

## Nutrition risk in the child and adolescent population of the Basque country: the enKid Study

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Cross-sectional population studies provide valuable information for nutrition surveillance and planning intervention strategies. The enKid Study is the largest nutrition survey on the child and adolescent Spanish population to date. In the present paper, nutrition risks in children and young people of the Basque country based on the enKid Study subsample for the Basque region are presented. Dietary assessment was completed by means of a 24 h recall and a food frequency questionnaire completed in an interview with the mother or caregiver for children under 13 years. A second 24 h recall was completed on 25 % of the sample. Body weight, height and circumference were measured on each individual. Overweight and obesity were defined using Cole *et al.* cut-offs. Fat intake supplied 40 % of energy intake and saturated fats 13.8 %. Overall, 80 % of the sample had intakes of fat above 35 %. Main food sources of fats were added fats (32 %), meat (20 %) and milk products (20 %). Buns, cakes and pastry supplied 11 % of total fat intake. The nutrients showing the highest proportion of people who did not reach one third (33 %) of the Spanish dietary reference intake levels were vitamin D, vitamin E, vitamin A and folate. Prevailing food pattern showed a high consumption of meat and meat products, milk, dairy products and cereals. Conversely, consumption of fruit, vegetables and fish was low; in fact, 89 % of the sample had a normal consumption of fruit and vegetables below five portions a day. Prevalence of obesity was estimated at 3.94 %, and 17.85 % of the sample was classified as overweight.

### Dietary survey: Child nutrition: Nutrition risk: Obesity: Population studies

Nutrition during childhood is essential for appropriate growth and development. An increasing body of evidence suggests that diet and life-style factors in this stage of life have a potential lifelong effect on risk factors for many chronic diseases such as obesity, CHD, hypertension, diabetes and some types of cancer (Kemmer, 1987; Nicklas *et al.* 1988). Furthermore, some cohort studies among children and young people show tracking of dietary patterns in this period and their influence on those prevailing in later life (Wang *et al.* 2002).

In recent years, obesity has become a major public health problem in most developed countries (World Health Organization, 2000). Of major concern is its spread among the youngest population groups (Lobstein *et al.* 2004). Information from cross-sectional population studies is of great value for the identification and prioritization of problems in a public health context. Such studies provide valuable information on dietary patterns, nutritional intake, proportion of the population meeting nutrition recommendations, the prevalence of overweight and obesity, inactivity and additional relevant information. Understanding determinants and other behavioural facts is relevant for the design and implementation of preventive action plans.

Dietary assessment in cross-sectional population studies needs a compromise between adequate precision of the estimate and what is feasible within given time and resource constraints. The most commonly used dietary data collection methods are interviewer-administered 24 h recalls, self-administered food records and food frequency questionnaires. Variation within each individual in dietary intake is one of the most important estimation issues, as has long been recognized (Beaton *et al.* 1979; Sempos *et al.* 1985). Mean 1 d intakes by individuals in a group can be an unbiased estimate of the group's usual mean intake, but only if the single days are a good representation of all days (Guenther *et al.* 1997).

In the last decade, an intense debate has arisen regarding nutrient intake recommendations and a major conceptual shift has occurred, from a nutrient deficit prevention approach to the health-enhancing potential of a nutrient adequacy approach.

The enKid Study is the largest nutrition study carried out on a representative random sample of the Spanish child and adolescent population (2–24 years), covering all geographical regions in the country (Serra Majem & Aranceta Bartrina, 2000). Information from this study has been an important tool for community nutrition action in Spain over recent years.

**Abbreviations:** BMR, basal metabolic rate; CHO, carbohydrate; DRI, dietary reference intake; EAR, estimated average requirements; EI, energy intake; SFA, saturated fatty acids.

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The present paper focuses on nutrition risks in children and young people of the Basque country based on the enKid Study subsample for the Basque region. The purpose of this study is to assess inadequate nutrient intake, to identify major food intake patterns and to determine the prevalence of obesity and overweight in this population.

## Methods

### *Study sample*

The enKid Study is a population-based, observational cross-sectional study carried out on a random sample of the Spanish population aged 2–24 years. The sample was drafted by a multiple step sampling procedure based on the population census of residents aged 2–24 years. The theoretical sample size for the whole study was set at 5500 individuals, considering an anticipated participation rate of 70%. The sampling technique included stratification by geographical area and size of municipality of residence, further randomized into subgroups. Municipalities were the primary sampling unit and individuals within the municipalities the final units in the sample.

The sample of the Basque country was oversized in order to get an adequate sample size representative for the region. The theoretical sample size for the Basque country was set at 1100 individuals to get estimates with a sampling error lower than 3%. Analysis of results in this subsample is the basis for this study.

### *Dietary assessment*

Dietary intake was assessed by means of a 24 h recall. Information was collected at the home of the participant, using household measures to estimate portion sizes. Additional information on food descriptions and portion sizes was gathered as required on site. A second 24 h recall in an independent non-consecutive day was completed in a random 25% of the sample in order to assess day-to-day intra-individual variation in dietary intake.

Day-of-collection data were randomly assigned throughout weekdays, including weekends and non-school days. Data collection was completed covering all seasons of the year (May 1998–April 2000). Data were collected by trained dietitians during a personal interview with each participant and their mother or caregiver responsible for feeding the child for those under 13 years.

Additionally, a 164-item food frequency questionnaire was completed for each participant. The study questionnaire included questions on dietary habits, consumption of supplements, physical activity on weekdays as well as leisure time, tobacco and alcohol use, food preferences and a questionnaire on beliefs and information regarding food- and nutrition-related issues (Aranceta *et al.* 2002; Pérez-Rodrigo *et al.* 2002).

### *Anthropometrical measurements*

Anthropometrical measurements were assessed on each individual following standard protocols (Serra-Majem *et al.* 2001*a,b*). Body weight, height and circumferences were measured on the day of the interview, with the subject in underwear without shoes, using an electronic scale (to the

nearest 100 g), a portable Kawe stadiometer (to the nearest 1 mm) and an inextensible Hoescht metric tape (to the nearest 1 mm). Measuring devices were systematically calibrated.

Observers followed an intensive training period to familiarize themselves with the protocol, procedures to follow and standardization of criteria before beginning the fieldwork. In this study, overweight and obesity have been defined based on BMI, computed as body weight (kg) divided by the squared height (m), using Cole *et al.* (2000) cut-offs according to a reference population percentile distribution of BMI specific for age and sex.

### *Additional variables*

The study protocol included socioeconomic family background considering the level of education and occupation of the mother and father. The educational level was later classified as low (less than 8 years of education completed), medium (between 8 and 12 years of education completed) or high (more than 12 years of education completed). The professional occupation of the parents was considered under a common hierarchical structure. This information was used to define three levels (low–medium–high) of family socioeconomic status, according to the methodology described by the Spanish Society of Epidemiology (Álvarez Dardet *et al.* 1995).

All questionnaires were specially designed for the study and were previously pretested and validated (Serra Majem & Aranceta Bartrina, 2000). All field workers followed a training period prior to data collection. Fieldwork was completed between May 1998 and April 2000. The study protocol was approved by the ethical committee of the Spanish Society of Community Nutrition. Parental consent was requested for each participant.

### *Statistical analysis*

Nutrient intakes in this study were estimated based on the 24 h recall data. The specific nutrient database software used consisted of the Spanish food composition database by Mataix *et al.* (1998) completed with information from the McCance & Widdowson food composition tables (Holland *et al.* 1991).

Data from the 24 h recall were adjusted for intra-individual variability using the method described by Liu *et al.* (1978) in order to estimate usual nutrient intakes, after cubed root transformation in order to achieve normality of the distributions. The data were back-transformed after adjustment. Basal energy expenditure was calculated using gender–age–weight-specific equations computed by Schofield (1985). Dietary reporting status was assessed by computing a ratio of reported energy intake (EI) to calculated basal metabolic rate (BMR; Goldberg *et al.* 1991). Low reporters were defined in this study as those with EI:BMR below 1.14.

Prevalence of inadequate nutrient intake was estimated as the proportion of population groups below a cut-off level of recommended intakes, considering the dietary reference intake (DRI) values for the Spanish population (Consejo Superior de Investigaciones Científicas, 1994). For comparison purposes, the estimated average requirements (EAR) cut-off method approach using EAR nutrient reference values from the Institute of Medicine (2000*a,b*) have also been used (Barr *et al.* 2002).

The usual consumers of specific foods were estimated from the food frequency questionnaire, while food consumption estimates from commonly eaten foods and food groups were derived from the 24 h recalls. Inadequate consumption by food group was calculated by comparison with Spanish food-based dietary guidelines.

Data were analysed using the statistical package SPSS for Windows (version 12.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics such as mean, standard error estimates and quartile distribution are presented for the variables considered, as well as prevalence estimates. Prevalence of inadequate consumption across groups was compared by the  $\chi^2$  statistic for rates and proportions.

## Results

### Participation rate

In the Basque country, the sample was formed by 847 individuals aged 2–24 years, 399 boys (mean age 15.3 (SE 6.4) years) and 448 girls (15.2 (SE 6.3) years), resulting in a 77% participation rate. Response rate within the region varied from 70.3% in Araba to 80.7% in Bizkaia. Participation was lower among boys (70.8%) than girls (83.4%). Table 1 shows the characteristics of respondents in the sample according to subgroups used in this analysis (age, sex, family socioeconomic status, region).

### Energy and nutrient intake

After adjustment for intra-individual variability, EI:BMR was computed and individuals with a ratio < 1.14 were excluded

from this analysis. Such low ratios are considered very unlikely as the usual energy intakes do not satisfy energy requirements, and rather they are considered to be under-reporters according to the 24 h recall. Valid records from 718 individuals were included in this analysis, 350 boys and 368 girls.

Distribution of energy and macronutrient intake by age and sex group is presented in Table 2. Mean energy intake shows a profile harmonically growing with age to reach a peak at 10–13 years in girls and at 14–17 years in boys. Cereals (31%) and milk products (20%) were the main sources of energy in the diet, followed by meat and meat products (15%), sweets (14%) and added fats (14%).

Fat intake on average supplied 40% of energy intake; saturated fatty acids (SFA) 13.8%, MUFA 16.6% and PUFA 6.1%. Overall, 29% of the sample had intakes of fat that contributed between 35 and 39% of energy and in 51.7% of the sample fat intake supplied 40% of energy in the diet or more. This proportion was significantly higher in girls and children aged 2–5 years (58%). In the youngest age group, 48% of the sample had fat intakes above 40% of energy intake. Main sources of fats in the diet were added fats which contributed to 32% fat intake, meat (20%) and milk products (20%). Buns, cakes and pastry supplied 11% of total fat intake.

Regarding SFA, 55% of the sample had intakes in the range which supplied 10–14% energy from SFA, and overall less than 12% of the sample had SFA intakes contributing less than 10% energy to the diet. The pattern was similar in boys and girls. Main sources of SFA in the diet were dairy products (34.6%), meat and meat products (22%) and buns, cakes and pastry (14%).

**Table 1.** Characteristics of participants; enKid Study – Basque country

	enKid Study – Basque country sample					
	Total		Boys		Girls	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Age group						
2–5 years	82	9.68	44	11.03	38	8.48
6–9 years	104	12.28	54	13.53	50	11.16
10–13 years	142	16.77	73	18.30	69	15.40
14–17 years	160	18.89	80	20.05	80	17.86
18–24 years	359	42.38	148	37.09	211	47.10
Total	847	100.00	399	100.00	448	100.00
Region						
Bizkaia	477	56.32	247	61.90	230	51.34
Araba	109	12.87	42	10.53	67	14.96
Gipuzkoa	261	30.81	110	27.57	151	33.71
Total	847	100.00	399	100.00	448	100.00
Size of municipality						
< 10 000 inhabitants	64	7.56	33	8.19	31	6.94
10 000–50 000 inhabitants	62	7.27	34	8.19	28	6.36
50 000–350 000 inhabitants	428	50.58	205	51.46	223	49.71
> 350 000 inhabitants	293	34.59	127	32.16	166	36.99
Total	847	100.00	399	100.00	448	100.00
Family SES level						
Low	124	14.66	58	14.50	67	14.84
Medium	503	59.38	234	58.75	269	60.05
High	220	25.96	107	26.75	112	25.11
Total	847	100.00	399	100.00	448	100.00

SES, socioeconomic status.

Table 2. Distribution of energy and macronutrient intake in children and young people of the Basque country by sex and age groups; enKid Study – Basque country

Age group		Boys					Girls				
		Mean	SE	Percentile 25	Median	Percentile 75	Mean	SE	Percentile 25	Median	Percentile 75
2–5 years	Energy (kcal)	1847.36	2.47	1660.71	1805.79	2141.15	1824.21	1.99	1619.79	1796.49	1989.93
	Protein (% energy)	16.69	0.02	13.63	15.61	18.97	14.43	0.02	11.65	14.62	17.49
	Fat (% energy)	39.97	0.02	37.13	38.71	43.66	43.31	0.03	39.90	42.37	46.43
	SFA (% energy)	14.43	0.01	13.41	13.60	16.39	14.96	0.02	11.30	14.75	18.40
	MUFA (% energy)	16.65	0.01	15.28	16.42	18.79	17.15	0.02	14.04	17.56	18.03
	PUFA (% energy)	5.32	0.01	4.53	5.51	6.29	6.00	0.02	4.73	6.69	10.80
	CHO (% energy)	46.21	0.02	44.05	46.26	47.48	45.11	0.03	41.95	43.69	51.15
	Cholesterol (mg/1000 kcal)	217.32	0.50	153.54	215.69	267.28	139.45	0.31	98.04	116.50	207.01
	Fibre (g/1000 kcal)	6.25	0.01	5.05	6.00	6.51	6.12	0.02	3.46	6.06	8.62
	Energy (kcal)	2109.64	2.35	1912.74	2020.62	2288.46	1842.01	1.80	1598.47	1995.98	2228.16
	Protein (% energy)	15.61	0.02	13.03	15.01	17.69	15.39	0.02	13.13	15.01	17.19
Fat (% energy)	39.21	0.04	35.74	38.71	42.08	40.31	0.04	36.34	41.09	43.66	
SFA (% energy)	14.23	0.02	12.55	13.79	16.29	13.93	0.02	11.97	13.70	16.96	
MUFA (% energy)	15.97	0.02	13.76	15.66	17.37	16.51	0.02	14.80	15.66	18.22	
PUFA (% energy)	5.80	0.01	4.04	5.90	7.47	6.68	0.02	4.33	6.39	9.04	
CHO (% energy)	47.59	0.04	44.17	47.69	52.26	47.04	0.05	43.54	47.40	51.91	
Cholesterol (mg/1000 kcal)	169.09	0.38	124.59	161.70	181.17	175.74	0.63	106.92	140.36	218.09	
Fibre (g/1000 kcal)	6.01	0.01	4.44	5.48	7.50	7.29	0.02	5.00	6.29	8.93	
10–13 years	Energy (kcal)	2397.53	3.15	1941.57	2266.14	2693.94	2271.24	2.59	1898.79	2275.44	2559.09
	Protein (% energy)	14.72	0.01	12.94	14.62	16.10	15.60	0.02	13.13	14.32	17.19
	Fat (% energy)	38.81	0.03	35.64	39.31	43.17	39.70	0.03	35.15	39.90	42.18
	SFA (% energy)	13.66	0.02	11.30	12.74	16.10	14.17	0.02	11.68	13.89	16.39
	MUFA (% energy)	15.42	0.01	13.85	15.94	17.18	15.93	0.01	13.95	16.13	17.37
	PUFA (% energy)	6.57	0.02	4.24	5.71	8.94	6.21	0.01	4.33	6.00	7.67
	CHO (% energy)	49.33	0.03	45.75	48.79	53.72	47.54	0.03	43.33	48.43	50.34
	Cholesterol (mg/1000 kcal)	177.42	0.41	119.17	163.12	213.15	176.15	0.40	118.41	151.77	242.06
	Fibre (g/1000 kcal)	5.44	0.01	4.15	4.95	6.91	6.21	0.01	4.41	5.88	7.65
	Energy (kcal)	2916.21	3.39	2328.45	2777.64	3528.15	2274.83	2.56	1873.68	2185.23	2518.17
	Protein (% energy)	15.28	0.01	13.23	14.82	17.29	15.90	0.03	12.64	14.72	16.20
Fat (% energy)	40.76	0.03	35.84	40.59	44.65	42.16	0.03	38.12	41.68	46.33	
SFA (% energy)	14.63	0.02	12.26	13.89	17.44	14.00	0.02	11.20	14.08	15.91	
MUFA (% energy)	16.20	0.01	13.95	16.23	17.65	17.09	0.02	14.23	15.85	19.65	
PUFA (% energy)	6.54	0.01	4.14	6.00	8.74	7.35	0.02	4.63	6.88	9.53	
CHO (% energy)	46.83	0.03	43.34	46.46	51.59	44.89	0.04	39.76	44.58	50.79	
Cholesterol (mg/1000 kcal)	140.80	0.27	102.87	127.75	156.39	165.76	0.37	101.33	158.72	205.77	
Fibre (g/1000 kcal)	5.99	0.01	4.54	5.73	7.06	6.73	0.01	4.98	6.05	8.75	
18–24 years	Energy (kcal)	2888.68	2.77	2228.01	2721.84	3363.54	2142.31	1.80	1770.45	2027.13	2425.17
	Protein (% energy)	17.51	0.01	15.21	16.99	19.07	16.66	0.01	14.22	16.99	19.07
	Fat (% energy)	39.23	0.02	35.35	40.30	43.96	39.61	0.03	33.37	39.80	45.15
	SFA (% energy)	13.13	0.01	10.43	12.74	14.75	13.63	0.02	11.11	13.12	15.43
	MUFA (% energy)	16.70	0.01	14.42	17.75	19.08	17.56	0.02	14.33	17.37	20.41
	PUFA (% energy)	5.74	0.01	4.33	5.76	6.88	5.16	0.01	3.75	4.63	6.39
	CHO (% energy)	45.17	0.02	40.85	43.41	48.61	45.80	0.03	41.02	46.20	51.56
	Cholesterol (mg/1000 kcal)	197.69	0.32	130.79	177.49	205.52	196.39	0.36	126.51	152.64	266.90
	Fibre (g/1000 kcal)	6.55	0.01	4.66	6.42	7.67	7.09	0.01	4.89	6.45	8.55

SFA, saturated fatty acids; CHO, carbohydrate.

Total carbohydrates (CHO) supplied 46% of the total energy intake and 43.7% of the sample had CHO intakes that supplied less than 45% of energy intake. Less than 1% of girls in the age group 18–24 years had CHO intakes below the estimated requirements according to the Institute of Medicine, set at 100 g.

On average, protein intake supplied 16% of energy intake, 16.3% in boys and 15.8% in girls. In 2% of the sample, protein intake supplied less than 10% energy of the diet; for 14.2% protein intake supplied more than 20% of energy intake, but intake levels above 30% energy from protein were limited to 0.1%.

In the male group, mean fibre intake ranged from 11.5 g in boys aged 2–5 years up to 18.5 g in the oldest age group. In the female group, fibre intake was lowest in girls 2–5 years (12.7 g) and increased with age up to a mean value of 15.3 g in the age group 14–17 years. As nutrient density, this intake level varied between 5.4 g/1000 kcal and 6.5 g/1000 kcal among boys across age groups and between 6.1 g/1000 kcal and 7.3 g/1000 kcal in girls. Overall, 59.3% of the sample had fibre intakes under 15 g/d. In the female subgroup, 7.4% had fibre intakes above 25 g/d. In the male subgroup, 7.1% had fibre intakes above 30 g/d.

Food consumption with breakfast supplied 17.5% of daily energy intake. Lunch, i.e. the early afternoon meal, was the main meal of the day. Food consumption at this time of the day contributed 33.5% of total energy intake; the afternoon snack supplied 14.9% and dinner was 25.9% of energy intake. However, 4.5% of the sample did not have any breakfast on the day reported. Furthermore, 4.4% reported usually they did not have any breakfast. This rate was higher in boys (7.3%) than girls (3.2%). A high proportion of those having breakfast, 70%, usually had incomplete breakfasts where fruits were missing.

#### Risk of inadequate micronutrient intake

For the present analysis, only dietary intake has been considered, but not supplements. From the general questionnaire, 21.8% of the sample reported consumption of some supplement in the past 12 months, 27.9% in girls and 15.7% boys. The use of supplements was more common in the older age group, 18–24 years (28.9%).

The estimates were performed on intake levels adjusted for intra-individual variability, thus on estimated usual intake. Mean intake of Fe, Zn, vitamin A, vitamin E and vitamin D were lower than Spanish recommended dietary intakes. The nutrients showing the highest proportion of people who did not reach one-third of the Spanish DRI levels were vitamin D, vitamin E, vitamin A and folate. The highest rates of people who did not reach two-thirds of Spanish DRI levels were observed for the same nutrients, as well as for vitamin C, vitamin B<sub>6</sub>, Fe, Ca, Mg and Zn. The risk for inadequate intakes was higher in the female subgroup for Fe, Ca, Zn, folate and vitamin E (Table 3).

Considering the EAR cut-off approach, the estimated prevalence of inadequate intake was higher for Mg, folate, vitamin C, vitamin E and vitamin D. Prevalence of inadequate intake of folate was significantly higher among girls.

**Table 3.** Percentage of children and young people in the Basque country whose daily nutrient intake was below cut-off levels (less than two-thirds of the Spanish dietary reference intake) by sex (enKid Study – Basque country)

Dietary component	All	Boys	Girls	Significance level*
Vitamin A	43.1	45.6	40.3	NS
Vitamin C	16.4	15.3	17.2	NS
Vitamin E	57.7	55.8	60.1	0.000
Thiamin	0.9	0.6	1.3	0.01
Riboflavin	1.2	1.03	1.5	NS
Niacin	1.2	1.3	1.0	0.01
Vitamin B <sub>6</sub>	8.6	5.7	12.5	0.01
Folate	28.7	4.5	57.5	0.000
Vitamin B <sub>12</sub>	0.12	0.2	0	NS
Ca	4.3	2.6	6.4	0.05
Mg	14.3	14.4	14.2	NS
Fe	15.1	2.6	30	0.000
Sample size	847	399	448	

NS, not statistically significant.

\* Difference among age/gender groups, determined by two-tailed test.

#### Food consumption pattern

The prevailing food consumption pattern shows a high consumption of meat and meat products, milk, dairy products and cereals. Conversely, consumption of fruit, vegetables and fish was low in this population group. The risk of inadequate consumption of vegetables was higher in the younger age subgroups, particularly among boys, in which more than 90% reported their usual consumption to be below recommended levels, i.e. two portions of vegetables a day. Inadequate consumption of fruit was also more frequent in boys. More than 60% of the sample reported usual consumption of fruit below two portions per day and 25.9% reported usual intakes between two and three portions per day. Overall, 89% of the sample had usual consumption of fruit and vegetables below five portions a day. Regarding dairy products, 36% of boys and girls of the study group showed inadequate consumption of milk and dairy products (fewer than four portions per day). Likewise, consumption of buns, sweets and pastry was above desirable for 47% of the sample. Table 4 shows the percentage of usual consumers by food group, mean frequency of consumption and proportion of the sample with inadequate intake according to Spanish food-based recommendations.

#### Overweight and obesity

Considering Cole *et al.* criteria to define overweight and obesity, as adopted by the International Obesity Task Force, prevalence of obesity among children and young people in the Basque country is estimated at 3.9%. A total of 17.8% of the sample was classified as overweight, higher in the male subgroup (22%). Prevalence of overweight and obesity was higher in children younger than 14 years, both in boys and girls (Table 5).

#### Discussion

The enKid Study is to our knowledge the first study to provide data on individually assessed anthropometrical measurements, dietary intake and life-styles in a national random population

**Table 4.** Percentage of usual consumers by food group, mean frequency of consumption and proportion of the sample with inadequate intake according to Spanish food-based recommendations\*  
enKid Study – Basque country

	Boys			Girls		
	Consumers (%)	Frequency of consumption	Inadequate consumption (%)	Consumers (%)	Frequency of consumption	Inadequate consumption (%)
Meat (p/week)	99.9	6.4	23	99.8	5.4	15
Sausages, butchery products (p/week)	99.7	5.4		98.4	5.4	
Fish (p/week)	98.1	3.5		98.4	3.3	2.4 p/d
Eggs (p/week)	96.9	2.8		95.5	2.6	
Milk and dairy products (p/d)	98	3.7	33	99.6	3.5	39
Legumes (p/week)	99.1	2.5	5.4	98.4	2.2	6.7
Cereals (p/d)	99	3.9		99	3.6	
Potatoes (p/week)	90	3.2		89	3.1	
Cereals + potatoes (p/d)	99	4.4	38	99	4.1	50
Vegetables (p/d)	99.6	1.1	83	99.9	1.25	78.3
Fruit (p/d)	99.5	1.3	91.1	99.6	1.8	83.1
Fruit and vegetables (p/d)	99.9	2.5	92.1	99.9	3.0	85
Buns, cakes, pastry (p/d)	92.5	0.97	50.4	96.4	0.88	43.7
Sweets (p/d)	82.6	2.3	8.3	90.8	2	12.4
Salted snacks (p/week)	86.1	2.1	29.8	81.9	1.8	22.1
Sugared soft drinks (p/week)	83.5	3.4	14.5	80.6	1.9	10.1

\*Spanish food-based recommendations: meat + fish + eggs, 2 portions/d; milk + dairy products, 3–4 portions/d; legumes, 1–2 portions/week; cereals + potatoes, 4–6 portions/d; vegetables,  $\geq 2$  portions/d; fruit,  $\geq 3$  portions/d.

sample of Spanish children and young people. Furthermore, it is the first such nutrition survey carried out in this population group in the Basque country region.

The usefulness of performing such population studies is widely acknowledged to provide valuable input for monitoring and planning public health strategies. In this case, the high participation rate achieved, the careful design of the protocol and the procedures followed ensured good quality useful data.

Most recent nutrition surveys in children and adolescents in developed countries report intakes below recommendations in significant proportions of the population (Hercberg *et al.* 1991; Gregory & Lowe, 2000; Tomkins, 2001; Sutor & Gleason, 2002). This is also the case for the enKid Study, both for the whole of the country and for the Basque country region. Particularly high prevalences of inadequacy were estimated for nutrients such as folate, vitamins C, A, E and D. Certainly, the methodologic issue of under-reporting that is believed to occur in dietary studies using 24 h recalls or food records must be addressed when interpreting the findings of this study (Livingstone & Black, 2003). To evaluate the potential for under-reporting, we used a common method to identify under-reporters that is based on the Schofield (1985) formula for basal energy expenditure and using a cut-off for the ratio EI:BMR as developed by Goldberg *et al.* (1991). Their equation calculates the lower 95 % confidence limit of EI:BMR assuming a given requirement for physical activity level, below which it is unlikely that the mean intake represents either habitual intake for weight maintenance or a random low intake (the Goldberg cut-off). Using this method, we found that 17 % of children could be classified as under-reporters. Another methodologic issue for children is accurate reporting of dietary intake.

One study documents overestimates of energy in young males, whereas other studies indicate that 24 h recalls approximate energy intakes of children (Livingstone & Black, 2003). In this case, in order to improve the accuracy of the reports, the mother or caregiver responsible for feeding the child was present during the interview with the child for those under 13 years. Furthermore, since the interviews took place at the home of the participants, it was possible to complete data on food descriptions and portion sizes according to household measures in most cases for the benefit of the information collected.

Fat intake was high in the Basque country enKid Study. This finding is consistent with the general results of the enKid Study in Spain (Serra-Majem *et al.* 2001a,b, 2002). It is interesting to note that the main sources of fat in the diet of Basque children were added fats, meat, milk products and buns, cakes and pastry. Similarly, the Four Provinces study conducted in a sample of 6–7-year-old children in four Spanish provinces identified olive oil and sunflower oil, French fries, whole milk, meat products and biscuits as the main sources of fat in this population group (Royo-Bordonada *et al.* 2003).

Among American children and young people, 34.6 % had fat intakes below 30 % of energy and only 15 % had sugar intakes below 10 % of energy (Munoz *et al.* 1998). In the Basque country, fat intake is high. In fact, only 20 % of the sample had fat intakes below 35 %. It is noteworthy, however, that added fat, particularly olive oil, is one the main sources of fat in the diet that supplied 32 % of fat intake, while MUFA was 17 % of total energy.

**Table 5.** Prevalence of overweight and obesity in children and young people of the Basque country by age and sex according to Cole *et al.* cut-off criteria (2–24 years)

	2–5 years (%)	6–9 years (%)	10–13 years (%)	14–17 years (%)	18–24 years (%)	Total (%)
<b>Total</b>						
Overweight	19.52	13.80	17.75	10.80	12.45	13.91
Obesity	10.42	9.08	2.53	4.09	1.04	3.94
Overweight + obesity	29.94	22.89	20.28	14.88	13.49	17.85
	100.00	100.00	100.00	100.00	100.00	100.00
<b>Boys</b>						
Overweight	26.32	16.00	21.99	11.62	18.99	18.49
Obesity	8.07	8.13	1.57	7.01	0.69	3.73
Overweight + obesity	34.39	24.13	23.55	18.63	19.68	22.22
	100.00	100.00	100.00	100.00	100.00	100.00
<b>Girls</b>						
Overweight	12.35	11.54	13.14	9.92	4.35	8.73
Obesity	12.89	10.07	3.57	0.97	1.47	4.18
Overweight + obesity	25.24	21.60	16.71	10.89	5.82	12.91
	100.00	100.00	100.00	100.00	100.00	100.00

George *et al.* (1993) found that in New Zealand, 10–11-year-old boys received 36% and 10–11-year-old girls received 35% of their total daily energy from fat, with SFA providing 16% and PUFA 4% of energy. The evening meal provided the greatest proportion of fat for both girls and boys in this survey (George *et al.* 1993). The same study found milk and milk products contributed 18% of total fat intake. In a study on preschool children, 27% of total fat intake came from milk and milk products (McMahon, 1990). Data from the Australian National Nutrition Survey (Australian Bureau of Statistics, 1995) showed intakes comparable to those of New Zealand, i.e., energy intake from fat was 34% for 12–15-year-olds and 32% for 16–18-year-olds. Snacks, including some fast foods, can also be major contributors of daily fat intake. Data from the UK show that fried potatoes (crisps and chips) contribute 13% of the total fat intake of teenagers aged 16–17 years (Crawley, 1993).

The findings on nutrient inadequacy are consistent with the overall food consumption pattern estimated. A high proportion of children and adolescents reported inadequate consumption of fruit and vegetables. Five per cent of the sample reported that they never consumed any vegetables at all and in more than 9% this was the case for vegetable salads. Eighty-nine per cent of the sample did not meet the recommendation of five portions of fruit and vegetables. Other studies, such as the Pro Children Study, which assessed fruit and vegetable consumption in 11–13-year-olds in nine European countries including Spain, showed similar results (Yngve *et al.* 2005). In the Pro Children Study, Spain and Iceland reported the poorest consumption of fruit and vegetables.

A study among American children and young people found mean food group intakes for the youth population as a whole below even minimum recommendations for all food groups, except for the dairy group (Munoz *et al.* 1998). In this study the percentage of children meeting the recommendations for each food group ranged from 30% for fruit, grain, dairy and meat, to 36% for vegetables. In the enKid Study, both at national level and in the Basque country, consumption of milk and dairy products is adequate in a high proportion of the population. In the Basque country, 13% of the sample had less than two portions of the dairy group every day.

Most surveys show that fruit juices, citrus fruit, other kinds of fruit and vegetables are the main sources of vitamin C in children's diets. This is the case in the enKid Study in the Basque country. Nevertheless, in significant proportions of the population, estimated intake levels were below two-thirds of Spanish DRI or were even below EAR cut-offs. In fact, it is worth noting that fruit and vegetable consumption was inadequate in a high proportion of the sample. Conversely, consumption of sweet and salted snacks, buns, cakes and pastry was above desirable. These foodstuffs were reported mainly as part of the mid-morning or afternoon snacks, but also supplied 25% of energy with breakfast, 31% for the afternoon snack and 18% as part of other snacks during the day.

Suitor and Gleason (2002) estimated 78.9% of American children had vitamin E intakes below EAR levels. Prevalence of inadequate intakes in this survey was high for folates (50.6%) and also Mg (36.5%). Females aged 14–18 years were the subgroup showing the highest rates of inadequate intakes. Overall, inadequate intakes of vitamin C in the American study were identified in 10.2% of the sample, 22% in girls aged 14–18 years. Low intakes of vitamins A, C and Mg tend to reflect low intakes of fruits and vegetables. Vitamin E is a shortfall nutrient for a high proportion of children and young people in the enKid Study in the Basque country. Current intake levels are likely underestimated because of the under-reporting of food intake on dietary surveys, especially related to the intake of fats and oils, and the limitations of nutrient databases with regard to the vitamin E content of foods as has been reported (Institute of Medicine, 2000a; Maras *et al.* 2004).

A number of epidemiological studies using data obtained from national surveys suggest that energy-dense, nutrient-poor foods may displace nutrient-dense foods, potentially reducing the consumption of foods from other food groups to lower levels than recommended and limiting the ability to achieve recommended nutrient intakes (Kant and Schatzkin, 1994; Kant, 2000, 2003).

Estimated prevalence of obesity in Basque children and youth population was high. Furthermore, compared with previous estimates in studies carried out in children in Bilbao

in 1988, 95th percentile for BMI has increased from 19.1 to 21.1 kg/m<sup>2</sup> at the age of 6 years and from 18.5 to 20.4 kg/m<sup>2</sup> in girls. The shift at the age of 13 years was from 24.9 to 26.8 kg/m<sup>2</sup> for boys and from 25.9 to 27.5 kg/m<sup>2</sup> for girls over the past 15 years, a trend similar to that seen for the whole of the country, comparing data from the PAIDOs study performed in 1985. The estimated prevalence of obesity in Spanish children aged 6–13 years in the mid-1980s was 6.4%. In the year 2000, compared with the same reference standards, prevalence of obesity in this age group has doubled to 13.9%.

## Conclusions

Fat intake is high in the Basque country population aged 2–24 years and 80% of the sample showed fat intakes above 35% of energy intake. More than 87% of the study group had SFA intakes >10% of energy. Nutrient density in the average diet of this group could improve. Risk for inadequate intake was detected for Ca, Fe, vitamin C, folate, vitamins B<sub>6</sub>, A, E and D. Food consumption pattern is characterized by a high consumption of meats and dairy products and an inadequate consumption of fruit and vegetables.

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