

School meals in French secondary state schools with regard to the national recommendations

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In 2001, a circular addressing both the composition of school meals and food safety issues was introduced in France to improve the nutrient composition of school meals and provided food-frequency guidelines to guarantee dietary balanced meals. The present study assesses the extent to which secondary state schools are familiar with and implement this circular. In 2005, a nationally representative sample of 1440 secondary state schools received a questionnaire on their catering service and the implementation of the circular's recommendations, and were requested to enclose all menus (lunches and dinners) served over 1 month. Menu analysis shows that progress is still required to achieve a meal composition in accordance with the food-group frequency guidelines appended to the circular. Some recommendations are followed by most of the schools, such as limiting high-fat products and providing plenty of raw fruits and vegetables, cooked vegetables and starchy foods. Other guidelines should be implemented further, especially with regard to the nutritional quality of main courses and dairy products, which are met by less than a third and a half of schools, respectively. Specific efforts are necessary for evening meals to ensure that the nutritional requirements of boarders are covered. Some recommendations, such as the food purchasing manager being trained in nutrition (38 % of schools) and the involvement of dietetic expertise when designing meals (6 %), seem to be linked to better dietary balance of meals. Implementation of the circular must therefore be promoted in schools and may require stronger regulatory nutrition standards and better cooperation between schools.

School meals: National guidelines: Adolescents: France

In France, as in most developed countries, childhood obesity has soared since the 1980s⁽¹⁾. In 1999, overweight (including obesity) among children aged 3–14 years was close to 15 %⁽²⁾, according to the International Obesity Taskforce definition⁽³⁾. Overweight among French children aged 6–11 years was found to be associated with a snacking and sedentary pattern⁽⁴⁾. In other respects, French children and adolescents spend approximately 7–8 h a day at school and more than 90 % of French secondary state schools have a canteen, serving lunches to nearly 2 650 000 children and dinners to 159 000 boarders⁽⁵⁾, almost 5 d a week. Thus, schools are potentially implicated in the prevention of childhood overweight, notably through the type of food they serve. Since the early 2000s, the food environment at school has therefore been part of the French national nutrition policies. Beverages and food vending machines have been banned on school premises since 2005, by law enforcement⁽⁶⁾. However, dietary balanced school meals must also be ensured to encourage school-aged children to adopt healthier eating behaviours. Indeed, several studies have demonstrated that controlling the availability of food items seems to be one of the best ways of guiding students towards healthy food choices at lunchtime^(7–9).

In 2000, the French Food Safety Agency published a review dealing with the nutritional balance of school meals in France,

from pre-school to high school⁽¹⁰⁾. Its conclusions highlighted a nutrient intake that was high in fat and low in Ca and Fe with regard to the national RDA, and insufficient servings of dairy products, fruits and vegetables. An inter-ministerial circular dealing with food composition and food safety of school meals was therefore introduced on 25 June 2001⁽¹¹⁾. (In France, a circular is a text issued by a ministry intended for public officers for application. It is not compulsory but acts as recommendations.) It included several recommendations on how to design and prepare school meals and appended food-group frequency guidelines, which defined the minimum or maximum frequency with which twelve food groups should be offered for twenty consecutive meals (Table 1)⁽¹²⁾. This circular also included recommendations on nutrition and taste education of children and promoted catering for children with special dietary needs due to illnesses such as food allergies.

Since 2002, a few studies have evaluated how schools were meeting these recommendations, and mainly the food-group frequency guidelines^(13,14). Their conclusions showed large gaps between recommendations and food composition of school meals: dairy products with high Ca content remained insufficient and main courses were too high in fat with too

Abbreviations: AS, agricultural training; ES, general and vocational teaching.

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Table 1. The twelve food-group frequency guidelines appended to the national circular

Food group	Courses	Frequency guidelines for twenty meals
Starters containing 15% lipids or more*	Starter	8 maximum
Fried products containing 15% lipids or more†	Starter, main course, side dish, dessert	6 maximum
Pastries containing 15% lipids or more‡	Dessert	4 maximum
Main courses with a protein/lipid ratio of <1§	Main course	2 maximum
Raw fruits and vegetables	Starter, dessert, fruit	15 minimum
Cooked vegetables	Side dish	10
Starchy foods¶	Side dish	10
Red meat	Main course	4 minimum
Fish with a protein/lipid ratio of ≥2	Starter, main course	4 minimum
Preparation including <70% fish, meat or eggs**	Starter, main course	4 maximum
Dairy products containing 150 mg of Ca per portion††	Starter, dairy product, dessert	10 minimum
Dairy products containing 100–150 mg of Ca per portion‡‡	Starter, dairy product, dessert	8 minimum

Reading example: starters containing 15% lipids or more should not be served more than eight times during twenty consecutive meals and, conversely, red meat should be served at least four times during the same period.

* Including meat products (pâtés, saucisson, etc.) alone or served with butter, quiches and puff pastries, eggs with mayonnaise, celeriac in remoulade dressing, etc.

† Including plain or chocolate- or jam-filled doughnut, breaded cheese, vegetables fritters, fish and shrimp fritters, crisps, etc.

‡ Including fruit pies, doughnuts, cakes, brownies and pastries, etc.

§ Including sausages, egg products, mixed dishes (lasagnes, sauerkraut with meat, stuffed vegetables, etc.), pizzas, quiches and puff pastries, hamburgers, etc.

|| In the present study, this frequency guideline has been interpreted as '10 minimum'.

¶ Including potatoes, pulses, pasta, rice, etc.

** Including crêpes, poultry filled with cheese and ham, chicken or fish nuggets, fish cakes, cereal and legume-based dishes (lasagnes, pasta with sauces, chilli con carne, etc.), hamburger, stuffed vegetables, etc.

†† Including plain yoghurt, hard cheese, firm cheese, etc.

‡‡ Including quark, petit-suisse, yoghurt with fruit, jellified milk, some custard desserts, etc.

little protein content. These studies were conducted on small school samples or at a local scale, and their results were not representative at the national scale. In this context, the objectives of the present study were: (1) to assess how French lower and upper secondary state schools implement the circular; (2) to describe food composition of school meals with regard to the national guidelines. To our knowledge, the present study is the first in France to examine these issues, based on a nationally representative survey.

Method

School sampling

The present study is based on a cross-sectional survey carried out on 1440 lower and upper secondary state schools (i.e. 10–18-year-old children) from November 2005 to April 2006. These schools came from two independent samples: a sample of 240 agricultural upper secondary schools administrated by the Ministry of Agriculture and providing agricultural training (AS) and a sample of 1200 lower and upper secondary schools administrated by the Ministry of Education and providing general and other vocational teaching (ES). The AS state school sample was exhaustive, whereas the ES state school sample was drawn from the census of 7000 secondary schools housing a cafeteria compiled by the Ministry of Education in 2004–5. The 1200 ES schools were randomly selected by a balanced sampling design, with an equal inclusion probability and without stratification, by using the cube method⁽¹⁵⁾. This method is used to randomly select a sample where the Horvitz–Thompson estimators of the population totals of a set of auxiliary variables equal the known totals of these variables. Consequently, the sample reflects the initial structure of the sampling frame for these controlled variables. The controlled variables used to ensure national representativeness of the sample were geographical location,

school size and type (lower secondary school, upper general secondary school and vocational upper secondary school), size of urban area and location in a deprived area or not. Because the data available on these controlled variables for private schools were not very reliable, the study covered only state schools, which represent 66% of all secondary schools but 78% of pupils enrolled in secondary schools in France⁽¹⁶⁾.

Study design and measurements

Every school received a questionnaire by post in November 2005, with a stamped return envelope. The questionnaire collected general information on the school itself (number of pupils, boarding facilities, etc.) and its cafeteria (attendance at the cafeteria, number of meals per day, opening hours, prices, staff, management, etc.), and included questions seeking to assess the school's familiarity with and implementation of the circular⁽¹¹⁾. The last part of the questionnaire concerned the main difficulties encountered by schools in following the circular guidelines ('insufficient funds', 'staff shortage', 'insufficiently trained staff', etc.). In addition, schools had to provide the menus (lunches and dinners) proposed for 1 month. The study was approved by the French Data Protection Authority (Commission Nationale Informatique et Libertés).

In France, both lunch and evening meals are organised into several courses eaten one after the other. For each meal received, the different courses were identified as starter, meat course/main course (e.g. meat alone or mixed dishes), side dish (vegetables or starchy foods), dairy product (creamy products excluded), fresh fruit or dessert (creamy products and cooked fruits included). The number of courses in the menu was noted as schools could provide four-course (starter, main course, side dish and dessert/fruit) or five-course menus (starter, main course, side dish, dairy product and dessert/fruit). In the present study, the meat courses and side dishes were counted separately even if they were served

together. Then, every food item was allocated a nutrient composition according to the French national food composition database⁽¹⁷⁾. Food items were also assigned to one or more of the twelve food groups defined by the guidelines when they met the conditions of courses and nutrient composition (mainly for dairy products, high-fat foods and main courses; Table 1). The food-group frequency guidelines defined the minimum or maximum frequencies with which the twelve food groups should be offered. For example, starters containing 15 % lipids or more should not be served more than eight times during twenty consecutive meals and, conversely, red meat should be served at least four times during the same period. These guidelines were established for sets of twenty no-choice menus. But the number of menus sent differed from one school to another (sixty-four schools sent fifteen to twenty meal sets and 643 schools sent twenty or more meal sets), and most of the menus were free-choice menus. Thus, to enable comparisons with the guidelines, the food-group frequencies observed in school meals were related to a set of twenty meals, according to the following formula:

$$\left(\frac{\left(\sum_{\text{all meals}} \text{dishes corresponding to the food-group definition} \right)}{\left(\sum_{\text{all meals}} \text{all dishes corresponding to the courses included in the food-group definition} \right)} \right) \times \left(20 \times \text{number of courses included in the food-group definition} \right).$$

The compliance of schools with regard to each food-group frequency guideline and the number of food-group guidelines met by each school were calculated. Three levels of compliance with these guidelines were defined (low (five or less out of twelve), intermediate (six or seven out of twelve) and high (eight or more out of twelve)) and the distribution of schools within these classes was studied. As specified in the circular, analyses were carried out separately for lunches and dinners.

Variables of the questionnaire dealing with the meal design, staff training in nutrition and cafeteria features were analysed and compared with the results of food composition of meals.

Data analysis

All analyses were computed using the Statistical Analysis System statistical software version 8.2 (SAS Institute Inc., Cary, NC, USA) and carried out on the schools that provided both the questionnaire and menus (for at least 15 d in a row). A weighting coefficient was calculated by the ranking ratio method of the CALMAR macro⁽¹⁸⁾ to ensure the national representativeness of the final sample. Comparisons between schools used the Mantel–Hanzel χ^2 test, logistic regression or ANOVA, and were adjusted on the number of meals served per day. Critical *P* values were established at *P*=0.05. The ES and AS schools were studied separately because of the different sampling designs.

Results

Six hundred and thirty-five ES schools (53 %) and 150 AS schools (63 %) filled in the questionnaire, and 570 ES schools

(48 %) and 137 AS schools (57 %) also provided menus for a period of at least 15 d.

Main characteristics of French secondary school cafeterias

Several differences were found between the ES and AS schools in terms of boarding facilities, school size and cafeteria attendance (Table 2). Ninety-five per cent of the AS schools had boarding facilities, whereas in the ES schools only upper secondary schools did. The ES schools welcomed more pupils than the AS schools did, but the average cafeteria attendance rate was higher in the AS schools (94 % of the pupils) than in the ES schools (67 % of the pupils).

Most secondary schools catered on the school premises and directly managed their own catering service. Lower secondary schools were more likely to offer a single menu, while upper secondary schools preferred free-choice of dishes, except in agricultural schools. Most of the schools adopted menus with five courses rather than four. These menus were generally designed by the cook, less frequently by a menu committee or a health professional as recommended by the circular. Nevertheless, nearly half the schools had the meal design checked by a health professional who was a dietitian in 15 % of cases.

More than one-third of secondary schools had a food purchasing manager who was trained in nutrition. Also, 20–30 % of schools had drawn up the specifications for food purchases including nutrient requirements on composition.

Compliance of meal food composition with each national recommendation

The twelve food-group frequency guidelines (described in Table 1) were known by almost 90 % of schools and were reported frequently used by 75 % of them (Table 2). However, Table 3 shows that only five recommendations were followed by more than 75 % of schools, both at lunches and dinners: high-fat foods (starters, fried products and pastries); raw fruits and vegetables; starchy foods. Two other guidelines were followed by approximately half of the schools: cooked vegetables and dairy products containing at least 150 mg of Ca per portion. The remaining five guidelines were less frequently met. They dealt mainly with the nutritional quality of main courses (red meat, meat-, fish- or egg-based dishes, main courses with a protein/lipid ratio of < 1, fish with a protein/lipid ratio of > 2) and also with dairy products containing between 100 and 150 mg of Ca per portion. Agricultural schools showed better rates of compliance with the recommendations concerning the protein content of main courses (red meat, high-fat main courses or dishes with low-animal-product content) and the Ca content of dairy products. Marked variations were also observed between lunches and dinners. Evening meals were more in line with the recommendations on dairy products but had a much lower level of compliance with the recommendations aiming at improving the Fe content and the quality of main dishes (red meat, main courses with a protein/lipid ratio of < 1, meat-, fish- or egg-based dishes). In the ES schools, compliance with servings of fruits and vegetables was also lower at dinner.

Table 2. Main characteristics of secondary school cafeterias in France (percentages and 95% confidence intervals)

	ES schools		AS schools	
	%	95% CI	%	95% CI
Type of school				
Lower secondary school	66.8	63.0, 70.5	–	
General upper secondary school	21.1	18.0, 24.5	65.8	57.7, 73.4
Vocational upper secondary school	12.1	10.1, 15.4	34.2	26.7, 42.4
Number of pupils per school				
Mean	587	233		
SD	325	104		
Boarding facility	22.9	19.6, 26.3	95.3	90.5, 98.1
Cafeteria attendance (% at least 3 d/week)				
Mean	67	94		
SD	22	8		
Lunches served (per d)				
Mean	364	223		
SD	238	100		
Organisation of the cafeteria				
Autonomous kitchen (catering on the school premises)	84.8	82.0, 87.6	97.8	95.5, 100
Satellite kitchen (getting meals from another school catering service)	9.9	7.6, 12.2	1.6	0, 3.6
Central kitchen (catering on the school premises and delivering to a satellite kitchen)	5.3	3.4, 6.8	0.6	0, 1.8
Management of the catering service				
Self-management by the school	92.9	90.9, 94.9	98.1	95.9, 100
Catering delegated to a firm	7.1	5.1, 9.1	1.9	0, 4.1
Level of food choice for meal				
No choice (one menu only)	46.8	42.9, 50.7	45.1	37.1, 53.1
Guided choice (choice between several menus)	22.2	19.0, 25.4	19.5	13.1, 25.9
Free choice (large choice of foods to compile meal)	31.0	27.4, 34.6	35.4	27.7, 43.1
Number of meal courses				
Four-course meal (starter, main course, side dish, dessert/fruit)	25.7	22.1, 29.3	14.4	8.5, 20.3
Five-course meal (starter, main course, side dish, dairy product, dessert/fruit)	74.3	70.7, 77.9	85.6	79.7, 91.5
Person in charge of designing meals				
Meal commission	25.9	22.5, 29.3	28.9	21.6, 36.2
School manager + cook	38.9	35.1, 42.7	25.9	18.8, 32.9
Cook only	20.6	17.4, 23.7	32.5	24.9, 40.0
Health professional	4.3	2.7, 5.9	3.9	0.8, 7.0
Others	10.2	7.9, 12.6	8.9	4.3, 13.5
Meal design checked by a health professional	40.4	36.6, 44.3	56.3	34.5, 50.4
If yes, by a dietitian	15.7	11.1, 20.2	16.7	7.4, 26.0
Use of the food-group frequency guidelines for meal design				
Always–often	75.9	72.5, 79.3	85.1	79.3, 90.9
Rarely–never	12.5	9.9, 15.1	8.0	3.6, 12.4
Unknown	11.6	9.0, 14.2	6.9	2.8, 11.0
Nutrition training of the person in charge of cafeteria food supplies	37.5	33.6, 41.3	37.5	29.6, 45.3
Nutritional requirements in food specifications				
Yes	28.5	24.9, 32.0	20.1	13.6, 26.5
No	13.3	10.6, 16.0	14.4	8.8, 20.0
No specifications	43.9	40.0, 47.8	58.9	51.0, 66.8
Do not know	14.4	11.6, 17.2	6.7	2.7, 10.6

ES, general and vocational teaching; AS, agricultural training.

Compliance of meal food composition with all national recommendations

The ES schools followed an average of six recommendations out of twelve both at lunchtime and evening meals (Table 4). In the AS schools, there was a difference between lunches and dinners: 7.0 guidelines met at lunches and 5.8 at dinners. According to the three levels of compliance defined, 22.4 and 18.2% of the ES and AS schools, respectively, had a low level, 59.2 and 38.7% an intermediate level and 18.4 and 43.1% a high level for lunches (Table 3). For evening meals, the level of compliance shifted towards lower values, particularly in the AS schools: 34.9 and 39.2% of the ES and AS schools, respectively, with a low level, 54.6 and 53.7% with an intermediate level and only 10.4 and 7.0% remained at the highest level.

Several school features were associated with the number of food-frequency guidelines being met (Table 4). In lunches, it was improved in the event of five-course meals ($P < 0.005$) and when a health professional was involved in designing the meal ($P = 0.01$). Among health professionals, dietitians were the most efficient ($P = 0.03$). The food purchasing manager being trained in nutrition and the inclusion of nutritional requirements in food specifications also appeared to be linked to a higher number of recommendations being met, especially for dinners.

Discussion

The present study is the first survey representative of the French situation to be conducted in order to assess the implementation of the circular of 25 June 2001 on the

Table 3. Prevalence of schools meeting the food-group frequency guidelines for twenty meals (Percentages and 95 % confidence intervals)

Food group	Frequency guidelines	ES schools				AS schools			
		Lunch (n 570)		Dinner (n 137)		Lunch (n 137)		Dinner (n 133)	
		%	95 % CI	%	95 % CI	%	95 % CI	%	95 % CI
Percentage of compliance with the food-frequency guidelines									
Starters containing 15 % lipids or more	8 maximum	95.5	93.5, 97.1	97.4	93.0, 99.4	86.5	79.6, 91.8	89.1	82.4, 93.9
Fried products containing 15 % lipids or more	6 maximum	100.0	99.5, 100.0	100.0	97.7, 100.0	100.0	97.8, 100.0	100.0	97.8, 100.0
Pastries containing 15 % lipids or more	4 maximum	76.1	72.4, 79.6	77.1	68.9, 84.1	77.5	69.5, 84.3	69.5	60.9, 77.2
Main courses with a protein/lipid ratio of < 1	2 maximum	13.8	11.0, 16.9	3.8	1.2, 8.8	26.7	19.5, 34.9	4.0	1.4, 8.9
Raw fruits and vegetables	15 minimum	93.6	91.2, 95.4	83.1	75.5, 89.1	89.6	83.2, 94.1	81.7	74.1, 87.9
Cooked vegetables	10 minimum	62.7	58.6, 66.7	45.2	36.4, 54.3	63.5	54.9, 71.6	57.1	48.3, 65.7
Starchy foods	10 minimum	78.4	74.8, 81.7	88.7	81.8, 93.6	76.1	68.1, 83.0	78.4	70.3, 85.0
Red meat	4 minimum	24.4	20.9, 28.1	13.6	8.2, 20.8	58.7	50.0, 67.0	9.9	5.4, 16.3
Fish with a protein/lipid ratio of ≥ 2	4 minimum	10.2	7.8, 13.0	4.9	1.8, 10.1	6.5	3.0, 12.0	1.7	0.3, 5.7
Preparation including < 70 % fish, meat or eggs	4 maximum	31.9	28.1, 35.9	9.3	4.9, 15.7	55.7	47.0, 64.2	8.4	4.3, 14.5
Dairy products containing 150 mg of Ca per portion	10 minimum	34.7	30.8, 36.8	51.7	42.7, 60.6	46.0	37.4, 54.8	50.6	41.8, 59.4
Dairy products containing 100–150 mg of Ca per portion	8 minimum	19.8	16.6, 23.3	22.9	16.0, 31.2	20.6	14.1, 28.4	32.1	24.2, 40.8
Level of compliance with all food-frequency guidelines									
Low level ($\leq 5/12$)		22.4	19.1, 26.1	34.9	26.7, 43.8	18.2	12.1, 25.7	39.2	30.8, 48.1
Intermediate level (6 to 7/12)		59.2	55.0, 63.2	54.6	45.6, 63.4	38.7	30.5, 47.4	53.7	44.8, 62.4
High level ($\geq 8/12$)		18.4	15.3, 21.8	10.4	5.7, 17.0	43.1	34.7, 51.9	7.0	3.3, 12.8

ES, general and vocational teaching; AS, agricultural training.

Table 4. Number of the food-frequency guidelines met for twenty meals
(Mean values and standard deviations for twenty meals)

	ES schools								AS schools							
	Lunch				Dinner				Lunch				Dinner			
	<i>n</i>	Mean	SD	<i>P</i>	<i>n</i>	Mean	SD	<i>P</i>	<i>n</i>	Mean	SD	<i>P</i>	<i>n</i>	Mean	SD	<i>P</i>
Total	570	6.4	1.3		137	6.0	1.1		137	7.0	1.6		133	5.8	1.2	
Number of meal courses				<0.0001								0.002				
Four courses	147	6.0	1.1						16	6.2	2.0					
Five courses	421	6.6	1.3						120	7.2	1.4					
Person in charge of designing meals				0.01				ND				ND				ND
Meal school committee	143	6.5	1.4		38	5.9	1.2		37	6.9	1.2		37	5.9	1.0	
School manager + cook	229	6.3	1.2		46	5.9	1.1		42	7.1	1.5		41	5.7	1.2	
Cook only	120	6.2	1.1		37	6.0	1.1		38	6.8	1.9		36	5.6	1.2	
Health professional	25	6.8	1.3		6	6.0	0.0		6	7.8	1.9		6	6.8	1.1	
Others (catering firm, etc.)	51	6.8	1.5		10	6.1	1.8		12	7.9	1.7		11	6.2	1.3	
Meal design checked by a health professional				0.03				0.95				0.51				0.05
Yes	227	6.5	1.4		62	6.0	1.2		58	7.2	1.5		56	6.1	1.2	
No	316	6.3	1.2		73	5.9	1.1		78	6.9	1.6		77	5.6	1.1	
If yes, by a dietitian				0.03				ND								
Yes	31	7.0	1.7		6	6.1	1.1									
No	196	6.4	1.3		57	6.0	1.2									
Nutrition training of the food purchasing manager				0.64				0.17				0.68				0.32
Yes	215	6.3	1.2		54	6.1	1.2		54	7.2	1.6		53	6.0	1.4	
No	297	6.4	1.3		71	5.8	1.1		75	7.0	1.6		72	5.7	1.0	
Nutritional requirements in food specifications				0.39				0.009				0.47				0.13
Yes	155	6.5	1.3		43	6.4	1.2		26	6.7	1.4		24	6.1	1.0	
No	82	6.3	1.3		27	5.8	1.1		18	7.4	1.6		18	6.0	1.6	
No specifications	245	6.3	1.3		54	5.7	1.0		83	7.1	1.6		82	5.7	1.2	

ES, general and vocational teaching; AS, agricultural training; ND, not determined.

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composition of meals served in state secondary school canteens. It does not deal with the food or nutrient intakes of children but gives information on the compliance of foods offered in school meals with the national recommendations⁽¹¹⁾.

The study presents a number of limitations. First, it covers only state schools. This limitation remained acceptable as the latter represented 78 % of the pupils in all secondary schools in France⁽¹⁶⁾ and as the circular was first addressed to public officers. However, no data on private school meals are yet available, although they welcome nearly a fifth of the French pupils who eat school lunches⁽¹⁶⁾. Apart from that, after two reminders during the school year, the final response rate remained at a level of 55–65 % of schools, which was in the range of response rates observed in studies based on a similar design^(7,19). Information concerning 785 schools was collected, representing approximately 10 % of all state secondary ES schools, 63 % of the state AS schools and 261 500 meals served daily. Second, food composition of meals was collected through the menus sent by schools and was not observed directly on the school premises at mealtime. Thus, inaccuracies on food items sometimes existed, especially for fruits and cheese. Possible last-minute changes in the menu because of food supply difficulties were also not specified. Furthermore, data were collected in the autumn/winter season only and some food items were seasonal (like soup or fruit). Nevertheless, these limitations did not invalidate the results presented here, as the food-frequency guidelines apply in every season and have to be used for meal design that could not take supply difficulties into account.

The present results showed that many children were enrolled to eat in French secondary school canteens. The observed rates of school canteen attendance were in accordance with those published by the Ministry of Education (64.5 % for secondary ES state schools in 2005⁽⁵⁾), which substantiates the study's national representativeness. To our knowledge, no data were available for agricultural schools. Furthermore, many pupils in upper secondary schools, and particularly in the AS schools, also used the boarding facilities and were dependent on school meals to cover their nutritional requirements. In this context, school catering is likely to play an important role in the development of healthy eating habits in adolescents.

France is characterised by a strong traditional meal frequency and structure⁽²⁰⁾, which has remained consistent over the years^(21,22). French children usually have three main meals daily (breakfast, lunch and dinner), to which an afternoon snack is generally added. Lunch and dinner are composed of four or five courses, eaten successively. Lunch is the most important meal of the day and should provide optimal nutrient and food intakes. However, this traditional meal structure has recently tended to be simplified, by skipping peripheral courses (notably starter or dessert)⁽²³⁾. This was particularly the case for dinners and to a lesser extent for lunches. Therefore, in parallel to the improvement of children's dietary habits, school canteens could contribute to preserving the traditional French meal pattern.

The meal composition analysis showed that the food-group frequency guidelines were well followed for high-fat foods and plant products but not for the nutritional quality of main courses and dairy products. As the present study is the first nationally representative one in France, it is difficult to

compare our findings with standard or published results. Nevertheless, a local study in a French region (Rhône-Alpes) has shown similar trends in forty-three lower secondary schools in 2004⁽²⁴⁾. A comparison with previous studies – the national food-consumption survey 'individuelle et nationale sur les consommations alimentaires' 1 (1999)⁽²⁵⁾ and a non-representative study on food composition of school meals (2002)⁽¹³⁾ – indicates a shared trend in compliance with the food-group frequency guidelines. Since these studies, the provision of plant products (fruits and vegetables, starchy foods) and Carich dairy products seemed to have improved, whereas the nutritional quality of main courses (red meat, fish and main courses with a protein/lipid ratio of < 1) seemed to be worse.

Evening meals met the guidelines even less often, especially those concerning the nutritional quality of main courses. This can be explained by fewer meals served or by a lack of staff to prepare dinner which could favour resorting to ready-to-eat dishes instead of home-made ones. This finding could also back up the tendency to simplify the traditional French dinner structure observed over recent years⁽²³⁾. However, the menus sent showed that school dinners kept the traditional structure in four or five courses; and the problem lay only in setting the nutritional quality of food served. Therefore, as boarders are totally dependent on school meals to cover their nutritional requirements, dietary balance of dinners must improve in secondary schools.

Some factors were identified in the present study to facilitate the implementation of the guidelines. First, five-course meals achieved better compliance than four-course meals. This can be partly explained by the systematic presence of dairy products in five-course meals, which meet the dairy product frequency guidelines better. The circular allows the two meal systems, but we can ask ourselves whether defining the school meal standard as five courses would not be more effective in enhancing dairy product intake in schoolchildren. Implementation of the circular's recommendations seeking to improve the nutritional quality of meals (inclusion of nutritional requirements in food specifications, staff trained in nutrition and involvement of health professionals to design meals) enabled schools to propose better balanced meals with regard to the frequency guidelines, at both lunch- and dinnertime. Even though the links were not always statistically significant (lack of statistical power for dinners and the AS schools), the trends observed should favour the generalisation of these practices in secondary schools. Indeed, they expressed school awareness of the importance of nutrition and their commitment to serve well-balanced meals. Nevertheless, schools reported having to deal with insufficient funds and time shortages that could prevent them implementing these recommendations (results not shown). Pooling resources between schools may favour the hiring of dietitians to supervise and control the dietary balance of menus, or the creation of purchase groups to promote nutritional requirements in food specifications, and especially for processed food. This coordination between schools could be managed by the local authorities (departments and regions), which have been in charge of the secondary school catering since 2006. Nevertheless, the overall quality of food should be taken into account beyond its nutritional content. In May 2008, the French government published a new circular

aimed at increasing the proportion of organic food to 20% in 2012 in the menus offered in state canteens (ministries, universities, state offices, etc.)⁽²⁶⁾ and encouraged the local authorities to do so in school canteens.

In other respects, adolescence is a transition stage between a childhood eating pattern, mainly controlled by parents, and an own adulthood eating pattern⁽²⁷⁾. The changes in food consumption that occur during this transition often lead to a decrease in the overall diet quality^(27–29). Nevertheless, if children have become accustomed to healthy eating patterns, these partly continue in adolescence and adulthood^(29,30). Therefore, maintaining a healthy food environment during this transition, especially at schools, may help them to keep or adopt healthy dietary behaviours. Many studies have demonstrated that food item availability on school premises needs to be managed to change the students' dietary habits at school^(7,9,19). If healthy food items are proposed to children, they should not compete with high-fat or high-sugar foods to achieve healthier food choices by pupils⁽³¹⁾. In Texas, a policy concerning vending machine or snack bar access during lunchtime has, for example, changed student food choices in the cafeteria⁽⁹⁾. In France, the food-group frequency guidelines restrict the food choice for children by limiting high-fat foods and promoting healthy food items. They are not compulsory, however acting rather as recommendations for proposing dietary balanced meals. After the prohibition of food vending machines in schools, it seems worth making these guidelines compulsory to reinforce healthy eating behaviours in schoolchildren. Other countries, like the UK, are developing statutory rules to define food composition of school meals⁽³²⁾. In France, the objective to do so has finally been included in the second National Nutrition and Health Plan (National Nutrition and Health Programme 2), introduced in 2006 by the Ministry of Health⁽³³⁾, and may be in force soon. It will be added to the national nutrition policies existing in France since the introduction of the first National Nutrition and Health Plan in 2001⁽³⁴⁾. But whenever the menus comply with the guidelines, the true nutrient intakes of children depend on their own choice from these menus. This is why nutrition education of children remains essential. Nutrition policies at schools should find a balance between what is taught to pupils and what is offered in school meals.

Conclusion

The present study is the first survey representative of the French situation to be conducted in order to evaluate the implementation of the circular of 25 June 2001 on the composition of school meals. It shows that progress is still required to achieve a meal composition in accordance with the food-group frequency guidelines appended to the circular. Recommendations with respect to the limitation of high-fat products and those relative to encouraging the provision of plant products (fruits, vegetables and starchy foods) were well followed, but those relative to the quality of main courses and dairy products were less implemented. Specific efforts are also necessary to improve the quality of evening meals, to ensure that the nutritional requirements of boarders are covered. One way to reach this goal would be to make the frequency guidelines regulated standards instead of

recommendations. A better implementation of the circular's nutritional recommendations (nutrition training for the food purchasing manager, involvement of dietitians or health professionals in meal design, etc.) also seems to be able to improve the dietary balance of meals, and therefore promote healthier food choices and eating behaviours in schoolchildren. Their application may, however, need cooperation and resource pooling between schools, which could be initiated by the local authorities in charge of secondary school catering.

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