

Stabilization of overweight prevalence and improvement of dietary habits in French children between 2004 and 2008

Caroline Carriere^{1,2}, Coralie Langevin^{1,2}, Edoard Kossi Déti¹, Pascale Barberger-Gateau², Sylvie Maurice² and Hélène Thibault^{1,2,*}

¹Univ. Bordeaux, ISPED, Centre INSERM U897-Epidemiologie-Biostatistique, Bordeaux, France: ²INSERM, ISPED, Centre INSERM U897-Epidemiologie-Biostatistique, 146 rue Léo Saignat, F-33076 Bordeaux Cedex, France

Submitted 30 January 2014: Final revision received 14 August 2014: Accepted 4 September 2014: First published online 13 October 2014

Abstract

Objective: The objective of the present study was to describe changes in overweight and obesity prevalence and eating habits among 7·5–10·5-year-old children in Aquitaine (France) between 2004 and 2008, and to assess how the programme 'Nutrition, Prevention and Health of children and teenagers in Aquitaine' implemented in 2004 may have impacted these changes.

Design: Two cross-sectional studies were conducted in two samples of children: the 'before programme' sample during the school year 2004/2005 and the 'after programme' sample during the school year 2008/2009.

Settings: Data were collected on gender, age, weight, height, area of residence (rural/urban) and socio-economic status of the school (non-low socio-economic/low socio-economic). Multivariate analyses were used to assess the effect of the regional programme intervention on the evolution of overweight and obesity prevalence and eating habits independently.

Subjects: The 'before programme' sample included 1836 children from 163 schools during the school year 2004/2005 and the 'after programme' sample included 3483 children from 210 schools during the school year 2008/2009.

Results: After adjustment of the model for age, residential area and socio-economic status of the area of residence, the prevalence of overweight including obesity (OR = 1·05; 95 % CI 0·89, 1·23, $P = 0·56$) and of obesity (OR = 0·99; 95 % CI 0·71, 1·39, $P = 0·96$) was found to have stabilized and eating habits had improved: intake of light afternoon meals had increased (OR = 1·38; 95 % CI 1·13, 1·69, $P = 0·002$) while snacking in the morning (OR = 0·50; 95 % CI 0·45, 0·57, $P < 0·001$) and nibbling (OR = 0·81; 95 % CI 0·70, 0·93, $P < 0·001$) had decreased.

Conclusions: These results encourage the promotion and implementation of regional and national interventions among children regarding their eating habits in order to stabilize or decrease the prevalence of overweight.

Keywords
Overweight
Obesity
Children
France
Dietary habits

Obesity has been recognized as a major public health epidemic by the WHO since 1998⁽¹⁾ and is a well-established risk factor for several chronic diseases^(2–4). Over the past few years, the prevalence of overweight and obesity has increased dramatically among children and adolescents both in developed countries and other parts of the world^(5–7). Several local and national studies in France have shown that overweight prevalence among children aged 5–17 years increased from 3 % in 1965 to 5 % in 1980, 12 % in 1996 and 16 % in 2000^(8,9). Since the 2000s, a study carried out on representative samples of French children has shown that overweight prevalence on a national scale seems to have stabilized at about 16 %^(10–12). Obesity is known to be a multifactorial problem resulting from a

reduction in physical activity^(13,14) and changes in dietary habits^(15–17). Several studies have shown that the principal risk factors for childhood overweight include parental obesity, low socio-economic status (SES), low physical activity, high level of sedentary activities and inappropriate diet such as the consumption of fatty and sugary foods^(14,18,19). In France, the National Program on Nutrition and Health (PNNS) was launched by the Ministry of Health in 2001^(8,20). One of its main objectives is to stop the increase in the prevalence of childhood obesity in France. Various public health actions for improving dietary habits and physical activity in children have been implemented. In accordance with the objectives and tools of the PNNS, a multidisciplinary public health programme called

*Corresponding author: Email Helene.thibault@isped.u-bordeaux2.fr

'Nutrition, Prevention and Health for children and teenagers in Aquitaine' (www.nutritionenfantaquaine.fr) was launched in November 2004 in Aquitaine (south-west France) to improve the diet and physical activity of children and adolescents and to stabilize the prevalence of childhood obesity, by means of three key strategies⁽²¹⁾:

1. early detection, prevention and management of childhood obesity by mobilizing stakeholders in Aquitaine;
2. improvement of the food supply in middle schools and implementing extracurricular activities; and
3. implementation of educational programmes on food and physical activity aimed at children, their families, and their educational and medical communities.

Before launching the programme, a study was conducted in 2004–2005 among 7.5–10.5-year-old children in order to guide the intervention and to provide baseline data on dietary habits, lifestyle, and overweight and obesity prevalence. Four years later, the study was repeated in order to evaluate the impact of the programme on children's lifestyle.

The objective of the present study was therefore to describe changes in overweight and obesity prevalence and dietary behaviour among 7.5–10.5-year-old children in Aquitaine from 2004 to 2008 and to assess the impact of the programme 'Nutrition, Prevention and Health of children and teenagers in Aquitaine' on this evolution.

Methods

Study design and participants

Two cross-sectional surveys were conducted in 2004 and 2008 on representative samples of primary schools randomly selected in Aquitaine. Stratification variables were the district, the size of the school, the area of residence (urban or rural) and the zone category (low socio-economic (LSE) or non-LSE). Schools selected for each study could be different.

The surveys were conducted on children of the same age group:

1. before implementation of the programme (2004/2005 school year), sample called 'before programme' (163 schools); and
2. after implementation of the programme (2008/2009 school year), sample called 'after programme' (210 schools).

All the children in third grade from the selected schools who were seen by the school nurse during the annual health check were included in the samples. Children aged less than 7.5 years or more than 10.5 years old were excluded from the analysis for the sake of homogeneity. Parents were informed of the survey and only children whose parents agreed were included in the study.

Data were collected by means of a questionnaire (see Appendix) completed by the school nurse in the presence of the child during the health check. Data transmitted for the analysis were anonymous.

Data collection and measurements

Weight status

Weight status was determined from weight and height measurements collected by school nurses. Weight and height were measured by school nurses in the morning or the afternoon (fasting was not necessary) using standardized procedures and measurement devices. Weight was measured with the child lightly dressed, without shoes, and with the school health centre scales; height was measured with the child standing up, his/her weight being equally distributed on both feet, with head, back and buttocks on the vertical part of the height gauge. Weight status was determined by BMI, calculated from measured weight and height data transmitted by school nurses as follows: $BMI = [\text{weight (kg)}] / [\text{height (m)}]^2$. Weight status (normal, overweight or obesity) was attributed with the International Obesity Task Force definition⁽²²⁾ according to the BMI, gender and age of the child.

Eating habits

In both surveys, eating habits of children were assessed by school nurses who collected information on their usual breakfast intake (always, sometimes or never), morning snack intake (yes or no), light afternoon meal intake (yes or no) and nibbling habits (yes or no; in the present study, 'nibbling' refers to eating something between the light afternoon meal (food intake recommended for children) and dinner). The composition of each dietary intake was also described.

School socio-economic status

In France, state-run schools are described by the school administration as LSE (low SES) or non-LSE (non-low SES), according to their socio-economic characteristics^(23,24). LSE schools have a high rate of school failure or are located in specific geographical areas (rural area, suburbs of big cities) where socio-economic difficulties are prevalent (including low SES of families). At the age of 5–10 years, most children go to school in the area where they live and their school address can be used as an indicator of SES of the area of residence.

Other variables

Children's age and gender were collected for both surveys. According to the National Institute for Statistics and Economic Studies, the area of residence is classified as urban if continuously built up and accommodating 2000 persons or more. Rural populations are all those not classified as urban.

Statistical analysis

Data registration was performed using EpiData software. Differences between samples were assessed by the χ^2 test or the Kruskal–Wallis test. All statistical tests were two-sided and a $P < 0.05$ was considered statistically significant. Models were fitted using the SAS statistical software package version

9.1.3. Multivariate analyses were used and odds ratios were calculated to assess the effect of the regional programme intervention on the evolution of overweight and obesity prevalence and eating habits independently.

Results

Study population

The response rate of schools was 89.0% in 2004/2005 and 92.4% in 2008/2009. The 'before programme' sample included 1836 children and the 'after programme' sample included 3483 children, for whom both weight status and dietary habits were known.

Characteristics of both samples are described in Table 1. For both samples, the male:female ratio was close to

1 ($P=0.67$). In the 'before programme' sample, the mean age of children and the rates of children who lived in low-SES areas and urban areas were slightly higher than in the 'after programme' sample ($P<0.05$). Thus, results concerning the evolution of weight status and dietary behaviour after 4 years of programme implementation were adjusted for age, area of residence (rural/urban) and SES of the living zone in a multivariate analysis.

Evolution of eating habits among children before and after the prevention programme

Four years after the prevention programme, eating habits had changed globally (Table 2). The proportion of children who usually took a light afternoon meal had increased significantly ($P<0.01$) while morning snack intake and nibbling

Table 1 Characteristics of children from the third grade before (n 1836) and after (n 3483) implementation of the prevention programme. Cross-sectional surveys in primary schools in the Aquitaine region, France

Variable	Before programme (school year 2004/2005)		After programme (school year 2008/2009)		<i>P</i>
	<i>n</i> or Mean	% or SD	<i>n</i> or Mean	% or SD	
Gender					0.67
Boys	905	49.3	1738	49.8	
Girls	931	50.7	1745	50.2	
Age (years)	8.79	0.50	8.71	0.44	<0.001
Zone					<0.01
LSE	177	9.6	249	7.1	
Non-LSE	1659	90.4	3234	92.9	
Residence					0.03
Rural	536	29.2	1208	34.7	
Urban	1300	70.8	2275	65.3	
Weight status					0.85
Normal weight	1556	84.7	2937	84.3	
Overweight (including obesity)	226	12.3	447	12.8	
Obesity	54	2.9	99	2.8	

LSE, low socio-economic.

Table 2 Eating habits and prevalence of overweight and obesity in third-grade children before (n 1836) and after (n 3483) implementation of the prevention programme. Cross-sectional surveys in primary schools in the Aquitaine region, France

Variable	Before programme (school year 2004/2005)		After programme (school year 2008/2009)		<i>P</i> (χ^2 test)
	<i>n</i>	%	<i>n</i>	%	
Breakfast intake					0.14
Never or sometimes	67	3.7	100	2.9	
Always	1769	96.3	3383	97.1	
Morning snack intake					<10 ⁻⁴
Yes	804	43.8	974	28.0	
No	1032	56.2	2509	72.0	
Light afternoon meal intake					<10 ⁻²
Yes	1657	90.3	3232	92.8	
No	179	9.7	231	7.2	
Nibbling					<10 ⁻²
Yes	356	19.4	559	16.0	
No	1480	80.6	2924	84.0	
Overweight (including obesity)					0.58
Yes	226	12.3	447	12.8	
No	1610	87.7	3036	87.2	
Obesity					0.84
Yes	54	2.9	99	2.8	
No	1782	97.1	3384	97.2	

Table 3 Summary of associations found between weight status and eating habits and programme intervention between 2004/2005 and 2008/2009 among third-grade children in the Aquitaine region, France: multivariate logistic regression analysis (*n* 5319)

Variable	Programme intervention		
	Point estimate	95 % CI	<i>P</i>
Overweight (including obesity)	1.05	0.89, 1.23	0.56
Obesity	0.99	0.71, 1.39	0.96
Breakfast	1.19	0.86, 1.62	0.30
Morning snack	0.50	0.45, 0.57	<0.0001
Light afternoon meal	1.38	1.13, 1.69	0.002
Nibbling	0.81	0.70, 0.93	<0.001

Model adjusted for year of intervention, area of residence, zone category and age.

had decreased significantly ($P < 0.01$). Moreover, the number of children who took breakfast had stabilized ($P = 0.14$; Table 2).

These results persisted after adjustment for age, area of residence and SES of the living zone: the increase in light afternoon meals (OR = 1.38; 95 % CI 1.13, 1.69, $P = 0.002$) and the decrease in morning snack intake (OR = 0.50; 95 % CI 0.45, 0.57, $P < 0.001$) and nibbling (OR = 0.81; 95 % CI 0.70, 0.93, $P < 0.001$) persisted (Table 3).

Moreover, the evolution was generally favourable with regard to the composition of breakfast, light afternoon meals and morning snacks. Fewer chocolates, candies and pastries were consumed (from 17.6 % to 12.6 % at morning snack intake and from 17.7 % to 10.3 % for light afternoon meals, $P < 0.0001$), while there was a significant increase in fruit consumption (from 18.7 % to 32.8 % for morning snack intake and from 20.1 % to 26.6 % for light afternoon meals, $P < 0.0001$).

Evolution of overweight and obesity prevalence before and after the programme

The overall prevalence of overweight (including obesity) and obesity stabilized between 2004/2005 and 2008/2009 ($P = 0.85$; Table 1). After adjustment for age, area of residence and SES of the living zone, the stabilization of overweight including obesity (OR = 1.05; 95 % CI 0.89, 1.23, $P = 0.56$) and obesity (OR = 0.99; 95 % CI 0.71, 1.39, $P = 0.96$) persisted (Table 3).

Discussion

The present study shows that overweight (including obesity) and obesity prevalence of children aged 7.5–10.5 years stabilized in Aquitaine (south-west France) between 2004/2005 and 2008/2009. This stabilization, which was the main objective of both the regional and national programmes for nutrition and health^(20,25), is consistent with recent studies conducted at national level in France among 7–9-year-old children⁽¹²⁾, in other European countries^(26–29) and in the USA, China and Australia⁽²⁹⁾.

Moreover, qualitative and quantitative improvements in children's dietary habits were also observed between

2004/2005 and 2008/2009. First, the proportion of children having a light afternoon meal (usually after class, around 16.00 hours) increased between the two periods studied. Because of the duration of the school day in France, this light afternoon meal is recommended for children. The protective effect of the afternoon meal has been described previously and may be explained by a better distribution of energy intake, thus avoiding nibbling between lunch and dinner⁽³⁰⁾. On the other hand, the proportion of children having a morning snack or nibbling decreased. Many studies report that the foods eaten in morning snacks and nibbling are often fatty and sweet and have a negative impact on food balance^(30,31). Finally, a slight but non-significant increase was observed in breakfast intake. This could be due to the fact that the percentage of children having breakfast every day in 2004/2005 was already high (96.3 %).

These changes in dietary habits among Aquitaine children are consistent with nationwide nutritional recommendations made by the PNNS and relayed regionally by the programme 'Nutrition, Prevention and Health for children and teenagers in Aquitaine', especially though the dissemination of flyers concerning the importance of taking breakfast and an afternoon meal and cutting out morning snacks^(25,32).

Actions undertaken on the basis of the PNNS⁽³³⁾ and the nutrition programme in Aquitaine⁽²⁵⁾ could be responsible for the stabilization of overweight and the improvement in dietary behaviour among 7.5–10.5-year-old children in Aquitaine. Besides promoting healthy dietary habits, other actions undertaken in Aquitaine, such as early detection of overweight and encouraging a physically active lifestyle, could also have played a part⁽³²⁾. However, since there was no control group, we cannot even partly attribute the stabilization of overweight and obesity prevalences from 2004/2005 to 2008/2009 and improvement in dietary behaviour to the Aquitaine prevention programme. Moreover, the studies were performed on the same age group but not on the same children: in 2008/2009, some children in third grade had already benefited from health education campaigns in their first year in school, so they were more likely to have better dietary habits than those included in the first study. However, in most studies describing recent stabilization of overweight and obesity

prevalence, the trend was associated with national, regional and/or local actions that had been implemented in many sectors of society^(33,34).

Another limitation of the present study is the fact that lifestyle habits were not assessed, especially physical activity and sleep, which are recognized as factors for obesity in children^(35,36). Data on physical activity and sedentary lifestyle were collected but only in the second study in 2008/2009. Consequently, any changes in the physical activity of children could not be assessed between 2004/2005 and 2008/2009.

No sleep data were collected because children's assessment of their quality or duration of sleep is not necessarily reliable and in order to limit the time taken by school nurses to administer the survey.

On the other hand, one of the strengths of our study is the large representative samples studied in both analyses. Indeed, by conducting this survey at school, we were able to collect anthropometric data on a large number of children of the same age but with different lifestyles and SES. Another study strength is that data were collected by school health professionals, thereby ensuring high-quality data compared with self-reported data or multicentre measurements.

In addition, the multivariate analysis was adjusted for characteristics known to have an influence on overweight prevalence: age (increase in overweight prevalence with age)⁽¹⁰⁾, area of residence (higher prevalence of overweight among rural children)^(34,37,38) and especially SES of the living zone. Indeed, previous studies have shown that the stabilization of overweight prevalence seems to differ according to SES of the population, with a more significant slowing down of the increase in prevalence in non-low SES areas⁽³⁹⁾.

These findings reinforce the relevance of implementing public health programmes such as the PNNS and the Aquitaine programme. Furthermore, they underline the importance of implementing and pursuing interventions in primary schools in order to achieve consistent behavioural changes, as recommended by recent international^(1,16), national^(20,33) and regional policies. New data are now needed to continue to assess the evolution of overweight and obesity prevalence and dietary behaviour among children in the Aquitaine region.

Acknowledgements

Acknowledgements: The authors thank the school nurses and doctors who collected and recorded measurements during child health surveillance, and all partners from the Local Education Authority of the Aquitaine region involved in the programme 'Nutrition, Prevention and Health of children and teenagers in Aquitaine'. *Financial support:* This study was funded by the national health insurance scheme and the Regional Health Agency of Aquitaine as part of funding

allocated to the Aquitaine programme for nutrition, prevention and health. The funders had no role in the design, analysis or writing of this article. *Conflict of interest:* None. *Authorship:* H.T. was responsible for the conception, design, interpretation of the data, and writing and revising the manuscript. C.C. contributed to the design and interpretation of data and performed the analysis, writing and revising of the manuscript. C.L. contributed to writing and revising the manuscript. E.K.D. contributed to the analysis. P.B.-G. contributed to the interpretation and revised the manuscript. S.M. revised the manuscript. All authors have read and approved the final manuscript. *Ethics of human subject participation:* All data were anonymous: children's identity was not transmitted. Parents were informed of the study.

References

1. World Health Organization (2006) *Addressing the Socio-economic Determinants of Healthy Eating Habits and Physical Activity Levels among Adolescents*. Geneva: WHO.
2. Dudina A, Cooney M, Backer D *et al.* (2011) Relationships between body mass index, cardiovascular mortality, and risk factors: a report from the SCORE investigators. *Eur J Cardiovasc Prev Rehabil* **18**, 731–742.
3. Wang L, Denniston M, Lee S *et al.* (2010) Long-term health and economic impact of preventing and reducing overweight and obesity in adolescence. *J Adolesc Health* **46**, 467–473.
4. L'Allemand-Jander D (2010) Clinical diagnosis of metabolic and cardiovascular risks in overweight children: early development of chronic diseases in the obese child. *Int J Obes (Lond)* **34**, Suppl. 2, S32–S36.
5. Jolliffe D (2004) Extent of overweight among US children and adolescents from 1971 to 2000. *Int J Obes Relat Metab Disord* **28**, 4–9.
6. Lobstein T & Frelut ML (2003) Prevalence of overweight among children in Europe. *Obes Rev* **4**, 195–200.
7. Wang Y & Lobstein T (2006) Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes* **1**, 11–25.
8. Girardet JP, Bocquet A, Bresson JL *et al.* (2009) French national program for nutrition and health: effects on children's health. *Arch Pediatr* **16**, 3–6.
9. Haute Autorité de Santé (2011) *Surpoids et obésité de l'enfant et de l'adolescent. Recommandations de bonne pratique clinique*. Saint-Denis La Plaine: HAS.
10. INSERM (2000) *Obésité: dépistage et prévention chez l'enfant*. Paris: INSERM.
11. Rolland-Cachera MF, Castetbon K, Arnault N *et al.* (2002) Body mass index in 7–9-y-old French children: frequency of obesity, overweight and thinness. *Int J Obes Relat Metab Disord* **26**, 1610–1616.
12. Salavane B, Peneau S, Rolland-Cachera MF *et al.* (2009) Stabilization of overweight prevalence in French children between 2000 and 2007. *Int J Pediatr Obes* **4**, 66–72.
13. Riddoch CJ, Bo Andersen L, Wedderkoop N *et al.* (2004) Physical activity levels and patterns of 9- and 15-yr-old European children. *Med Sci Sports Exerc* **36**, 86–92.
14. Hills AP, Andersen LB & Byrne NM (2011) Physical activity and obesity in children. *Br J Sports Med* **45**, 866–870.
15. Maffei C (2000) Aetiology of overweight and obesity in children and adolescents. *Eur J Pediatr* **159**, Suppl. 1, S35–S44.
16. World Health Organization (2003) *Diet, Nutrition and the Prevention of Chronic Diseases. Joint WHO/FAO Expert Consultation. WHO Technical Report Series no. 916*. Geneva: WHO.

17. Diethelm K, Jankovic N, Moreno LA *et al.* (2012) Food intake of European adolescents in the light of different food-based dietary guidelines: results of the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study. *Public Health Nutr* **15**, 386–398.
18. Juonala M, Juhola J, Magnussen CG *et al.* (2011) Childhood environmental and genetic predictors of adulthood obesity: the cardiovascular risk in young Finns study. *J Clin Endocrinol Metab* **96**, E1542–E1549.
19. Thibault H, Carriere C, Langevin C *et al.* (2012) Prevalence and factors associated with overweight and obesity in French primary school children. *Public Health Nutr* **16**, 193–201.
20. Hercberg S, Chat-Yung S & Chauliac M (2008) The French National Nutrition and Health Program: 2001–2006–2010. *Int J Public Health* **53**, 68–77.
21. Thibault H, Boulard S, Carriere C *et al.* (2010) Prevention and treatment of childhood obesity in the Aquitaine region (France). *Int J Pediatr Obes* **5**, Suppl. 1, 84.
22. Cole TJ, Bellizzi MC, Flegal KM *et al.* (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* **320**, 1240–1243.
23. Ministère de l'Éducation Nationale (1981) Enseignements Élémentaire et Secondaire: Zones Prioritaires. *Bulletin Officiel* **27**, 2077–2079.
24. Ministère de l'Éducation Nationale (1981) Zones prioritaires et programmes d'éducation prioritaires. *Bulletin Officiel spécial N°1*, 6–10.
25. Thibault H, Carriere C, Baine M *et al.* (2009) Prévention de l'obésité de l'enfant: l'expérience de l'Aquitaine. *Arch Pediatr* **16**, 570–572.
26. Jeannot E, Mahler P, Duperrex O *et al.* (2010) Evolution of overweight and obesity among 5–6-year-old schoolchildren in Geneva. *Swiss Med Wkly* **140**, w13040.
27. Bluher S, Meigen C, Gausche R *et al.* (2011) Age-specific stabilization in obesity prevalence in German children: a cross-sectional study from 1999 to 2008. *Int J Pediatr Obes* **6**, e199–e206.
28. Tambalisk D, Panagiotakos DB, Kavouras SA *et al.* (2010) Eleven-year prevalence trends of obesity in Greek children: first evidence that prevalence of obesity is leveling off. *Obesity (Silver Spring)* **18**, 161–166.
29. Olds T, Maher C, Zumin S *et al.* (2011) Evidence that the prevalence of childhood overweight is plateauing: data from nine countries. *Int J Pediatr Obes* **6**, 342–360.
30. Bellisle F, Rolland-Cachera MF, Deheeger M *et al.* (1988) Obesity and food intake in children: evidence for a role of metabolic and/or behavioral daily rhythms. *Appetite* **11**, 111–118.
31. Bocquet A, Bresson JL, Breind A *et al.* (2003) The morning snack at school is inadequate and unnecessary. *Arch Pediatr* **10**, 945–947.
32. Thibault H, Carriere C, Langevin C *et al.* (2010) La collation à l'école maternelle: évolution des perceptions et pratiques des enseignants d'Aquitaine entre 2004 et 2008. *Arch Pediatr* **17**, 1516–1521.
33. Girardet JP, Bocquet A, Bresson JL *et al.* (2009) Le programme national nutrition santé (PNNS): quels effets sur la santé des enfants? *Arch Pediatr* **16**, 3–6.
34. Sjoberg A, Moraeus L, Yngve A *et al.* (2011) Overweight and obesity in a representative sample of schoolchildren – exploring the urban–rural gradient in Sweden. *Obes Rev* **12**, 305–314.
35. Lioret S, Touvier M, Lafay L *et al.* (2008) Dietary and physical activity patterns in French children are related to overweight and socioeconomic status. *J Nutr* **138**, 101–107.
36. Spiegel K (2008) Sleep loss as a risk factor for obesity and diabetes. *Int J Pediatr Obes* **1**, 3 Suppl. 2, 27–28.
37. Bruner MW, Lawson J, Pickett W *et al.* (2008) Rural Canadian adolescents are more likely to be obese compared with urban adolescents. *Int J Pediatr Obes* **3**, 205–211.
38. Liu J, Bennett KJ, Harun N *et al.* (2008) Urban–rural differences in overweight status and physical inactivity among US children aged 10–17 years. *J Rural Health* **24**, 407–415.
39. Peneau S, Salavane B, Maillard-Teyssier L *et al.* (2009) Prevalence of overweight in 6- to 15-year-old children in central/western France from 1996 to 2006: trends toward stabilization. *Int J Obes (Lond)* **33**, 401–407.

Appendix

Questionnaire used for the study (translated from French)

EATING HABITS SURVEY AND PREVALENCE OF OBESITY IN CE2

Questionnaire to be completed by school nurses

GENERAL INFORMATION

Name of nurse(s): _____
 Name of school: _____

Date of birth of child: ___ / ___ / ___
 Date of visit: ___ / ___ / ___

No. of children: _____

Sex: Boy Girl
 Birth weight: _____ g

ANTHROPOMETRIC MEASUREMENTS

Height: _____ · _____ cm
 Weight: _____ · _____ kg

The child will be lightly dressed and without shoes, barefoot or in thin socks. The child is measured standing, weight evenly distributed on both feet, heels together, head positioned so that the line of sight is perpendicular to the body. Head, back, buttocks and heels in contact with the vertical board fathom. The movable part of the measuring rod is brought into contact with the highest point of the head. Do not pull the child's head upwards. The child is weighed with scales accurate to at least 0.5 kg. The child is still in the centre of the plateau, weight evenly distributed on both feet.

PROFESSION OF PARENTS

Father: _____
 Mother: _____

Appendix *Continued*

ENQUIRE IF POSSIBLE SOCIAL AND OCCUPATIONAL STATUS OF PARENTS (CSP)

Father: Category I Category II Category III Category IV

Mother: Category I Category II Category III Category IV

Rate the professional category (CSP) using the indicated profession by parents

Category I: CSP privileged: entrepreneurs, professionals, managers in public sector, teachers and related, professional sectors of information, arts and entertainment, administrators and business enterprise, engineers, technical and business managers, teachers and related.

Category II: CSP rather privileged: associate professionals in health and social sector, clergy and religious professionals (public administration, administrative and commercial business), technicians, foremen, supervisors, retired executives, associate professionals.

Category III: CSP average: farmers, artisans, traders and related, civil servants, officers in Public Service, police and military, corporate administrative workers, shop assistants, personal services to individuals, retirees farmers, retired craftsmen, traders and entrepreneurs.

Category IV: CSP disadvantaged: skilled and unskilled workers, labourers, employees and retired workers, the unemployed who have never worked, anyone without a professional activity.

EATING HABITS

1. Today did you have breakfast?

No Yes

If 'yes' it is usually composed of:

- Biscuits, cakes, pastries
- Bread
- Breakfast cereals
- Stewed fruit
- Yoghurt, cheese
- Candy, sweets, chocolate bars

- Milk
- Chocolate milk
- Fruit juice
- Sodas
- Others: _____

2. Today, do you have a snack in your schoolbag?

No Yes

If 'yes', it is intended and used for:

- Morning break
- Afternoon break
- For the light afternoon meal (16h30)
- When I want, when I'm hungry

If 'yes' it is usually composed of:

- Biscuits, cakes, pastries
- Bread
- Breakfast cereals
- Stewed fruit
- Yoghurt, cheese
- Candy, sweets, chocolate bars

- Milk
- Chocolate milk
- Fruit juice
- Sodas
- Others: _____

3. Do you usually have a light afternoon meal after school (16 h30–17 h)?

No Yes

If 'yes' it is usually composed of:

- Biscuits, cakes, pastries
- Bread
- Breakfast cereals
- Stewed fruit
- Yoghurt, cheese
- Candy, sweets, chocolate bars

- Milk
- Chocolate milk
- Fruit juice
- Sodas
- Others: _____

4. Do you eat something between 16 h30 and dinner?

No Yes

If 'yes', why?.....

If 'yes' it is usually composed of:

- Biscuits, cakes, pastries
- Bread
- Breakfast cereals
- Stewed fruit
- Yoghurt, cheese
- Candy, sweets, chocolate bars

- Milk
- Chocolate milk
- Fruit juice
- Sodas
- Others: _____

5. Do you drink sodas (sugary drinks)?

- 1 or 2 times/week
- More than 2 times/week
- Daily

Comment: