost or sometimes)	611 (43.4)	433 (51.0)	178 (31.8)	< .001
Low (rarely or never)	797 (56.6)	416 (49.0)	381 (68.2)	
Simple exercise for health				
High (always or almost or sometimes)	650 (46.2)	464 (54.7)	186 (33.3)	< .001
Low (rarely or never)	758 (53.8)	385 (45.3)	373 (66.7)	
Physical activity in daily life				
High (always or almost)	595 (42.3)	382 (45.0)	213 (38.1)	.010
Low (sometimes or rarely or never)	813 (57.7)	467 (55.0)	346 (61.9)	
Going out				
High (always or almost)	510 (36.2)	323 (38.0)	187 (33.5)	.079
Low (sometimes or rarely or never)	898 (63.8)	526 (62.0)	372 (66.5)	
Rest				
Sleep quantity				
High (always or almost)	705 (50.1)	406 (47.8)	299 (53.5)	.037
Low (sometimes or rarely or never)	703 (49.9)	443 (52.2)	260 (46.5)	
Sleep quality				
High (always or almost)	752 (53.4)	422 (49.7)	330 (59.0)	< .001
Low (sometimes or rarely or never)	656 (46.6)	427 (50.3)	229 (41.0)	
Staying up late				
High (sometimes or rarely or never)	609 (43.3)	331 (39.0)	278 (49.7)	< .001
Low (always or almost)	799 (56.7)	518 (61.0)	281 (50.3)	
Rest				
High (always or almost)	686 (48.7)	411 (48.4)	275 (49.2)	.773
Low (sometimes or rarely or never)	722 (51.3)	438 (51.6)	284 (50.8)	
Alcohol drinking				
1 day a month or less (never)	512 (36.4)	273 (32.2)	239 (42.8)	< .001
1-3 days a month	504 (35.8)	301 (35.5)	203 (36.3)	
More than 1 day a week	392 (27.8)	275 (32.4)	117 (20.9)	
Smoking				
Never smoker	1,206 (85.7)	680 (80.1)	526 (94.1)	< .001
Smoker or nonsmoker	202 (14.3)	169 (19.9)	33 (5.9)	
Tooth brushing				
Three times a day or more	130 (9.2)	59 (6.9)	71 (12.7)	< .001
Twice a day	885 (62.9)	466 (54.9)	419 (75.0)	
Once a day or less	393 (27.9)	324 (38.2)	69 (12.3)	

Note. chi-square test.

Table 3 Relationship between breakfast consumption habits and demographic variables based on gender ($N=1,408$)

	Breakfast					
	Males			Females		
	High group	Low group	P -value ^{1,2)}	High group	Low group	P -value ^{1,2)}
	n (%)	n (%)		n (%)	n (%)	
Age (Mean \pm SD)	21.3 \pm 1.0	21.4 \pm 1.1	.129	21.0 \pm 0.9	21.2 \pm 1.0	.099
Affiliated department						
Science	282 (46.0)	331 (54.0)	.497	59 (60.8)	38 (39.2)	.046
Humanities	98 (49.0)	102 (51.0)		124 (67.0)	61 (33.0)	
Medical	14 (38.9)	22 (61.1)		204 (73.6)	73 (26.4)	
Family constitution ($n=1,392$)						
Two-generation	288 (48.7)	303 (51.3)	.084	255 (69.3)	113 (30.7)	.853
Three-generation	87 (43.3)	114 (56.7)		109 (69.4)	48 (30.6)	
Others	16 (34.0)	31 (66.0)		18 (64.3)	10 (35.7)	
Number of siblings						
None	35 (46.1)	41 (53.9)	1.000	43 (74.1)	15 (25.9)	.587
One	175 (46.5)	201 (53.5)		193 (70.7)	80 (29.3)	
Two	146 (46.3)	169 (53.7)		122 (65.9)	63 (34.1)	
Three or more	38 (46.3)	44 (53.7)		29 (67.4)	14 (32.6)	
Living with family members						
Yes	179 (63.9)	101 (36.1)	< .001	221 (81.3)	51 (18.8)	< .001
No	215 (37.8)	354 (62.2)		166 (57.8)	121 (42.2)	
Number of years in residence ($n=1,405$)						
4 years or less	220 (39.4)	338 (60.6)	< .001	173 (58.4)	123 (41.6)	< .001
5–19 years	67 (56.8)	51 (43.2)		74 (76.3)	23 (23.7)	
20 years or more	107 (61.8)	66 (38.2)		137 (84.0)	26 (16.0)	
Residence area						
Metropolitan areas	150 (57.3)	112 (42.7)	< .001	134 (70.9)	55 (29.1)	.541
Regional cities	244 (41.6)	343 (58.4)		253 (68.4)	117 (31.6)	

Note. 1) chi-square test; 2) t -test.

2. Relationship between breakfast consumption and attributes based on gender (Table 3)

No significant difference was seen between males and females in the mean age of the high and low groups in regard to breakfast consumption. Significantly more females were classified into the high group for “medicine” compared with “science” ($P = .046$). For males, no disparities were observed between affiliated departments. Significantly more males and females were classified into the high group for “living with family members” compared with “not living with family members” (both $P < .001$), and for “20 years or more in residence” compared with “4 years or less” and “5–19 years” (both $P < .001$).

3. Factors related to breakfast consumption

The results indicated relations between breakfast consumption and the 11 other health-related habits (see the attributes adjustment model in Table 4).

Next, a multiple logistic regression analysis was conducted with breakfast consumption as the dependent variable, and with all other health-related habits as the

independent variable, including the same adjustment variables as the model mentioned above (see the all variables adjustment model in Table 4). Relations were found between breakfast consumption and gender, affiliated department, living with family members, and residence area. After adjusting for the influence of these attributes, breakfast consumption was found to be significantly related to nine health-related habits: nutritional balance, fruit and vegetable consumption, simple exercise for health, physical activity in daily life, sleep quantity, sleep quality, (not) staying up late, frequency of drinking alcohol, and frequency of smoking. In the all variables adjustment model, the Nagelkerke R^2 was 0.342, and the predictive accuracy was 72.4%.

IV. DISCUSSION

1. Current state of health-related habits among university students

The present study clarified the current state of basic healthy lifestyles among university students. Only half

Table 4 Multiple logistic regression analysis with breakfast consumption habits as the dependent variable ($N=1,408$)

Dependent variables	Attributes adjustment model			<i>P</i> -value	All variables adjustment model			<i>P</i> -value
	OR	95%CI			OR	95%CI		
		lower	upper			lower	upper	
Nutritional balance (high = 1)	5.12	3.83	6.84	<.001	3.11	2.21	4.39	<.001
Fruit and vegetable consumption (high = 1)	3.06	2.41	3.88	<.001	1.56	1.16	2.09	.003
Snacking (high = 1)	0.97	0.77	1.23	.821	0.84	0.65	1.09	.195
Sports clubs (high = 1)	1.03	0.82	1.30	.807	0.87	0.66	1.15	.334
Simple exercise for health (high = 1)	1.78	1.41	2.25	<.001	1.33	1.00	1.78	.049
Physical activity in daily life (high = 1)	1.85	1.47	2.34	<.001	1.42	1.08	1.88	.013
Going out (high = 1)	1.37	1.08	1.73	.009	0.86	0.64	1.14	.283
Sleep quantity (high = 1)	2.57	2.04	3.26	<.001	1.66	1.24	2.22	<.001
Sleep quality (high = 1)	2.16	1.71	2.72	<.001	1.39	1.05	1.84	.022
Staying up late (high = 1)	2.09	1.66	2.64	<.001	1.59	1.22	2.07	<.001
Rest (high = 1)	1.54	1.23	1.92	<.001	0.96	0.74	1.26	.787
Alcohol drinking (1 day a month or less (never) = 1) ¹⁾	1.55	1.22	1.97	<.001	1.35	1.03	1.78	.029
Smoking (never smoker = 1)	2.04	1.47	2.84	<.001	1.64	1.13	2.38	.009
Tooth brushing (twice a day or more = 1) ²⁾	1.27	0.98	1.64	.070	1.11	0.83	1.48	.476
Age					0.87	0.77	0.99	.033
Gender (females = 1)					1.87	1.35	2.61	<.001
Affiliated department								
Humanities (reference)								
Science					1.28	0.92	1.78	.147
Medical					1.61	1.08	2.40	.019
Living with family members (yes = 1)					3.00	2.28	3.93	<.001
Residence area (metropolitan areas = 1)					0.71	0.54	0.95	.019

Note. OR = odds ratio; 95%CI = 95% confidence interval.

Adjustment variables (demographic variables): age, gender, affiliated department, living with family members, residence area.

All variables adjustment model:

Nagelkerke $R^2 = .342$

Hosmer-Lemeshow test: $P = .082$

Predictive accuracy = 72.4%

1) Frequency of drinking alcohol was divided into “never or one-day a month or less” and “other.”

2) Frequency of brushing the tooth was divided into “more than twice a day” and “other.”

or fewer of males regularly consumed breakfast, compared with about 70% of females. In other words, the results of this study indicated that more than 50% of males and 30% of females reported skipping breakfast. According to the results of the National Health and Nutrition Survey in Japan³³⁾, the prevalence of skipping breakfast among those aged in their twenties was higher than that among all generations 30 years or older (24.0% for males and 25.3% for females). The results of the present study showed that breakfast consumption habits among university students have become worse compared with the general population in their twenties. Only approximately 30% of both males and females had always considered the nutritional balance. This result was slightly low compared

with the results of a previous study (approximately 40%) among those in their twenties³³⁾. The results of the present study indicated that about 30% of male and 50% or more of female university students were not engaging in physical activity and maintaining good exercise habits. According to the results of a previous study among those in their twenties, 61.0% of males and 72.7% of females were not engaging in any physical activity or exercise throughout the week³³⁾. Therefore, the results of the present study indicate that university students engage in more physical activity or exercise habits than the general population in their twenties. Furthermore, about 40–50% of university students reported not getting enough sleep or being able to sleep well, and for 50–60% reported always

staying up late. A previous study among the general population in their twenties reported that 37.1% of the participants felt like they had deficient amounts of sleep (lack of sleep) and that 27.1% were not satisfied with their sleep quality³³⁾. Therefore, the results of this study demonstrated that university students had insufficient sleep habits. For alcohol drinking, about 30% of male and 40% of female university students reported drinking “1 day a month or less (never)”. This result was a lower prevalence than that reported in a previous study among those in their twenties, i.e., 51.2% for males and 62.1% for females³³⁾. In other words, university students consumed more alcohol. The results of the present study suggest that about 80% of males and more than 90% of females were never smoking university students. A previous study among those in their twenties reported that 65.9% of males and 89.9% of females were never smokers³³⁾. Therefore, the results of this study suggest that university students are more frequently never smokers. Of all generations 20 years or older, never smokers were the highest prevalence among those aged in their twenties³³⁾. Therefore, the results of this study may reflect the spread of health education and the construction of the social environment with regard to never smoking for the younger generation.

On the basis of the above, although those who participated in the 2015 National Health and Nutrition Survey, with which the results of this study were compared, may have healthier lifestyle habits than the general population, it was suggested that university students had less healthy lifestyles compared with a similar generation, particularly for nutrition and dietary habits, rest, and alcohol drinking. A previous study reported that health-related habits among those in their twenties worsen more than those at other life stages⁴⁾. Previous studies both inside and outside of Japan have also reported that lifestyles among university students decrease remarkably and that they engage in unhealthy behaviors^{5,7,9~11)}. It is considered that during this period, an individual's lifestyle habits are reconstructed, and these direct the lifestyle habits of subsequent life stages. Therefore, it is necessary to consider the period in which students enter university as the starting point for risky lifestyle behaviors in order to promote a healthy lifestyle.

2. Relations between breakfast consumption habits and other health-related habits

It was also found that breakfast consumption habits was positively related with multiple health-related habits; i.e., better nutritional balance, fruit and vegetable consumption, simple exercise for health, physical activity in daily life, enough sleep quantity, sleep quality, not staying up late, lower alcohol drinking, and lesser smoking. Previous studies have reported relations between breakfast consumption habits (or skipping breakfast) and fruit and vegetable

consumption^{21~23)}, sleep^{24~27)}, smoking^{27,28)}, and physical activity²⁹⁾. Additionally, the results of this study clarified the connections among breakfast consumption and nutritional balance, physical activity in daily life, and alcohol drinking. Furthermore, the present study examined the comprehensive relation between breakfast consumption habits and other health-related habits. The results suggest that students who regularly consume breakfast have more favorable behaviors regarding various other health-related habits. Accordingly, breakfast consumption status showed potential as an indicator for understanding individuals' overall health-related habits. That is, we consider breakfast consumption habits as core one of indicator for elucidating university students with high-risk health-related habits. For example, students who skip breakfast are at high risk for lifestyle habits; thus, their various other lifestyle habits can be checked as a next step, leading to specific health interventions.

3. Limitations and future directions

This study targeted certain universities in four regions of Japan, and questionnaire requests were made by department unit. It therefore may have been somewhat biased in terms of representation of Japanese university students. Regarding the adjustment variables in the analysis in this study—namely, gender, affiliated department, living with family members, and residence area—future study will need to verify these results via analyses among target groups with equivalent attributes. The investigation items relating to health-related habits in this study were produced based on six elements that constitute a fundamental lifestyle for health promotion³²⁾, with reference to the National Health and Nutrition Survey in Japan. That notwithstanding, consideration should still be given to whether this covers the health-related lifestyle habits of university students. Additionally, the present study used a cross-sectional design. It is also necessary to study the potential for maintaining the habit of eating breakfast to lead to improvements in individuals' overall lifestyle habits. Thus, by implementing a cross-sectional study and intervention with a focus on this habit, the effects on other health-related lifestyle habits should be verified over time.

V. CONCLUSION

This study clarified the status quo of university students' unhealthy lifestyle habits. The study further revealed the connections among breakfast consumption and various health-related habits, such as nutritional balance, fruit and vegetable consumption, simple exercise for health, physical activity in daily life, sleep quantity, sleep quality, staying up late, alcohol drinking, and smoking. Accordingly, comprehension of the breakfast consumption status of university students may be used as core one of indicator for identifying those with high-risk health-related habits, who

are targets for support.

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None declared.

References

- 1) Ministry of Health, Labour and Welfare (MHLW). Annual Health, Labour and Welfare Report 2013-2014: For the Realization of a Society of Health and Longevity. 2014a. <http://www.mhlw.go.jp/wp/hakusyo/kousei/14/dl/1-02-1.pdf> (accessed December 8, 2016).
- 2) Ministry of Health, Labour and Welfare (MHLW). Health Japan 21 (the second term): Analysis and Assessment Project. 2015a. http://www.mhlw.go.jp/seisakunitsuite/bunya/kenkou_iryuu/kenkou/kenkounippon21/en/kenkounippon21/mokuyou.html (accessed December 8, 2016).
- 3) Ministry of Health, Labour and Welfare (MHLW). Secondary Basic Plan for the Promotion of Dietary Education. 2011. <https://www.mhlw.go.jp/file/06-Seisakujouhou-10900000-Kenkoukyoku/01-03.pdf> (accessed December 14, 2017). (in Japanese).
- 4) Ministry of Health, Labour and Welfare (MHLW). Tertiary Basic Plan for the Promotion of Dietary Education. 2016. <https://www.mhlw.go.jp/file/06-Seisakujouhou-10900000-Kenkoukyoku/shokuiku1.pdf> (accessed December 14, 2017). (in Japanese).
- 5) Ansari WE, Stock C, John J, et al. Health promoting behaviours and lifestyle characteristics of students at seven universities in the UK. *Cent Eur J Public Health* 2011; 19: 197-204.
- 6) von Bothmer MIK, Fridlund B. Gender differences in health habits and in motivation for a healthy lifestyle among Swedish university students. *Nurs Health Sci* 2005; 7: 107-118.
- 7) Moreno-Gómez C, Romaguera-Bosch D, Tauler-Riera P, et al. Clustering of lifestyle factors in Spanish university students: the relationship between smoking, alcohol consumption, physical activity and diet quality. *Public Health Nutr* 2012; 15: 2131-2139.
- 8) Date M, Kashizuka S, Kitajima M, et al. Survey of health and lifestyle habits for women's university students. *Bulletin of Mukogawa Women's University* 2011; 59: 97-106.
- 9) Tokunaga M, Hashimoto K. Health and life habits: differences between age groups and changes from the beginning to the closing of school term. *J Health Sci* 2002; 24: 57-67 (in Japanese).
- 10) Haase A, Steptoe A, Sallis JF, et al. Leisure-time physical activity in university students from 23 countries: associations with health beliefs, risk awareness, and national economic development. *Prev Med* 2004; 39: 182-190.
- 11) Lovell GP, Nash K, Sharman R, et al. A cross-sectional investigation of depressive, anxiety, and stress symptoms and health-behavior participation in Australian university students. *Nurs Health Sci* 2015; 17: 134-142.
- 12) Australian Bureau of Statistics. 4364.0.55.001 - Australian Health Survey: First Results, 2011-12. 2012. <http://www.abs.gov.au/ausstats/abs@.nsf/lookup/4364.0.55.001main+features12011-12> (accessed February 23, 2016).
- 13) Tanaka M, Mizuno K, Fukuda S, et al. Relationships between dietary habits and the prevalence of fatigue in medical students. *Nutrition* 2008; 24: 985-989.
- 14) Goto M, Kiyohara K, Kawamura T. Lifestyle risk factors for overweight in Japanese male college students. *Public Health Nutr* 2010; 13: 1575-1580.
- 15) Nagata K, Yoshida M, Ishimoto T, et al. Skipping breakfast and less exercise are risk factors for bone loss in young Japanese adults: a 3-year follow-up study. *J Bone Miner Metab* 2014; 32: 420-427.
- 16) Yanagita M, Tsuchiya M, Ishihara K. Factors associated with skipping breakfast among male factory employees. *Doshisha Journal of Health & Sports Science* 2010; 2: 54-60.
- 17) Maruyama K, Kiyama M, Sato S, et al. A cross-sectional study of the associations between skipping breakfast and cardiovascular risk factors: circulatory risk in communities study. *Japanese Journal of Cardiovascular Disease Prevention* 2015; 50: 14-26.
- 18) Sakata K, Matsumura Y, Yoshimura N, et al. Relationship between skipping breakfast and cardiovascular disease risk factors in the national nutrition survey data. *Jpn J Public Health* 2001; 40: 837-841.
- 19) Uemura M, Yatsuya H, Hilawe EH, et al. Breakfast skipping is positively associated with incidence of type 2 diabetes mellitus: evidence from the Aichi workers' cohort study. *J Epidemiol* 2015; 25: 351-358.
- 20) Higuchi T, Hamada K, Irie S. The effect of breakfast omission and breakfast type on body temperature, mood and intellectual performance. *J Jpn Soc Clin Nutr* 2007; 29: 35-43.
- 21) Laska MN, Hearst MO, Lust K, et al. How we eat what we eat: identifying meal routines and practices most strongly associated with healthy and unhealthy dietary factors among young adults. *Public Health Nutr* 2014; 18: 2135-2145.
- 22) Azadbakht L, Haghighatdoost F, Feizi A, et al. Breakfast eating pattern and its association with dietary quality indices and anthropometric measurements in young women in Isfahan. *Nutrition* 2013; 29: 420-425.
- 23) Fujii H, Nakano T, Muto T, et al. Skipping breakfast is associated with poor vegetable intake among college students in Japan. *Dokkyo J Med Sci* 2010; 37: 47-54.
- 24) Cheng SH, Shih CC, Lee IH, et al. A study on the sleep quality of incoming university students. *Psychiatry Res* 2012; 197: 270-274.
- 25) Wang L, Qin P, Zhao Y, et al. Prevalence and risk factors of poor sleep quality among Inner Mongolia Medical University students: A cross-sectional survey. *Psychiatry Res* 2016; 244: 243-248.
- 26) Sun J, Yi H, Liu Z, et al. Factors associated with skipping breakfast among Inner Mongolia Medical students in China. *BMC Public Health* 2013; 13:42: 1-8.
- 27) Yasugi H, Nishiyama M, Ohishi K. Lifestyle and breakfast-skipping among Japanese co-medical university students. *Dokkyo J Med Sci* 2008; 35: 101-107.
- 28) Kiyohara K, Kawamura T, Kitamura T, et al. The start of smoking and prior lifestyles among Japanese college students: a retrospective cohort study. *Nicotine Tob*

- Res 2010; 12: 1043–1049.
- 29) Pengpid S, Peltzer K, Kassean HK, et al. Physical inactivity and associated factors among university students in 23 low-, middle- and high-income countries. *Int J Public Health* 2015; 60: 539–49.
- 30) Chen J, Cheng J, Liu Y, et al. Associations between breakfast eating habits and health-promoting lifestyle, suboptimal health status in Southern China: a population based, cross sectional study. *J Transl Med* 2014; 12:348: 1–10.
- 31) Ministry of Health, Labour and Welfare (MHLW). National Health and Nutrition Survey. 2014b. <http://www.mhlw.go.jp/toukei/chousahyo/index.html#tyousahyou> (accessed December 8, 2016).
- 32) Minister of Health, Labour and Welfare (MHLW), A Basic Direction for Comprehensive Implementation of National Health Promotion, 2012. 2012. <https://www.mhlw.go.jp/file/06-Seisakujouhou-10900000-Kenkoukyoku/0000047330.pdf> (accessed September 5, 2018).
- 33) Ministry of Health, Labour and Welfare (MHLW). The National Health and Nutrition Survey in Japan, 2015. 2015b. <https://www.mhlw.go.jp/bunya/kenkou/eiyou/h27-houkoku.html> (accessed September 5, 2018).

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