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Vegetable Intake Days in Total Day on School was Higher than that on Non-School Days For Japanese Children Aged 6–9 Years

Research Article

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Abstract

Vegetables consumption is associated with a reduced risk for chronic diseases. Vegetables consumption is a key behavior to target during childhood. However, little is known about dietary intake for Japanese children. Therefore, the present study aimed to examine vegetables intake separated by eating occasion between six schooldays and six non-school days for Japanese children aged 6–9 years. The study was conducted under a cross-sectional design. The study was conducted between August 2012 and March 2013. The dietary survey was conducted four times each year: in August (summer), November (autumn), January (winter), and March (Spring). In each season, the survey was conducted on three non-consecutive days, two of which were weekdays and one which fell on a weekend. Non-consecutive, twelve-day dietary records were performed on six school days and six non-school days. Participants lived in seaside Kinki area (n=48). We compared vegetables intake between school days and non-school days. We also examined numbers of vegetable dish and variety of vegetables (numbers of vegetable consumed in an eating occasion). On school days intakes of vegetables at breakfast, lunch, and in total day were higher than those on non-school days. Moreover, numbers of vegetable dishes and variety of vegetables were higher on school days than those on non-school days. The difference mainly resulted from vegetable intake at lunch. In conclusion, we found Vegetable intake days in total day on school was higher than that on non-school days and the difference mainly resulted from vegetable intake at lunch. Future researches should explore the dietary intake including vegetable for Japanese children.

Keywords:

Vegetable; Japanese; Children; School days; Non-school days

Introduction

Vegetables consumption is associated with a reduced risk for chronic diseases, including cancer, and cardiovascular disease [1]. Vegetables consumption is a key behavior to target during childhood because dietary behaviors track from childhood into adolescence and adulthood [2,3] and food habits in children are still easy to change [4]. However, children from most of the developed countries including Japan do not meet the recommendations for daily intake of vegetables [5–7].

Little is known about dietary intake for Japanese children. The National Health and Nutrition Survey in Japan and the National Nutrition Survey in Japan have assessed dietary intake continuously since 1945 on representative samples of Japanese aged ≥1 year [8]. Koga et al., examined

factors associated with dietary fat intake in Japanese male children [9]. However, the survey conducted only 1-day of weekday of Autumn. Asakura et al reported intakes between the school and non-school days were significantly different many nutrients, and school lunches appear to improve intake of most vitamins and minerals in Japanese children [10]. Aung et al., examined the micronutrient intake in Japanese children [11]. However, these studies do not report foods intake between the school and non-school day.

Therefore, the present study aimed to examine vegetables intake separated by eating occasion between six schooldays and six non-school days for Japanese children aged 6–9 years.

Materials and Methods

Study participants

Participants lived in a seaside town of Kinki aria, Japan. Participants were 48 children aged 6–9 years at August 2012 (baseline). The study was conducted between August 2012 and March 2013. The dietary survey was conducted four times each year: in August (summer), November (autumn), January (winter), and March (Spring). In each season, the survey was conducted on three non-consecutive days, two of which were weekdays and one which fell on a weekend. The interval from the first day to the third day was less than 2 weeks in each season. August was during the summer vacation. Therefore, of the twelve survey days six days were school days and the other six days were non-school days.

The survey was conducted according to the guidelines in the Declaration of Helsinki and all procedures involving human subjects were approved by the Ethics Committee of Osaka City University, Faculty of Human Life Science (approval code number 19-05). Informed consent was obtained from all guardians of child participants.

Dietary records

Guardians of the participating children were asked to complete dietary records of their children's dietary intake. Dietary intake at home was recorded by the guardian who was the main preparer of meals for the participating children. All foods and beverages consumed out of school were recorded. The guardians were provided a manual for dietary record, recording sheets, measuring cup, measuring spoons, and kitchen scale. The guardians weighted the ingredients, and in all drinks, whenever possible. If participants ate out and weighting was difficult, they recorded the restaurant's name, name of dishes and whether any food was left uneaten. The main items recorded on the dietary record sheets were names of dishes, names of foods and any ingredients in dishes, approximate amount of foods consumed [amount measured by measuring cup or measuring spoon, or number of consumed food], measured weight of each ingredient, food and/or dish. In addition, the guardians were asked to submit the package of prepared foods or snacks with the recording sheet for estimation of ingredients.

Dietary intake from the school lunch was estimated from observation records by the researchers and menus prepared by the elementary school dietitians. Researchers recorded the amount of each participant's food distribution was added to the refiled food, and the leftovers was subtracted.

Other measurements

Body height and weight were measured to the nearest 0.1 cm and 0.1 kg, respectively, with the child wearing light clothing and no shoes at baseline (August). The prevalence of obesity in the children was evaluated by percentage of excess weight, which was defined using the formula: [(actual weight – standard weight)/standard weight] ×100 [%]. If percentage of excess weight was ≥20%, the child was categorized as overweight, and if ≤-20%, he/she was categorized as underweight. The standard weight was calculated using age- and sex-specific formula which included actual height and coefficients [12].

Statistical analysis

All analyses were separated by eating occasion (breakfast, lunch, dinner, snack, and daily total). Dietary intake was estimated using the Standard Tables of Food Composition [13].

We classified vegetables based on the National Health and Nutrition Survey Japan [8]. We considered a vegetable dish as a dish contained at least 17.5 g of vegetables [14]. We counted the number of vegetable dishes at an eating occasion. Variety of vegetables was considered as the number of vegetables consumed at an eating occasion.

We compared vegetables intake between school days and non-school days using paired t-test. Pearson correlation tests were done between vegetables intake in total day and vegetables intake at each meal or snack, between total vegetables intake in total day and the numbers of vegetable

dishes at an eating occasion and between total vegetables in total day and the numbers of vegetable at an eating occasion to test for a significant relationship.

All statistical analyses were performed using SPSS version 26.0 (IBM Corporation, Tokyo, Japan). All reported p-values were two-tailed, and p-values <0.05 were considered statistically significant.

Results

Participant characteristics are shown in Table 1, About 40% of children were boys. Mean ages (standard deviation) of participants were 7.8 (1.0) years at baseline. Few children were underweight or overweight.

The difference in vegetables intake between school days and non-school days are described in Table 2. Energy intake on school days were lower at breakfast and snack as well as in total day. However, on school days intakes of vegetables at breakfast, lunch, and in total day were higher than those on non-school days. Moreover, numbers of vegetable dishes and variety of vegetables were higher on school days than those on non-school days.

Table 1: Characteristics of schoolchildren (n=48)

Variable	Category	n or mean	% or SD
Sex	Boys	20	42
	Girls	28	58
Age (years)	6	7	15
	7	11	23
	8	16	33
	9	14	29
	Mean, SD	7.8	1.0
Height (cm)	Mean, SD	124.7	8.0
Weight (kg)	Mean, SD	24.8	5.4
Percentage of excess weight (%)	Mean, SD	-1.8	11.4
	Underweight	1	2
	Normal	46	96
	Overweight	1	2

Data are presented as n and %, unless indicated otherwise.

Body conposition was evaluated by percentage of excess weight, defined using the formula: [(actual weight - standard weight/standard weight] ×100 [%]. If percentage of excess weight was ≥20%, the child was categorized as overweight; if ≤-20%, he/she was categorized as underweight.

Table 2: Dietary intakes of Japanese schoolchildren aged 6–9 years (n=48)

	School days			Non-school days			Difference between school and non-school days				p-value
Energy intake (kcal/day)											
Breakfast	332	±	98	364	±	105	-32	(-58	,	-5)	0.020
Lunch	517	±	81	510	±	126	7	(-28	,	42)	0.678
Dinner	594	±	152	618	±	184	-24	(-68	,	20)	0.286
Snack	216	±	141	293	±	165	-77	(-113	,	-40)	<0.001
Total day	1660	±	323	1785	±	389	-125	(-199	,	-50)	0.001
Vegetables (g/day)											
Breakfast	13.5	±	20.5	9.3	±	16.0	4.2	(0.0	,	8.4)	0.049
Lunch	70.1	±	16.4	32.2	±	26.7	37.9	(28.9	,	47.0)	<0.001
Dinner	74.4	±	37.8	77.2	±	37.7	-2.8	(-14.1	,	8.5)	0.618
Snack	2.7	±	7.6	7.0	±	16.9	-4.3	(-8.0	,	-0.6)	0.023
Total day	160.6	±	56.5	125.6	±	66.0	35.0	(19.8	,	50.2)	<0.001
Numbers of vegetable dishes (dishes/day)											
Breakfast	0.2	±	0.3	0.1	±	0.2	0.1	(0.0	,	0.1)	0.050
Lunch	1.5	±	0.3	0.5	±	0.3	1.0	(0.9	,	1.1)	<0.001
Dinner	1.2	±	0.5	1.2	±	0.4	0.0	(-0.1	,	0.1)	0.816
Snack	0.00	±	0.00	0.02	±	0.06	-0.02	(-0.04	,	0.00)	0.013
Total day	3.0	±	0.7	1.9	±	0.7	1.1	(0.9	,	1.2)	<0.001
Variety of vegetables (items/day)											
Breakfast	0.4	±	0.5	0.3	±	0.4	0.1	(0.0	,	0.2)	0.204
Lunch	3.7	±	0.9	1.1	±	0.8	2.7	(2.4	,	3.0)	<0.001
Dinner	2.5	±	1.2	2.6	±	1.0	-0.1	(-0.5	,	0.3)	0.534
Snack	0.00	±	0.00	0.04	±	0.11	-0.04	(-0.1	,	0.0)	0.030
Total day	6.6	±	1.7	4.0	±	1.6	2.6	(2.1	,	3.1)	<0.001

Values are expressed as mean ± standard deviation or mean (95% confidence interval).

Table 3: Pearson correlation coefficients between vegetables intakes in a total day of Japanese school children aged 6–9 years. (n=48)

	School days				p-value	Non-school days				p-value
Total vegetables (g/day)										
Breakfast	0.74	(0.58	,	0.85)	<0.001	0.44	(0.18	,	0.64)	0.002
Lunch	0.40	(0.13	,	0.61)	0.005	0.74	(0.57	,	0.84)	<0.001
Dinner	0.86	(0.76	,	0.92)	<0.001	0.82	(0.69	,	0.89)	<0.001
Snack	0.32	(0.03	,	0.55)	0.029	0.50	(0.25	,	0.69)	<0.001
Numbers of vegetable dishes (dishes/day)										
Breakfast	0.66	(0.47	,	0.80)	<0.001	0.38	(0.10	,	0.60)	0.008
Lunch	0.30	(0.01	,	0.54)	0.041	0.54	(0.31	,	0.72)	<0.001
Dinner	0.77	(0.61	,	0.86)	<0.001	0.72	(0.54	,	0.83)	<0.001
Snack	-				-	0.00	(-0.29	,	0.28)	0.987
Total day	0.90	(0.83	,	0.94)	<0.001	0.84	(0.72	,	0.90)	<0.001
Variety of vegetables (items/day)										
Breakfast	0.62	(0.41	,	0.77)	<0.001	0.34	(0.06	,	0.57)	0.017
Lunch	0.15	(-0.14	,	0.41)	0.319	0.64	(0.43	,	0.78)	<0.001
Dinner	0.70	(0.52	,	0.82)	<0.001	0.69	(0.50	,	0.81)	<0.001
Snack	-				-	-0.03	(-0.31	,	0.26)	0.837
Total day	0.75	(0.59	,	0.85)	<0.001	0.85	(0.74	,	0.91)	<0.001
Values are expressed as Pearson correlation coefficient (95% confidence interval). - indicated n/a.										

Both on school days and on non-school days, vegetables intake at all eating occasions were positively associated with total vegetable intakes in total day (Table 3). Both on school days and on non-school days, numbers of vegetable dishes and variety of vegetables at most eating occasions were positively associated with total vegetable intakes in total day except for variety of vegetables at lunch on school days.

Discussions

Vegetable intake days in total day on school was higher than that on non-school days and the difference mainly resulted from vegetable intake at lunch. Lunch on school day consumed by the participants was school lunch. School meals are nutritionally managed based on school meal intake standards. Asakura et al. reports the prevalence of inadequate nutrient intake was clearly lower on the school days [10]. This result was partly explained by the fact that vegetable intake was higher on school days. Mostly, school meals were more in the amount and variety of vegetables per meal than at home. In this sense, school lunch contributes to improving diet quality for children.

Vegetable intake at every eating occasion was significantly associated with vegetable intake in total day. However, from the correlation coefficients between vegetable intake at each eating occasion and that in total day, we observed the between-individual variance of vegetable intake at breakfast and dinner on school days and lunch and dinner. School meals greatly contribute to within-individual variance, but in order to reduce the disparity of vegetable intake, another approach to increase vegetable intake at home is necessary.

Number of vegetable dishes and variety of vegetable at most meals and in total day was positively associated with vegetables intake in vegetable intake. Methods to assess intake of vegetable in children was dietary records, 24-h recalls, food frequency questionnaires [15]. These methods require times and efforts. The number of vegetable dishes and variety of vegetables may be a simple screening tool to measure vegetable intake in Japanese children.

Variety of vegetable was positively associated with total vegetable intake. Different nutrients are included depending on the type of vegetables. However, Burrows et al. reported that the variety of vegetable is positively associated total diet quality [16]. Increasing the variety of vegetables consumed regularly could be important areas to target improvements in diet quality.

Parents of children are important role models who determine the home availability and accessibility of vegetables, facilitate easy consumption and enforce rules demanding children to eat vegetables [17,18]. Younger adults in Japan was lower intake of vegetables than that older adults [8]. Effective strategies promoting vegetables intake in both children and parents are warrant.

In the present study, the guardian who was the main preparer of meals for the participating children records dietary intake at home, and the records were more accurate than self-report by children. The present study conducted for all season, and we were able to take into account seasonal variation including multiple school days and non-school days. However, our study had some limitations. The key limitation was the small sample size of the study. The present study was conducted on a local area in Japan. Our results may not be applied to Japanese children in general. The present examined only vegetable intake. Although vegetable was one of food lower than the recommendation, intake of foods other than vegetable are also importance. Further studies are needed to examine the total diet for Japanese children.

Conclusions

In conclusion, we found Vegetable intake days in total day on school was higher than that on non-school days and the difference mainly resulted from vegetable intake at lunch. Future researches should explore the dietary intake including vegetable for Japanese children.

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