

Effects of Menu Elements on the Increase of the Amount of Fat in School Lunch

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(Accepted September 30, 2011)

Abstract

Fat content in school lunch was surveyed. Menu contents were analyzed and elements that increased fat content were examined.

Fat content in school lunch was much different among 10 schools. As for average amounts of fat served in school lunch, the least among the elementary schools was 18.8 g and the most was 24.9 g.

It became clear that the schools using secondary processed food frequently also used fried food frequently ($r = 0.76$). Fat content was not necessarily high simply because secondary processed food items were used and depended on what kinds of secondary processed food were used.

A reason why the “other food as staple food” menu group differed from the other two groups was that bread and pasta used as staple food contained more fat.

Introduction

Although fat is essential for humans, it is stated that attention needs to be paid to how to consume fat. For example, a survey¹⁾ found that 77% of elementary school children and 72% of junior high school children consumed fat in excess of proper fat intake ranges. “Dietary Reference Intakes for Japanese (2005 version)” has replaced Nutritional Requirements for Japanese, which includes fat requirement used for the calculation of the proper fat intake ranges, since 2005, and established targets²⁾ for total fat intake. Although the requirement and the target are difference concepts, both are expressed in fat energy ratio; the fat requirement was “25–30 (%)” for 1–17 years

old children and the dietary reference intake target for total fat was “20 or higher and lower than 30 (%energy).” National Health and Nutrition Survey, 2005 fiscal³⁾, found that 40% or more of boys aged eight to nine and 25% or more of girls in the same range of age seemed to consume fat in excess of the target. The ratio of those children is believed to “agree to the ratio of high-risk people for diseases related life style under consideration⁴⁾”. It has become a task to decrease “the ratio of the people⁴⁾”.

School lunch, which children take almost everyday and is prepared for nutritional balance, is supposed to play an important role not only in health promotion for growing children but also in the development

of desirable eating habits⁵⁾. Staff at school has been making efforts for school lunch to achieve the objectives. Many studies have been conducted on the amounts of nutrients and paid attention to decrease in the amount of fat. Chief of School Health Education Section ; Bureau of Sports and Youth ; Ministry of Education, Culture, Sports, Science, and Technology, requests “School Lunch Nutrition Report (weekly report),” which records average nutrition intake, energy ratio, and average food intake. Selected schools and joint cooking facilities are to meet the request with biannual reports.

As we have reported^{6), 7)} school lunch menus served at some elementary and junior high schools tended to be excessively high in fat energy ratio.

In this study, fat content in school lunch served about half a year after “Dietary Reference Intakes for Japanese” began to be used was surveyed. The purpose was to advise schools that tended to serve excessive amounts of fat to control the amount of fat supply. Menu contents were analyzed and elements that increased fat content were examined to obtain some findings, which are reported here.

1. Methods

(1) Subjects

The subjects of the study were school lunch menus served at 10 elementary or junior high schools in Fukuoka Prefecture in January

2006. Table 1 shows characteristics of the 10 schools.

With respect to menu classification, school menus were prepared by individual schools ; uniform menus were prepared by municipalities or regions, which schools adopted with little modifications ; and standard menus were prepared by municipalities or counties, which each school modified to meet its own situation.

(2) Analysis and statistical method

School lunch menu tables, school lunch logs, or monthly reports were used for the analysis. Values for middle graders were used for elementary schools. Fat contents in secondary processed food were taken from data school dieticians worked out from suppliers’ labels. Menus were grouped to calculate average fat energy ratio for each school. As for animal fat, numbers of food containing it, such as animal meat, poultry meat, eggs, or milk are shown.

Cuisines with Japanese names were considered Japanese cuisines. When every dish was Japanese cuisine, the menu was considered a “Japanese meal” menu and all other menus were considered “non-Japanese meal” menus. All breads were considered western. When bread is served as staple food, the menu was considered “non-Japanese meal” even if all other dishes were Japanese. In this report, dessert was not taken into consideration for menu grouping because they were considered supplementary in menu composition. When a western dessert, such as yoghurt, was served

Table 1. Characteristics of surveyed schools and monthly average values for fat content ,fat energy ratio of school lunch

School	A	B	C	D	E	F	G	H	I	J
Levels of school	elementary school	elementary school	elementary school	elementary school	elementary school	elementary school	elementary school	middle school	middle school	middle school
Number of meals (servings)	about 1,100	about 500	about 600	about 500	about 700	about 300	about 600	about 300	about 3,100	about 5,700
Number of cooking staff at school*1	12	3	6	3	6	3	7	4	21-22	25-26
Cooking facility	at each school	at each school	at each school	at each school	at each school	at each school	at each school	at each school	joint cooking facility	joint cooking facility
Menu classification	school menu	school menu	school menu	school menu	standard menu	uniform menu	uniform menu	school menu	uniform menu	uniform menu
Fat (g)	21.0±4.6	21.2±5.1	22.1±4.3	24.9±6.4	18.8±5.4	21.7±6.9	21.8±4.7	24.4±6.2	23.8±4.7	28.5±8.0
Fat energy ratio (%)**2	29.2±5.6	29.8±5.4	30.5±4.0	32.5±6.4	26.4±7.3	29.8±9.3	30.8±5.4	28.0±6.9	26.7±4.4	31.7±6.7

*1combined number of regular and non-regular employees on days when ordinary or rice menus were served

**2Note: fat energy ratios were calculated from energy (kcal) and fat (g) recorded in menu tables, school lunch logs, or monthly reports.

with Japanese staple food and side dishes, the menu was included in the "Japanese meal" menu group, in five cases.

Milk for drinking, which "is effective for calcium intake by children who should make efforts to take milk" and 206 g of which is specified in Standard Table of Food Composition for school Lunch⁸⁾, was not included in the number of the food.

For statistical treatment, Welch's t test was used for difference in average value between two independent samples.

2. Results and Discussion

(1) Schools that tended to serve excessive amounts of fat

As for average amounts of fat served in school lunch, the least among the elementary schools was 18.8 g and the most was 24.9 g, while the least among junior high schools was 23.8 g and the most was 28.5 g. Fat content served varied greatly by school. The elementary school providing the largest amount of fat served its middle graders as large an amount of fat as served at junior high schools.

Standards of Average Nutritional Requirements for School Lunch states that fat provides 25–30% of total energy intake from school lunch. As were mentioned in former report, some schools were somewhat higher than the standard. Great variance among schools could be inferred from data. It may be assumed that schools, elementary schools in particular, exceeding 30% are not few in the nation. The standard takes into account Nutritional Requirements for Japanese and the idea of Dietary Reference Intakes to calculate a desirable amount of fat

for maintaining and promoting children's health⁹⁾. The standard also advises that it shows "a national average per serving to a child and, therefore, should take into account the health and life activities of individual children and regional conditions for flexible use in practice." However, because municipalities and schools find it difficult to modify the standard in practice, the schools surveyed in this study did not alter the standard.

(2) Examination of menu elements that increased the amount of fat

Schools that were high in monthly average value and tended to serve excessive amounts of fat needed to control the amount of fat supply. Hence, menu contents were analyzed for concrete elements that increased fat content.

Likely causes of increased amounts of fat in school lunch are the following : facilities and equipments, preference of today's children, the idea of supplying nutrition for food deficiency continued until a recent time, frequent use of frying, western cuisines, menu composition with bread as staple food, animal meat and poultry meat, and secondary processed food^{6), 10), 11), 12)}.

In former report, fat energy ratio of the menu group "containing fried food" was found to be significantly higher. The frequency of serving menus "containing fried food" was 0.07 at the lowest frequency school, which served the menus once a month, whereas many schools, including school D serving once in three days, showed a frequency of about 0.3. The coefficient of simple correlation between the frequency and monthly average values of fat energy ratio

Table 2. Fat energy ratio of menu groups using and not using secondary processed food and frequency of the menus

Menu group // School	A	B	C	D	E	F	G	H	I	J	Average
Use of secondary processed food	28.9(8)	29.7(10)	30.3(9)	33.1(11)	27.8(2)	31.6(3)	33.7(7)	26.7(7)	26.8(12)	32.6(9)	29.8±6.7(78)
No use of secondary processed food	29.0(6)	30.4(3)	31.3(6)	26.5(1)	26.2(12)	29.6(12)	28.5(7)	29.1(8)	26.3(3)	30.4(7)	29.2±6.2(65)
Frequency of menus "using secondary processed food"	<0.57>	<0.77>	<0.60>	<0.92>	<0.14>	<0.20>	<0.50>	<0.47>	<0.80>	<0.56>	<0.55>

Units: fat energy ratio, %; number of menu served in (), times; frequency of menus "using secondary processed food"=frequency of menus "using secondary processed food"/number of times school lunch served in a month, times/times in <>

Table 3. Amount of fat in secondary processed food per serving

	Food	Fried food* ¹	Amount of fat (g)
School D	Rice with wheat (contracted)		0.3
	High quality fried shrimp	○	0.5* ²
	Pork filet cutlet	○	2.1* ²
	Steamed bun with meat filling		4.7
	School lunch hamburger		6.8
	Cabbage roll		7.0
	Cooked saury with a grated Japanese radish topping		7.3
	Corn gratin		7.4
	Sweet potato stick	○	9.6
	Cooked mackerel flavored with sesame and miso		14.0
	Grilled pork with miso flavor		14.6
Chicken ball shishkebab		16.6	
School B	Apple jelly		0.0
	Ingredients for steamed rice with fish, chicken, and vegetables		0.4
	Manten black beans		1.1
	Grilled salty salmon		1.5
	Sofooru type yoghurt (strawberry)		1.8
	Soy milk donut ball	○	4.7* ²
	Chicken piroshky	○	4.9
	Beef bowl (contracted)		6.5
	Cooked saury with grated Japanese radish topping		7.3
	Melon bread		11.3
	Cooked mackerel flavored with sesame and miso		14.0
Mayonnaise bread		15.1	
School J	Shrimp cutlet	○	0.5* ²
	scrambled egg		1.0
	Pork filet cutlet	○	1.6* ²
	Fried itoyori	○	1.8* ²
	Fried egg		4.0
	Chicken teriyaki patty		5.5
	School lunch gyoza* ³	○	5.8* ²
	Strawberry custard tart		6.5
	School lunch shumai	○	6.8* ²
	Baked pudding tart		6.8
	Fried pasta* ¹³	○	12.1
Butter snackie		22.6	

*¹ taken from materials including school lunch logs schools prepared from manufacturers' labels*² before heating by frying, which is said to add 4.0-6.0 grams of fat to food.*³ these were served on the same day.

given in Table 1 was calculated to be $r=0.50$, which shows a medial correlation¹³⁾.

Fried food not only meets the preference of today's children but also is easy to use as secondary processed food. A reason why most of fried food used in lunch sets at company cafeterias in Kumamoto Prefecture were prepared processed food was believed to be savings of preparation labor and time¹⁰⁾.

The menus were then divided into a menu group "using secondary processed food" and a menu group "not using secondary processed food" to examine the frequency of using secondary processed food (Table 2). The frequency was highest at school D, which also served menus "containing fried food" most frequently. School D was followed by school I and school B, which was the second highest in the frequency of serving fried food. Contract preparation of steamed rice was used six times a month to increase the frequency of menus "using secondary processed food" at school I, which was the second lowest in the frequency of serving

fried food. The frequency of "secondary processed food" menus was low at schools E and F, both of which used fried food infrequently. The coefficient of simple correlation between the frequency of menus "using secondary processed food" and the frequency of menus "containing fried food" was calculated to be $r=0.76$, showing a high correlation.

Cooking methods for secondary processed food used for school lunch were surveyed at schools D, B, and J, which were high at the frequency of "using secondary processed food." The survey revealed the following: school D used three kinds of fried food; school B used two kinds of fried food; school J used six kinds of fried food; and the secondary processed food was used in most cuisines involving fried food (Table 3). However, fat content in each of the 11 kinds of fried food was not necessarily high among various kinds of secondary processed food even after heating by frying.

Fat content varied among secondary

Table 4. Amount of fat in secondary processed food and in the same food manually prepared

	Fat content of secondary processed food (g)*1		Fat content of manually prepared food (g)*2	
	Per product,	(weight)	Per product,	(weight)
Fried shrimp (3L)*3	0.6	(38g)	1.0	(49g)
Fried hake*3	1.6	(60g)	1.7	(81g)
Beef croquet	4.3	(70g)	3.1	(148g)
Spring roll*3	8.4	(35g)	1.8	(43g)
Hamburger	9.3	(80g)	6.1	(97g)
Cooked sardine flavored with pickled Japanese plum	4.2	(50g)	5.6	(61g)
Teriyaki chicken	5.5	(50g)	7.0	(70g)

*1 taken from information materials of manufacturers
*2 taken from information material prepared by the menu committee in charge of standard menus for school lunch at elementary school E
*3 before heating by frying

Table 5. Amount of fat in one serving of staple food

	Rice			Other staple food		
	Staple food	Fat content (g)		Staple food	Fat content (g)	
		Each staple food	One meal serving		Each staple food	One meal serving
School D	Rice	0.6	}	Bread loaf	4.5	4.5
	Wheat	0.1		Milk bread	4.7	4.7
				Steamed bun with meat filling	4.7	}
				Mixed noodle	0.4	
School B				Butter roll	5.1	5.5
				Noodle	0.4	
	Rice	0.6	}	Bread loaf	4.4	4.4
	Wheat	0.1		Soy milk donut ball	4.7	5.0
	Beef bowl (contracted)	6.5	6.5	Mixed noodle	0.3	}
				Chicken piroshky	4.9	
				Noodle	0.3	}
				Bread Roll	4.5	
				Spaghetti	0.7	}
				Melon bun	11.3	
				Mayonnaise bun	15.1	15.1

Taken from information materials including school lunch logs provided by schools

process food, from 0 g to 22 g.

Secondary process food items were compared with the same food items manually prepared at schools for fat content (Table 4). A survey was conducted using information material of school E, which often manually prepared seven kinds of commonly used secondary processed food and was low in the frequency of menus “using secondary processed food.” Some of the secondary processed food had nearly the same fat content as the corresponding manually prepared food did and other secondary process food had several times more fat.

The menu group “using secondary processed food” and the menu group “not using secondary processed food”, which are shown in Table 2, were compared for fat energy ratio. The ratio varied: high in the menu group “using secondary processed food” at some schools and high in the menu group “not using secondary processed food” at other schools.

The above results clearly showed that fat

content was not necessarily high simply because secondary processed food items were used and depended on what kinds of secondary processed food were used.

Next, the menus were divided into two groups, the “Japanese meal” menu group and the “non-Japanese meal” menu group, in this report. Fat energy ratio was significantly low in the “Japanese meal” menu group at every school, $p < 0.01$.

The frequency of “Japanese meal” menus was between 0.3 and 0.4 at most schools. It was especially low at school J (0.17). Schools A and C served “Japanese meal” menus once or more in every two days. The coefficient of simple correlation between the frequency of Japanese meal menus and monthly averages of fat energy ratio given in Table 1 was $r = -0.24$, indicating a low correlation.

Staple food is the first to select in menu preparation and decisively influences the whole menu composition. From the “rice as staple food” menu group and the “both rice and other food as staple food” one, the

“other food as staple food” one was found significantly different in the average of fat energy ratio. A reason why the “other food as staple food” menu group differed from the other two groups was prospected that bread and pasta used as staple food contained more fat.

Therefore, school lunch logs of schools D and B, which were the highest, 0.50 in the frequency of the “other food as staple food” menus, were examined for fat content in staple food (Table 5). The amount of fat contained in the staple food of a school lunch serving was 0.7 g when rice was the staple food. An exception was beef bowl with a fat content of 6.5 g that was prepared as staple food by a contractor. “Other food as staple food” menus served at school D contained about 5 g of fat and those served at school B contained 4.4–15.1 g of fat. These values were several times to about 20 times more fat than in menus with rice as staple food.

There was a low correlation ($r = -0.31$) between the frequency of “rice as staple food” menus and the average monthly fat energy ratio at each school. A major cause of the low correlation was believed to lie with municipalities. Many municipalities stipulated how often rice should be served in school lunch in a week to make it difficult for schools to reflect concepts and directions of menu preparation in the frequency of serving rice.

The notice by the Director General of Bureau of Sports and Youth “on Meal Contents of School Lunch”⁹⁾ dated May 30, 2003, stated “Japanese have consumed beans, rich with fat and protein, in lieu of animal food for a long time. Beans have mainly been consumed in forms of processed bean product. Consideration should now be given to the consumption of beans that are rich with plant protein.” Soybeans in form were recommended for use. Insufficient consumption of beans and green and yellow vegetables is known to extend blood passage time and decrease blood fluidity¹⁴⁾.

Fish contains more unsaturated fatty acids and is considered desirable for health, like soybeans and processed bean products. Hence, whether fish, soybeans, or processed soybeans products was used for main dishes as main materials was focused on. The two menu groups of “fish, soybeans, or processed soybeans products as main dish” and “food other than fish, soybeans, or processed soybeans products as main dish” were compared. Fat energy ratio was low at every school of the former menu group ($p < 0.01$). The frequency of the former menu had no correlation with the average of fat energy ratio ($r = -0.001$).

With regard to animal meat, poultry meat, and eggs, “Standards of Nutritional Requirements for School Lunch (report)”¹⁵⁾ issued in March 2003 by Council of Cooperators in Survey and Research on Standards of Nutritional Requirements for School Lunch stated that “animal meat, poultry meat, and eggs are used for main dishes and meet children’s preference but somewhat decreased in quantity because they may lead to excessive consumption of protein and fat and excessive consumption of fat in particular may contribute to obesity and diseases related life style” in “points of caution in menu preparation, cooking, or school lunch guidance concerning each section of Standard Table of Food Composition.”

Saturated fatty acids, which are rich in animal meat, poultry meat, and eggs, increase the level of serum cholesterol. Therefore, “Dietary Reference Intakes for Japanese (2005 version)” set a dietary standard for saturated fatty acids and stated that “measures including limiting the consumption of saturated fatty acids are desirable because saturated fatty acids may enhance arteriosclerosis in children who are 10 years old or older and high in blood LDL cholesterol”²⁾. So it was analyzed whether animal fat should be used.

Concerning milk, milk for drinking contains 3.8% of fat, which corresponds to 7.8 g and 70.2 kcal per one serving of 208 g.

That calorie value corresponds to 10.8% of a total of 650 kcal, which is the standard given as the average nutritional requirement of school lunch for middle graders at elementary school. In other words, milk for drinking from school lunch provides about 40 % of fat requirement. However, because milk for drinking was recommended to serve by "Standards of Nutritional Requirements for School Lunch (report)", as explained in Methods, and was served every day at all schools according to this survey's results, it is taken out of discussion.

The "Standards" also mentioned "efforts are desired for choosing cooking methods in order to actively use milk for cooking, an important source of calcium. And because of high fat content and not a small content of such a saturated fatty acid as palmitic acid, milk for cooking was focused on as a food containing animal fat.

How many menu items in one serving contain food containing animal fat, such as animal meat, poultry meat, eggs, and milks, was examined to divide the menus into groups, for which fat energy ratio was calculated.

Food items containing animal fat were used nearly every day, with the maximum being six food items. Only six schools used no menu that contained animal fat and the schools had such menus twice a month or less frequently. "Fish, soybeans, or processed soybeans products as main dish" menus were served four or five times in a month at many schools. However, the schools often used food containing animal fat, such as animal meat, poultry meat, eggs, or milks, in some cuisines on the same days.

An examination of all the menus revealed that average fat energy ratio was 24.9% in the menu group "using no such food item" but increased with the number of such food items. The coefficient of simple correlation was $r = 0.46$, which indicated a medial correlation. It was confirmed that fat energy ratio tended to rise with the number of cuisines with a food material containing

animal fat even if the food material is used in small amounts.

Menus that were high in fat energy ratio often indicated following characters ; animal meat or poultry meat was used as a main material for a main dish like hamburger, sausage or cutlet ; milk, cheese or butter and bacon or poultry meat were used for a side dish or soup like cream stew ; food containing animal fat used for a garnish or a dessert like stick cheese, tart or bavarois.

It cannot be denied that customary serving of these menus for school lunch not only directly invited children "who consumed fat excessively" or "who needed to contrive good ways for fat consumption" to excessively consume animal fat but also developed taste for rich meals containing animal fat in other children, which might become a cause for excessive consumption of animal fat in their future. Although the reason was presumably consideration to children's preference, it became more important today for school dieticians and school lunch staff to be directly involved in guidance for children, approach children via teachers, and educate guardians at home in order to nurture children's preference patiently.

3. Conclusion

As for the schools tended to be excessively high in fat energy ratio, considering the prospect that new standards of average nutritional requirements for school lunch in accordance with "Dietary Reference Intakes for Japanese (2005 version)" will be issued¹⁶⁾ sooner or later, it is urgent to improve school lunch menus for low fat energy ratio.

As the school lunch program has been placing emphasis on shokuiku, it has been decided to revise School Lunch Law. The general rules of New Study Guide for Elementary and Junior high Schools clearly mentioned "shokuiku" and took up "school lunch based on the viewpoint of shokuiku and the development of desirable eating habits" as the content of the subject "special activities" covering all grades. All schools

should provide school lunch that suit shokuiku. Studies on shokuiku through school lunch¹⁷⁾ and reports that school lunch as a teaching material made shokuiku easier¹⁸⁾ began to appear. All schools should provide school lunch that suit shokuiku.

On the other hand, efforts should be made to make vegetables more palatable for children in response to limited food fiber intake, for example, which was number one cause for obesity developed by six graders¹⁹⁾. To do so, it may be considered to use good tasting and palatable food materials of the season²⁰⁾ and local products, which were recommended in Basic Plan to Promote Shokuiku, in increased amounts. It is also necessary to evaluate improvement in overall quality, including use of food materials of the season and local products, rice steaming method, use of processed food, approach to children with food allergies, consideration to the use of food additives, and the quality of materials used for cooking equipments²¹⁾. The overall evaluation may be predicted to raise the level of school lunch as a whole, facilitating the preparation of menus with proper fat content. Matsumoto²²⁾ reported that it seemed essential for some schools to secure school lunch quality junior high school children can actually feel well considered for preference and health. Oyabu²³⁾ reported that a survey on the amount of school lunch left uneaten per serving showed large differences among schools. Thus, improvement including menu seemed necessary.

We would like to thank all school dieticians for their cooperation.

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