Original Article

Factors associated with irregular breakfast consumption among high school students in a Japanese community

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Background and Objectives: This study evaluated the associations between the characteristics of high school students and irregular breakfast consumption and explored the association with knowledge regarding diet and dietary education in a community in Japan. **Methods and Study Design:** A cross-sectional survey using a self-administered questionnaire was conducted in 2007 among all the high school students in the second grade in Imari, Saga. Data for 318 male and 292 female students were analyzed. Irregular breakfast consumption was defined as consuming breakfast three times or less in a week. The associations between the characteristics of students and irregular breakfast consumption were assessed using logistic regression with adjustments for sex and school. **Results:** Among male students, a strong association between the consumption of juice or pop and irregular breakfast consumption was observed (OR comparing "≥2 servings" vs "rarely"=8.97, 95% CI=2.99–26.9). The associations with wake times and bed times were strong among male students, and the association with regular bowel movements was strong among female students. Students who had knowledge of regional agricultural and livestock products were more likely to consume breakfast regularly, and this association was significant among female students (OR=2.89, 95% CI=1.23–6.82). Significant associations were also observed with the consumption of snacks, and traditional greeting before meals. **Conclusions:** Several characteristics, including specific knowledge, were associated with the irregular consumption of breakfast. The results are of interest to policy makers, nutrition specialists, and educators working to enhance regular breakfast consumption among students.

Key Words: students, breakfast, knowledge, carbonated beverages, Japanese

INTRODUCTION

More than 10% of late teenagers reportedly skip breakfast in Japan.[1] The effect of skipping breakfast on the health of youths has been studied in numerous studies, and an association with the inadequate intake of nutrients as well as being overweight and having a high plasma cholesterol level has been reported.[2-9] These findings imply that the current and possibly future health of children and adolescents can be improved by encouraging them to consume breakfast regularly. Identifying youths who are likely to skip breakfast or to consume it irregularly would be helpful for targeting intervention efforts for students. Studies conducted in the USA and other Western countries have reported such characteristics;[10-15] however, limited number of such studies have been conducted among Asian populations or among populations in Japan.[11,16,17] In addition, certain knowledge is thought to influence diet and eating habits, but studies among students are scarce. A few studies have reported an association between knowledge of nutrition and its related attitudes or behaviours among school children, but other types of knowledge regarding diet have not been assessed.[18,19]

The aim of the current study was to identify factors associated with irregular breakfast consumption among male and female high school students in Imari, Japan. Knowledge related to regional diet and dietary education was also explored to evaluate its association with students' irregular consumption of breakfast.

MATERIALS AND METHODS
Subjects
Imari city, located in Saga, Japan, declared a policy of building a community with good dietary habits in 2005.[20] As part of the effort to implement this declaration, the

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city conducted a survey among high school students in 2007, aiming to obtain fundamental information on dietary education. The data evaluated in the current study was obtained from this survey. The methods have been previously described,[21] but briefly, all the students who were in the second grade of high school in Imari were asked to participate in the study. There were four high schools in Imari at that time, and 650 students were enrolled. Data for 610 students was available, and the participation rate was 93%. The majority of students were between the ages of 16-17 years old, and none of the students were younger than 16 years old. The study protocol was presented to the ethics committee of the National Institute of Public Health in Japan, and it was declared to be exempt from committee review (NIPH-TRN# 12001).

Definition of irregular breakfast consumption

All the data were collected using an anonymous, self-administered questionnaire. In the questionnaire, students were asked, "Do you eat breakfast?" and were instructed to select an answer from among four categories ("everyday", "4-5 days a week", "2-3 days a week", and "I rarely eat breakfast"). Students who answered that they ate breakfast 3 days a week or less were classified as irregular breakfast eaters. A preliminary analysis was previously reported.[20] About 9% of the students answered that they rarely ate breakfast, 4% of them answered that they ate breakfast 2-3 times a week, 10% of them answered that they ate breakfast 4-5 times a week, and more than 75% of them answered that they ate breakfast every day.[21]

Measures

The students' dietary habits were surveyed by asking the following questions: "Do you eat snacks?", "How much juice or pop do you drink a day?", "Do you finish the food on your plate?", "With whom do you usually eat dinner?", "Do you help cooking meals?", "Do you say *Itadaki-masu* and *Gochiso-sama?*", and "Is the TV kept turned on during mealtime?" In Japan, any cold fruit-flavored drinks that do not contain alcohol are customarily cold juices. *Itadaki-masu* and *Gochiso-sama* are the traditional phrases that are said before and after a meal in Japan.

Whether their bowel movements were regular or irregular was also asked in the questionnaire. Their wake times and bed times on school days were asked, and the length of sleep was calculated from the responses. To analyze the wake time, bed time, and length of sleep, the students were classified into two groups according to the median value.

Factors related to knowledge of diet and dietary education were surveyed by asking the following questions: "Have you ever eaten ritual foods in Imari?", "Do you know about the regional agricultural and livestock products in Imari?", "Do you know the word "*Shokuiku* (a term for dietary education used mainly in public administration)?", and "Have you ever seen the graphical representation of the Japanese Food Guide Spinning Top?" The Japanese Food Guide Spinning Top was developed by the Ministry of Health, Labour and Welfare, and the Ministry of Agriculture, Forestry and Fishery to depict the ideal general diet for Japanese people (Figure 1).[22,23]

Statistical analysis

Associations between irregular breakfast consumption and the characteristics of the students were assessed using a logistic regression analysis with adjustments for sex and school, and the OR and 95% CI were calculated. We also tested trends across the categories of consumption of snacks, dinner with family members, frequency of helping to cook meals, and saying traditional phrases by assigning equally spaced scores to the categories and treating the variables as continuous. A stratified analysis according to sex was also conducted. Several students did not provide answers for specific questions, and these students were excluded from the analysis associated with the specific question. The rate of missing values was 1.4% or less. All the analyses were performed using IBM SPSS Statistics version 19 (IBM Corporation, Armonk, NY, US).

RESULTS

Table 1 summarizes the associations between irregular breakfast consumption and the characteristics of the students. Students who rarely ate snacks were more likely to consume breakfast irregularly than those who ate snacks every day, and there was a significant trend across the categories of consumption. Students who consumed two or more servings of juice or pop per day were approximately six times more likely to consume breakfast irregularly than were students who rarely consumed such beverages, and there was a borderline significant trend across the categories of consumption. Students who rarely said traditional phrases before and after a meal were significantly more likely to be irregular breakfast eaters than were those who always stated the phrases, and there was a significant trend across categories of frequency. Students who reported irregular bowel movements were more likely to consume breakfast irregularly than students whose bowel movements were regular. Students who did not have knowledge of regional agricultural and livestock products in Imari were significantly more likely to consume breakfast irregularly than those who had such knowledge. Students who woke up after 7:00 AM and who went to bed after midnight on school days were significantly more likely to consume breakfast irregularly, compared with their respective counterparts. Having dinner with one's family was not associated with the irregular consumption of breakfast.

Table 2 and Table 3 summarize the associations between irregular breakfast consumption and the characteristics of the students stratified according to sex. Among male students, those who less frequently consumed snacks were borderline significantly more likely to eat breakfast irregularly. Among male students, those who consumed two or more servings of juice or pop were almost nine times more likely to consume breakfast irregularly than those who rarely consumed juice or pop, and there was a significant trend across categories of consumption. In contrast, this association was not significant among female students. Likewise, saying traditional phrases before and after a meal as well as the wake time and bed time were significantly associated with irregular breakfast consumption only among male students; there was also a significant trend across categories of frequency.

Table 1. Association between characteristics and irregular breakfast consumption among 610 high school students in the second grade in Imari, Saga, Japan

	Analyzed n[†]	OR adjusted for sex and school	95% CI	p-value for trend
Sex[‡]				
Women	292	1.00		
Men	318	1.26	(0.73 to 2.16)	
School[§]				
A	220	1.00		
B	149	1.56	(0.68 to 3.58)	
C	109	3.14	(1.44 to 6.85)	
D	132	6.54	(3.22 to 13.3)	
Consumption of snacks				
Everyday	134	1.00		0.02
4-5 in a week	113	1.09	(0.43 to 2.76)	
2-3 in a week	188	1.37	(0.64 to 2.90)	
Rarely	172	2.21	(1.07 to 4.56)	
Consumption of juice or pop in a day (one serving was defined as 500 mL)				
Rarely	240	1.00		0.05
1/2 Serving	155	1.05	(0.53 to 2.10)	
About 1 serving	186	0.95	(0.51 to 1.76)	
2 servings or more	29	5.99	(2.39 to 15.0)	
Finish the food on your plate				
Rarely leave the food	401	1.00		0.24
Almost rarely leave the food	164	0.91	(0.50 to 1.64)	
Frequently - almost always leave the food	44	2.25	(0.96 to 5.24)	
Family dinner				
With all family members	220	1.00		0.99
With some of the family members	278	0.76	(0.44 to.1.33)	
Eat dinner alone, or do not eat dinner	112	1.10	(0.56 to 2.15)	
Help cooking meals				
Everyday	81	1.00		0.79
4-5 in a week	101	1.76	(0.73 to 4.25)	
2-3 in a week	133	0.47	(0.16 to 1.41)	
Rarely	294	1.37	(0.62 to 3.04)	
Saying traditional phrases before and after a meal				
Always	174	1.00		0.01
Almost always	189	1.01	(0.53 to 2.03)	
Sometimes	101	0.78	(0.33 to 1.85)	
Rarely	146	2.34	(1.23 to 4.47)	
Keep the TV turned on during meals				
No	82	1.00		
Yes	526	1.61	(0.69 to 3.72)	
Bowel movement				
Regular	367	1.00		
Irregular	239	2.08	(1.23 to 3.51)	
Wake time				
7:00 AM or earlier	373	1.00		
Later than 7:00 AM	236	2.35	(1.41 to 3.94)	
Bed time				
Midnight or earlier	504	1.00		
After midnight	106	2.79	(1.57 to 4.96)	
Length of sleep				
7 hours or longer	320	1.00		
Less than 7 hours	289	1.41	(0.84 to 2.37)	
Knowledge of regional ritual foods				
Yes	356	1.00		
No	248	1.48	(0.85 to 2.60)	
Knowledge of regional agricultural and livestock products				
Yes	454	1.00		
No	154	2.05	(1.22 to 3.46)	
Know a Japanese term for dietary education, which is mainly used in public administration				
Know	347	1.00		
Do not know	261	1.25	(0.76 to 2.06)	
Knowledge of the graphical representation of the Japanese Food Guide Spinning Top				
Yes	380	1.00		
No	226	0.83	(0.50 to 1.40)	

[†]Only individuals whose information is available are included for the analysis. [‡]OR adjusted for school. [§]OR adjusted for sex.

Table 2. Association between characteristics and irregular breakfast consumption among 318 male high school students in the second grade in Imari, Saga, Japan

	Analyzed n[†]	OR adjusted for school	95% CI	p-value for trend
School[‡]				
A	102	1.00		
B	52	2.09	(0.64 to 6.83)	
C	61	3.92	(1.39 to 11.07)	
D	103	5.97	(2.35 to 15.17)	
Consumption of snacks				
Everyday	64	1.00		
4-5 in a week	53	1.34	(0.41 to 4.40)	
2-3 in a week	111	1.47	(0.56 to 3.84)	0.05
Rarely	89	2.52	(0.98 to 6.49)	
Consumption of juice or pop in a day (one serving was defined as 500 mL)				
Rarely	101	1.00		
1/2 Serving	74	2.04	(0.83 to 5.02)	
About 1 serving	120	1.16	(0.50 to 2.68)	0.02
2 servings or more	23	8.97	(2.99 to 26.92)	
Finish the food on your plate				
Rarely leave the food	231	1.00		
Almost rarely leave the food	70	0.68	(0.31 to 1.53)	
Frequently - almost always leave the food	16	2.03	(0.58 to 7.11)	
Family dinner				
With all family members	109	1.00		
With some of the family members	144	0.75	(0.37 to 1.53)	0.88
Eat dinner alone, or do not eat dinner	65	1.29	(0.57 to 2.94)	
Help cooking meals				
Everyday	32	1.00		
4-5 in a week	47	1.87	(0.57 to 6.13)	
2-3 in a week	57	0.27	(0.05 to 1.50)	0.95
Rarely	181	1.29	(0.45 to 3.68)	
Saying traditional phrases before and after a meal				
Always	94	1.00		
Almost always	94	1.08	(0.44 to 2.67)	
Sometimes	43	0.80	(0.25 to 2.50)	0.01
Rarely	87	2.82	(1.27 to 6.28)	
Keep the TV turned on during meals				
No	42	1.00		
Yes	274	1.78	(0.59 to 5.37)	
Bowel movement				
Regular	225	1.00		
Irregular	91	1.82	(0.94 to 3.54)	
Wake time				
7:00 AM or earlier	171	1.00		
Later than 7:00 AM	141	2.41	(1.24 to 4.67)	
Bed time				
Midnight or earlier	258	1.00		
After midnight	60	2.82	(1.38 to 5.79)	
Length of sleep				
7 hours or longer	172			
Less than 7 hours	146	1.48	(0.77 to 2.85)	
Knowledge of regional ritual foods				
Yes	170	1.00		
No	145	1.42	(0.70 to 2.88)	
Knowledge of regional agricultural and livestock products				
Yes	231	1.00		
No	87	1.74	(0.92 to 3.43)	
Know a Japanese term for dietary education, which is mainly used in public administration				
Know	165	1.00		
Do not know	151	1.27	(0.68 to 2.37)	
Knowledge of the graphical representation of the Japanese Food Guide Spinning Top				
Yes	177	1.00		
No	141	0.48	(0.25 to 0.93)	

[†]Only individuals whose information is available are included for the analysis.
[‡]OR obtained by a bivariate analysis

Table 3. Association between characteristics and irregular breakfast consumption among 292 female high school students in the second grade in Imari, Saga, Japan

	Analyzed n[†]	OR adjusted for school	95% CI	p-value for trend
School[‡]				
A	118	1.00		
B	97	1.23	(0.38 to 3.95)	
C	48	2.17	(0.63 to 7.48)	
D	29	9.82	(3.20 to 30.2)	
Consumption of snacks				
Everyday	70	1.00		0.18
4-5 in a week	60	0.83	(0.18 to 3.84)	
2-3 in a week	77	1.38	(0.39 to 4.80)	
Rarely	83	1.96	(0.62 to 6.19)	
Consumption of juice or pop in a day (one serving was defined as 500 mL)				
Rarely	139	1.00		0.86
1/2 Serving	81	0.35	(0.09 to 1.29)	
About 1 serving	66	0.86	(0.32 to 2.32)	
2 servings or more	6	2.22	(0.23 to 21.2)	
Finish the food on your plate				
Rarely leave the food	170	1.00		0.15
Almost rarely leave the food	94	1.33	(0.53 to 3.34)	
Frequently - almost always leave the food	28	2.58	(0.78 to 8.60)	
Family dinner				
With all family members	111	1.00		0.45
With some of the family members	134	0.74	(0.30 to 1.82)	
Eat dinner alone, or do not eat dinner	47	0.77	(0.22 to 2.70)	
Help cooking meals				
Everyday	49	1.00		0.69
4-5 in a week	54	1.72	(0.44 to 6.71)	
2-3 in a week	76	0.76	(0.17 to 3.36)	
Rarely	113	1.55	(0.45 to 5.37)	
Saying traditional phrases before and after a meal				
Always	80	1.00		0.45
Almost always	95	0.86	(0.28 to 2.62)	
Sometimes	58	0.78	(0.21 to 2.94)	
Rarely	59	1.62	(0.52 to 5.05)	
Keep the TV turned on during meals				
No	40	1.00		
Yes	252	1.45	(0.39 to 5.42)	
Bowel movement				
Regular	142	1.00		
Irregular	148	2.78	(1.12 to 6.89)	
Wake time				
7:00 AM or earlier	202	1.00		
Later than 7:00 AM	89	2.16	(0.93 to 5.05)	
Bed time				
Midnight or earlier	246	1.00		
After midnight	46	2.37	(0.88 to 6.38)	
Length of sleep				
7 hours or longer	148	1.00		
Less than 7 hours	143	1.18	(0.49 to 2.83)	
Ever eaten ritual foods in Imari				
Yes	186	1.00		
No	103	1.64	(0.64 to 4.19)	
Know the regional agricultural and livestock products in Imari				
Yes	223	1.00		
No	67	2.89	(1.23 to 6.82)	
Know a Japanese term for dietary education, which is mainly used in public administration				
Know	182	1.00		
Do not know	110	1.15	(0.49 to 2.70)	
Having seen the graphical representation of the Japanese Food Guide Spinning Top				
Yes	203	1.00		
No	85	2.36	(0.99 to 5.62)	

[†]Only individuals whose information is available are included for the analysis.
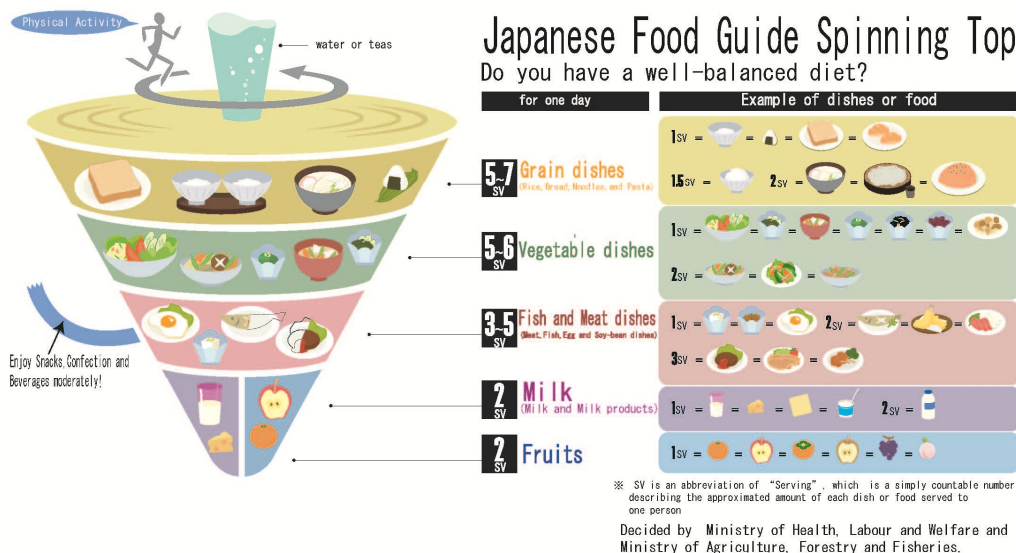[‡]OR obtained by a bivariate analysis.

Figure 1. Graphical representation of the Japanese Food Guide Spinning Top. (Source: Ministry of Health, Labour and Welfare and Ministry of Agriculture, Forestry and Fisheries, Japan)

Irregular bowel movement was significantly associated with breakfast consumption only among female students. A mixed association between irregular breakfast consumption and knowledge of the Japanese Food Guide Spinning Top was observed according to sex. Female students who had never seen the Japanese Food Guide Spinning Top were borderline significantly more likely to consume breakfast irregularly than the students who had seen the guide. The opposite association was observed among male students, and those who had never seen the Japanese Food Guide Spinning Top were significantly less likely to consume breakfast irregularly than the students who had seen the guide.

DISCUSSION

The current study observed the associations between irregular breakfast consumption and the characteristics of high school students in Imari city in Japan. The consumption of juice or pop was strongly associated with irregular breakfast consumption. The consumption of snacks, irregular bowel movements, sleeping habits, and not having knowledge of regional agricultural and livestock products were also significantly associated with irregular breakfast consumption. Studies evaluating characteristics associated with skipping breakfast among youths are still limited in Asian countries; therefore the current study provides valuable information.

Irregular breakfast consumption was strongly associated with the consumption of a large amount of juice or pop, especially among male students. We do not know the reason for the difference by sex, but more male students replied that they consumed juice or pop of approximately 1 serving or more in a day (44.9%) than did female students (24.7%), and the distribution could explain it. Students who skipped breakfast may have tried to ease cravings for food in an easy manner, by drinking juice or pop. On the other hand, irregular breakfast eaters were less likely to consume snacks, implying that such students were unlikely to compensate for the intake of necessary nutrients by snacking. The results suggest that the overall quality of the total nutritional intake in irregular breakfast eaters may have been poorer than that for students who consumed breakfast regularly. Poor nutrient intake among children and adolescents who skipped breakfast has been previously reported.[2,7,8,24]

Previous studies have consistently reported that children or adolescents who usually have family dinners are more likely to consume breakfast regularly,[4,9,25-27] but having family dinners was not associated with regular breakfast consumption among students in the current study. Interestingly though, saying traditional phrases before and after a meal was associated with breakfast consumption. We observed a significant association among male students; however an insignificant association was also implied among female students. The students may have obtained this tradition through having meals with family members when they were children. These students may have had a custom of having family dinners during childhood but were not participating in such a custom at the time of the questionnaire. This result implies the importance of family dinners and dietary education in the family for children, with the benefits possibly persisting until late adolescence.

The association between irregular bowel movements and the irregular consumption of breakfast was significant only among female students. Similar to the results of the current study, an association between skipping breakfast and irregular bowel movements was reported in a study examining female college students and in another study examining working women in Japan.[28,29] Women who do not consume breakfast regularly may be more susceptible to irregular bowel movements than men who do not consume breakfast regularly. Several previous studies reported that constipation was more common in women than in men.[30-32] However, the point estimate of the OR indicated a similar trend among male students as well.

Studies evaluating knowledge and breakfast consumption in students are scarce, and to our knowledge, no pre-

vious study has assessed the association between knowledge regarding dietary education and regular breakfast consumption. Previous studies have reported inconsistent results regarding the association between knowledge of nutrition and dietary behaviour among school children and university students.[18,19,33,34] In the current study, knowledge of regional agriculture and livestock products was associated with regular breakfast consumption, and the association was stronger among female students than among male students. Female students who were interested in local specialty products might be more conscious of the importance of diet. Knowledge of diets based on their community might be associated with a consciousness regarding their own health and with maintaining a healthy attitude towards eating. However, the association between knowing the Japanese Food Guide Spinning Top and the consumption of breakfast showed mixed results according to sex. The reason for this difference by sex remains unknown. Different approaches for male and female students may be required for certain topics in dietary education.

Because of the cross-sectional design of the study, a cause-effect relationship between the identified characteristics of the students and irregular breakfast consumption could not be revealed. Yet, for the purpose of making recommendations for modifying the habit of irregular breakfast consumption, we deliberately proposed recommendations for students based on the implied findings. Among the factors that showed significant association with irregular breakfast consumption, the most plausible factors that could contribute to modifying students' breakfast habits would be their bed times and waking times. Saving time for eating breakfast before going to school would be feasible way to change the habit. Although the length of sleep was not associated with irregular breakfast consumption in our study, previous studies from Japan have reported that students whose sleep lengths were shorter, or extremely longer were more likely to skip breakfast.[17,35] In addition, having a family custom of eating together and dietary education specified for regional products may give weigh to the students' understanding of the importance of desirable dietary habits.

In addition to the cross-sectional design, the current study had several limitations. Because of the cross-sectional design of the study, a cause-effect relationship between the identified characteristics of the students and irregular breakfast consumption could not be revealed. Several important predictors for skipping breakfast among children or adolescents, including overweight or obesity and parental education,[2,4] were not evaluated in the current study. Although the factors associated with skipping breakfast among Japanese high school students were implied in the current study, its actual health consequences cannot be revealed in this study because information such as obesity, menstrual status or history of disease is not available. Likewise, nutrient intake cannot be evaluated from the status of skipping breakfast in this study. The strengths of the current study were that all the second-grade students enrolled in high schools in the community were invited to participate in the study and that the participation rate was relatively high.

The current study among high school students in a Japanese community identified several characteristics that were associated with irregular breakfast consumption: namely, the consumption of a large amount of juice or pop, minimal snacking, irregular bowel movements, going to bed late, and waking up late. Knowledge of the regional agricultural and livestock products was implied to be associated with the habitual consumption of breakfast, especially among female students. Research in this field should be valued, as it would provide beneficial information for professionals who are engaged in dietary education. Further research examining students' knowledge and education, which might modify their attitudes towards healthy eating habits, is needed.

AUTHOR DISCLOSURES
The authors declare that there are no conflicts of interest.

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Original Article

Factors associated with irregular breakfast consumption among high school students in a Japanese community

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日本社区高中学生不规律早餐消费相关因素分析

背景与目的：该研究分析了高中生的特点与不规则早餐消费间的关系，探讨了日本社区饮食相关知识与饮食教育的关系。**方法与研究设计**：采用自填式问卷，于 2007 年在日本佐贺伊万里所有高二学生中进行横断面调查。对 318 名男生和 292 名女生的数据进行了分析。每周吃 3 次及以下早餐称为不规律早餐消费。使用 logistic 回归模型分析调整了性别和学校因素后学生的特点和不规则早餐消费之间的关系。**结果**：男生中，果汁和汽水与不规则的早餐消费之间有强关联（"≥2 次"和"很少"相比，OR=8.97，95% CI 为 2.99-26.9）。男生清醒次数和睡觉次数与不规则的早餐消费有关，女生规律排便与不规则的早餐消费有关。有区域农业和畜产品知识的学生更有可能有规律地吃早餐，而这种关系在女学生中亦存在（OR=2.89，95% CI=1.23-6.82）。该研究还发现零食摄入量和餐前传统的问候与不规则的早餐消费有关。**结论**：一些特征，包括特定的知识，与不规律早餐消费之间有关系。研究结果有利于政策制定者、营养专家和教育工作者提高学生的早餐消费量。

关键词：学生、早餐、知识、碳酸饮料、日本