

# Evaluation of Children's Lunch Box Contents by Photograph and Their Relationship with Mothers' Concern

Tomoko Osera<sup>1,2</sup>, Setsuko Tsutie<sup>3</sup>, Misako Kobayashi<sup>2</sup> & Nobutaka Kurihara<sup>1</sup>

<sup>1</sup>Hygiene and Preventive Medicine, Graduate School of Life Science, Kobe Women's University, Japan

<sup>2</sup>Takakuradai Kindergarten attached to Kobe Women's University, Japan

<sup>3</sup>Clinical Nutrition Management, Graduate School of Life Science, Kobe Women's University, Japan

Correspondence: Nobutaka Kurihara, Graduate School of Life Science, Kobe Women's University, 2-1 Higashisuma-Aoyama, Suma, Kobe, Japan. Tel: 81-78-737-2417. E-mail: kurihara@suma.kobe-wu.ac.jp

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## Abstract

Japanese kindergarten children usually bring lunch prepared by mothers. The contents may be influenced by mothers' food concerns. We investigated the relationship between mothers' concerns and children's lunch box contents and preferences. Lunch boxes of 209 children were digitally photographed for 4 days at a private kindergarten in Japan. The amounts of rice, main dishes, vegetables and fruits in the lunch boxes were estimated by measuring the area occupied by each in the photograph; a questionnaire, including questions on mothers' concerns and children's preferences, was completed by mothers. Vegetable amounts in the lunch boxes were significantly related to mother's concerns for their children's lunch. Compared with estimated vegetable amounts below 11%, the amounts above 11% indicated that the number of foods disliked by children was lower, and mothers reported a higher rate of mindfulness towards vegetables and lower rate towards frozen food and believed that they prepared a balanced lunch. Thus, vegetable amounts in children's lunch boxes, estimated using photographs, may predict mothers' food concerns and children's balanced/unbalanced diets.

**Keywords:** Children's Lunch Box, Photograph, Vegetables, Mothers' concern

## 1. Introduction

Mothers' attitude toward children acquiring healthy food habits may have an influence on children's consumption. The aim of this study is to investigate the relationship between mothers' concern for lunch box and children's lunch box contents. In the study, we investigate to mother's concern for children pay attention to their lunch box. In Japan, children at nursery facilities usually eat school lunches, while those at kindergartens usually bring packed lunches from home. There are no standards for ensuring that children bring healthy packed lunches in the UK (Rees, Richards & Gregory, 2008, Evans et al., 2010a) where approximately half of the school pupils get packed lunch from home (Smithers et al., 2000) similar trends have been observed in Japan, and it seems that foods cooked by mothers are included in children's packed lunches.

Mothers must be careful regarding the contents of the packed lunches. However, one study (Rees, Richards & Gregory, 2008) reported that in the UK, very few packed lunches contained vegetables, and fruit intake was particularly low for those having a school meal. Moreover, Evans et al. (2010a) reported that few packed lunches met the school meal standards. In the US, 41% of the elementary school children brought lunch to school on any given day, of which 45% brought snacks (Hubbard et al., 2013). In Australia, almost all children had some form of 'junk food' in their packed lunches, with a mean of  $3.1 \pm 0.1$  servings (Sanigorski et al., 2005). This indicates that children's packed lunch contains few vegetables in these countries. Similarly, the packed lunches of Japanese children may also contain unbalanced diets, although little research has been conducted on this subject in the kindergarten children. Thus, the contents may be influenced by the mothers' food concern. In this study, we investigated the varieties of foods contained in the children's packed lunches by mothers' with various food concerns.

Early childhood is the most important period for establishing healthy eating habits and controlling children's preferences. Childhood is a sensitive period for development of food acceptance patterns (Nicklas et al., 2001, Ilingworth & Lister, 1964, Cashidan, 1994). Likes and dislikes are easily acquired during the early years of life

(Birch, 1979, Birch & Fisher, 1998); Vereeken and Maes (2010) reported that young children's dietary habits were associated with the mothers' nutritional knowledge and attitudes. Thus, the mother's role is important in establishing a child's eating habits and preferences. In this study, we compared the frequency of eating a school lunch with that of eating a packed lunch. We investigated the relationship between the frequency of bringing a packed lunch to the school, mothers' concerns for the foods in lunches packed by them and children's preferences.

It has been well established that the foods consumed, particularly vegetables, are very important for overall health. Consumption of vegetables prevents conditions, such as cardiovascular diseases, stroke, hypertension, diabetes, obesity, and certain types of cancer, leading to enhanced human longevity (Zhang et al., 2011, Apped et al., 1997, World Cancer Research Fund & American Institute for Cancer Research, 2007, Carter et al., 2010). Food intake in individuals is influenced by many factors, such as age, sex, eating habits, knowledge of nutrition, individual preferences, overall health and social status (Osera et al., 2016a, MacFarlane, Crawford & Worsley, 2010, Bauer et al., 2008, Hlimi et al., 2012). Among these, preferences are one of the primary determinants of food intake (Cook, Wardle & Gibson. 2003, Dovey et al., 2008). We hypothesized that the contents of children's packed lunch reflect mothers' concerns for children's diet.

In order to test this hypothesis, we conducted an investigation in Japan to determine the percentage of space in children's lunch box accounted for by the vegetables and the effect of food preference as well as the mothers' concerns on this percentage. In addition, the relationship between mothers' concerns and contents of children's lunch boxes was assessed.

## 2. Method

### 2.1 Participant (Subject) Characteristics

We photographed children's lunch boxes that were assigned an ID number using a digital camera on three occasions over the course of a school year at a private kindergarten in Hyogo Prefecture, Japan, from April 2013 to March 2014. Using photographs, we classified the contents of each packed lunch into five groups: 1) rice (e.g., staple foods with grains), 2) main dishes (e.g., meat, poultry, eggs and fish), 3) vegetables, 4) fruits and 5) sweets (e.g., jelly or Jell-O) (Figure 1). We also measured the percentage of space accounted for by each food group in 209 lunch boxes. The amount of food from each group was then estimated in the lunch boxes of 209 children by measuring the area in the photograph with an image-analysing program. We performed the estimations by measuring the area in the photograph using Image J, and calculated the average of the three occasions for each food group.

The mothers were adequately informed about the objectives and methods of this investigation, and they answered the questionnaire voluntarily, with the right to withdraw at any time during the study. Individual privacy was strictly protected throughout the investigation. Under these conditions, the mothers agreed to cooperate with the scientific investigation while their children were included in this study. The study was performed after receiving approval from the principals of the kindergarten and nursery facilities. The study was also approved by the president of the kindergarten and the Kobe Women's University people's ethics committee.



Figure 1. Children's packed lunch with ID number

## 2.2 Research Design

Data were analysed together with a questionnaire regarding mothers' concerns for children's lunch boxes and their eating habits at the end of the investigation. In March 2014, questionnaires were distributed to mothers of the children who attended a private kindergarten in Hyogo Prefecture, Japan. The questionnaire sheets were distributed to the mother of each child (i.e., a mother with two children in kindergarten received two sheets and answered the questions regarding each child). In total, questionnaires from 264 (79%) children were collected; of them, 209 were included in the study. Mothers of 209 corrected all study that submitted questionnaire and their children bring packed lunch all day.

## 2.3 Questionnaire

The questionnaire completed by the mothers included 50 questions and had three sections: 1) children's food habits (18 questions), 2) mothers' food habits (14 questions) and mothers' concerns for their children's lunch box contents (18 questions). We defined the mother's concern for her child's lunch box as 'preparation time', 'consideration of the nutritional balance for the child's packed lunch' and 'the frequency of using frozen food'. We were obvious this questionnaire's reliability. This questionnaire is a revised version of the one originally created by the Japan Sports Council that was used to determine the food habits of elementary school children and junior high school students (Japan Sports Council, 2010). We revised it to specifically determine the food habits of children aged between 3 and 5 years and their guardians. These improvisations proved to be adequate, and we checked the reliability of the revised version. Specifically, questions regarding mothers' concerns for children's packed lunches were added to the original version. For the calculated data presented in Table 1, the median percentage of vegetables was 11%. Banalization of data was performed to divide it into two groups as shown in Table 2 and Figure 2.



Figure 2. Examples of children's packed lunches estimated vegetable amounts

Photographs on the left side show packed lunches with vegetable amounts below 11%; a) and b).

Those on the right side show packed lunches with vegetable over 11%; c) and d).

## 2.4 Statistics and Data Analysis

We used a five-point or a four-point rating scale in our research, with the highest point indicating good food habits. The foods that the children disliked were chosen from a list of 55 foods selected from those available at regular school lunches and often disliked by children as shown in our previous study (Osera et al., 2012). SPSS version 21.0 J was used for all statistical analyses. In addition, all data were analysed using a Fisher's exact test and Mann-Whitney U test. Study consisted of only the questionnaire; we attempted to determine a relation between the contents of the lunch box and the answers to the questionnaire regarding food habits. Children's lunch box and questionnaire had the same ID (Figure 1).

## 3. Results

Using photographs, the contents of each lunchbox were classified into five groups: 1) rice, 2) main dishes, 3) various kinds of vegetables, 4) fruits and 5) sweets. The percentages of area for each of the five groups were  $37.9\% \pm 9.2\%$ ,  $37.3\% \pm 10.0\%$ ,  $11.9\% \pm 7.8\%$ ,  $8.9\% \pm 7.9\%$  and  $2.0\% \pm 3.7\%$ , respectively (Table 1, Figure 3). The areas for vegetables, including broccoli and tomato, were combined and presented as a single area.

Table 1. Estimated amount of each group in lunch boxes

	Mean	±	SD	Max	Min
Rice	37.9	±	9.2	63	9
Main dishes	37.3	±	10	62	6
Vegetables	11.9	±	7.8	38	0
Fruit	8.9	±	7.9	32	0
Sweets	2.0	±	3.7	17	0

Note. N = 209

A total of three packed lunches per person.

Average of 209 children’s lunch boxes.

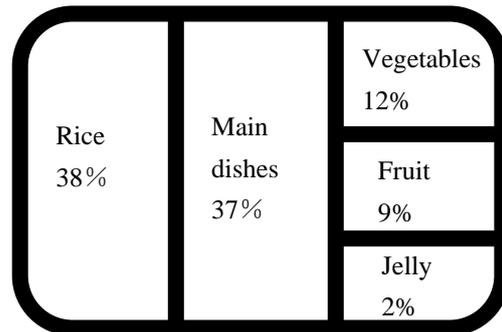


Figure 3. Average of children’s lunch box contents

For the calculated data presented in Table 1, the median percentage of vegetables was 11%. Banalization of data was performed to divide it into two groups as shown in Table 2 and Figure 2. The number of foods disliked by children was smaller when the percentage of the ‘vegetables’ area was above 11% ( $p < 0.01$ , Table 2). A greater percentage of the guardians associated with this area were mindful of vegetables, while only a small percentage used frozen food ( $p < 0.01$ , each). In cases with the percentage of the ‘vegetables’ area below 11%, these results were even lower. Therefore, the percentages of ‘vegetables’ area above or below 11% were significantly related with mothers’ consideration of a balanced lunch box ( $p < 0.01$ ). In addition, watching TV and school lunch fun was significantly related to the ‘vegetables’ area ( $p < 0.05$ , each). Thus, the percentage of ‘vegetables’ area may be related to children’s unbalanced or balanced diets and mothers’ concern for food.

Table 2. Relationship between the side dish area, children’s food habits and mothers’ concerns for the children’s packed lunch

	Side dishes area								
	Below 11%				Above 11%				P value
	N	Mean	±	SD	N	Mean	±	SD	
Children who disliked food <sup>+</sup>	72	8.06	±	8.09	75	4.69	±	4.11	0.006 <sup>**</sup>
Watching TV during dinner <sup>#</sup>	90	2.69	±	1.5	89	3.17	±	1.49	0.025 <sup>*</sup>
Children who enjoy school lunch <sup>#</sup>	90	4.10	±	0.97	89	4.40	±	0.78	0.031 <sup>*</sup>
Guardians who think lunch box is balanced <sup>#</sup>	90	3.07	±	0.79	87	3.53	±	0.76	0.000 <sup>***</sup>
Guardians who are mindful of vegetable amount in lunch box <sup>#</sup>	90	3.38	±	0.99	88	3.82	±	0.65	0.006 <sup>**</sup>
Guardians who do not use frozen food in packed lunch <sup>#</sup>	90	2.62	±	1.1	88	2.97	±	1.08	0.038 <sup>*</sup>

Note. When we calculated the data from Table 1, the percentage of the median values of vegetables was 11%. Banalization is the process of dividing the data into two groups presented above.

The amount of the ‘vegetables’ area below 11% vs. above 11% was assessed for significance using a Mann–Whitney U test.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

This binary distinction was performed according to the median value.

+ Guardians selected the children’s disliked foods from 55 food items.

# A five-point scale; the highest point indicates good habits.

A total of 52.9% of the children had a lunch box that contained some vegetables. We investigated whether tomatoes and other types of vegetables were present in their lunch box (Table 3). We found that 49.5% of the lunch boxes contained at least one tomato. Therefore, the percentage of ‘vegetables’ area or the presence of tomatoes in children’s lunch box was related to their well-balanced diets and mothers’ concerns for food.

‘Guardians who think that packed lunch is well-balance’ was related to the number of different types of vegetables in lunch boxes. Moreover, we found a relationship between the number of different types of vegetables or the presence of tomatoes and ‘nutritional balance’ ( $p < 0.01$  for both; Table 4). In addition, there was a relationship between the presence of tomatoes, ‘nutritional balance’ and ‘the time taken by mothers to prepare the packed lunch’ (Table 5). Furthermore, the presence of tomatoes in the lunch box was determined to be related to children’s balanced diets and mothers’ concerns for food.

Table 3. Relationship between the types of vegetables and presence of tomatoes

		Tomato			
		Presence		Absence	
		N	%	N	%
The types of vegetables in the lunch box	1	11	(27.5)	29	(72.5)
	2	22	(56.4)	17	(43.6)
	3	14	(63.6)	8	(36.4)
	4	6	(75.0)	2	(25.0)
	5	1	(100)	0	(0)
	6	1	(100)	0	(0)
All	55	(49.5)	56	(50.5)	

Note. N = 111

We randomly chose 124 from the 209 total lunch boxes.

The percentage of the lunch boxes which contained no vegetables was 10.

Table 4. Relationship between the types of vegetables and the mothers’ concerns for children’s packed lunch

The kinds of vegetables in the lunch box	0		1		2		3		Fisher’s exact test
	N	%	N	%	N	%	N	%	
Guardians who think that packed lunch is well-balanced									
Always good	2	(66.7)	0	(0)	1	(33.3)	0	(0)	0.006**
Usually	2	(5.4)	7	(18.9)	15	(40.5)	13	(35.1)	
No concern	4	(8.2)	18	(36.7)	13	(26.5)	14	(28.6)	
Sometimes not good	1	(7.7)	8	(61.5)	3	(23.1)	1	(7.7)	
Never	2	(66.7)	0	(0)	1	(33.3)	0	(0)	
Mothers who consider nutritional balance to be the most important thing									
Very much	9	(12.3)	30	(41.1)	21	(28.8)	13	(17.8)	0.021*
Not at all	4	(7.8)	10	(19.6)	18	(35.3)	19	(37.3)	

Note. The types of vegetables were assessed using a Fisher’s exact probability test; \*  $p < 0.05$ , \*\*  $p < 0.01$

Table 5. Relationship between the presence of tomatoes and the mothers' concerns for children's packed lunch

	Tomato				Fisher's exact test
	Presence		Absence		
	N	%	N	%	
Mothers who consider nutritional balance to be the most important thing while preparing the packed lunch					
Very much	29	(56.9)	22	(43.1)	0.027*
Not at all	26	(35.6)	47	(64.4)	
Lunch box preparing time					
Over 45 min	2	(22.2)	7	(77.8)	0.013*
30 min~	13	(36.1)	23	(63.9)	
20 min~	22	(61.1)	14	(38.9)	
10 min~	6	(37.5)	10	(62.5)	
5 min~	0	(0)	4	(100)	
Less than 5 min	3	(100)	0	(0)	

Note. Tomatoes present in the lunch box as assessed by a Fisher's exact test; \*  $p < 0.05$

#### 4. Discussion

In this study, we aimed to investigate the percentage of space in children's lunch boxes accounted for by the vegetables and the effect of food preference and mothers' concerns on this percentage as well as the relationship between mothers' concerns for children's lunch boxes and their contents.

The percentage of 'vegetables' area in the lunch boxes was  $11.9\% \pm 7.8\%$ . The majority of children's lunchbox capacity was either 360mL or 450mL. The percentage of 'vegetables' consumed was smaller than the increase in vegetable consumption as stipulated by Health Japan 21 (the second edition) (The Minister of Health, Labour and Welfare, 2013). This policy aims to ensure an intake of 350 g vegetables per day. Therefore, the percentage of vegetables in the lunches in this study was very far from the ideal proportion. More research is needed to determine the strategies for increasing this percentage.

In addition, when the percentage of the 'vegetables' area was above 11%, a larger percentage of mothers reported a mindfulness towards vegetables ( $p < 0.01$ ) and prepared a well-balanced packed lunch ( $p < 0.01$ ); a smaller percentage of them used frozen food, and the number of foods disliked by their children was smaller ( $p < 0.01$ ; Table 2) than when the area was below 11%. It has been reported that there is a strong correlation of the intake of fruits and vegetables with preferences and accessibility. The correlation observed between the children's and parents' intake of fruits and vegetables indicates that the parents' habits are a potential determinant for that of the children's (Bere & Kleep, 2004). It has also been reported that infants who received repeated dietary exposure to a particular food tend to prefer its flavour and, even, consume it more (Forestell & Mennella, 2007). Therefore, it is important to try to reduce the food types which children dislike during childhood by cooking well-balanced packed lunches, which includes not only fish and meat but also vegetables. By calculating the percentage of 'vegetables' area, mothers' food concerns and a balanced or unbalanced diet in children can be predicted.

When the percentage of 'vegetables' area was above 11%, the amount of time the children watched TV was smaller, and the number of children who considered school lunch to be enjoyable was greater than when the area was below 11% ( $p < 0.05$  for both; Table 2). Thus, it may be an indirect relation and not a direct one. Kristiansen et al. (2013) suggested that a higher academic background of the parents was associated with a smaller amount of time spent watching TV; lower frequency of watching TV in the child's bedroom; greater amount of exercise; consumption of more fruits and vegetables, fewer sweets and less soft drinks and fast food and with more regular meals. Children's propensities to consume high-fat and high-sugar foods were positively associated with high-risk television behaviours (Lissner et al., 2012). Our previous study suggested that children's preferences were related to enjoying the school lunch (Osera et al., 2014). The percentage of 'vegetables' area may influence not only children's preferences, contents of their lunch boxes and mothers' concerns for these contents but also the amount of time spent watching TV and enjoying the school lunch. These two indirect additional items, i.e., the amount of time spent watching TV and enjoying the school lunch may be related to the children's lifestyle and preferences for particular food types. Thus, by calculating the percentage of 'vegetables' area in the lunch box, mothers' food concerns for children's packed lunch and children's preferences, as well as the amount of time the children spend watching TV and enjoying a school lunch can be predicted.

Table 3 shows that in the children's lunch box containing vegetables, half of the items were a combination of

tomatoes and other vegetables. Almost all the children consumed one item of vegetables, and it was only a mini tomato, which is almost 10 g. Overall, the percentage of 'vegetables' area in the lunch boxes was smaller than the recommended Japanese dietary intake. Rogers investigated the primary school children's packed lunches in the UK. The total intake of fruit and vegetables for boys and girls was found to be 53.7 g and 66.6 g, respectively. Although the nutritional guidelines recommend that lunchtime meals should include one portion of both fruits and vegetables, the actual intake clearly fell far short of this, irrespective of meal type (Rogers et al., 2007).

Mothers' concerns for children's packed lunch were related to the vegetable items in the lunch boxes ( $p < 0.01$ ; Table 4). These results show that more types of vegetables in the lunch box indicate the mother's concern to be higher. Our previous study suggested that a mother's attitude toward her child's acquisition of healthy food habits has an effective influence on children's consumption of soybean products and that a mother's positive attitude toward soybean products may influence her children's consumption of soybean products (Osera et al., 2016 b). The presence of tomatoes was related with a greater concern about the nutritional balance and a shorter cooking time (Table 5). Therefore, the presence of tomatoes in the children's lunch box may be referred a good index. Hubbard et al. (2014) suggested that those who design school wellness policies should take initiatives to work collaboratively with parents to improve the quality of foods brought from home. Moreover, Blissett (2011) suggested that the context of an authoritative parenting and feeding style is associated with better fruit and vegetable consumption during the childhood years. It is recommended that children's lunch box includes a tomato because it is easy to consume about 10 g of brightly coloured vegetables.

Our study is cross-sectional; thus, we could not clearly demonstrate a cause and effect relationship. Practical intervention aimed at parents must be implemented as a long-term solution (Cleghorn et al., 2009). The smart lunch box intervention, targeting both parents and children, has led to small improvements in the food and nutritional content of the children's packed lunch (Evans et al., 2010b). In order to do so, a more effective strategy that may be appropriate for use in an intervention is needed. In future, we will attempt to perform a study on how to improve the contents of children's lunch boxes. However, the findings from the present study suggest target areas for improvement of intervention strategies.

In conclusion, the percentage of consumption of vegetables in the studied Japanese children was far lower than the recommended consumption per day in Japan. The percentage of 'vegetables' area in the lunch box seems to be related to mothers' concerns for vegetables and to children's preferences. In addition, vegetable amounts in packed lunch may be related to mothers' concerns for vegetables and children's preferences.

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