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Consumption of bakery products, sweetened soft drinks and yogurt among children aged 6–7 years: association with nutrient intake and overall diet quality

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The present study tests the hypothesis that higher consumption of bakery products, sweetened soft drinks and yogurt is associated with higher intake of energy, saturated fats, sugars and worse overall diet quality among Spanish children. This is a cross-sectional study covering 1112 children aged 6.0–7.0 years in four Spanish cities. Nutrient and food intake were obtained through a food-frequency questionnaire, and overall diet quality calculated using the healthy-eating index (HEI) developed by Kennedy *et al.* (1995). Standardized methods were used to measure anthropometric variables. Associations of interest were summarized as the difference in nutrient and food consumption between the value of the fifth and the first quintile of consumption (dq) of bakery products, sweetened soft drinks or yogurt, adjusted for energy intake and BMI. Bakery products, sweetened soft drinks and yogurt supplied 15·5, 1·0 and 5·6 % energy intake respectively. Higher consumption of these three foods was associated with greater energy intake ($P<0·001$), but not with higher BMI. Consumption of bakery products was associated with the proportion of energy derived from intake of total carbohydrates (dq 4·5 %, $P<0·001$) and sugars (dq 2 %, $P<0·001$), but did not show association with the HEI. Consumption of sweetened soft drinks was associated with a lower consumption of milk (dq −88 ml, $P<0·001$) and Ca (dq −175 mg/d, $P<0·001$), and worse HEI (dq −2, $P<0·01$). Consumption of yogurt, while associated with higher energy intake from saturated fats (dq 1·77 %, $P<0·001$) and sugars (dq 2·02 %, $P<0·001$), showed no association with the HEI. Differences in the intake of nutrients and foods across quintiles of consumption of bakery products, sweetened soft drinks and yogurt were usually very small. We conclude that the impact of the consumption of bakery products, sweetened soft drinks and yogurt on the quality of the diet of Spanish children is only modest, although it may contribute to aggravating certain unhealthy characteristics of their diet, particularly excess energy, saturated fats and sugars. Therefore, consumption of bakery products and sweetened soft drinks should be moderated, and priority given to consumption of low-fat, low-sugar yogurt.

Bakery products: Soft drinks: Yogurt: Diet quality: Children

Abbreviations: dq, value of the fifth minus the first quintile of consumption; FFQ, food-frequency questionnaire; HEI, healthy-eating index.

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In Spain, over 80 % of children aged 6.0–7.0 years consume bakery products (pastries, buns, biscuits, etc.), sweetened soft drinks and yogurt on a daily basis (Estudio 4 Provincias, 2001*a*). Moreover, there has been a great rise in the consumption of yogurt in the Spanish diet over the last decade (Ministerio de Agricultura, Pesca y Alimentación, 1999). From the standpoint of possible adverse health effects, bakery products have a high sugar, Na and saturated fat content, most of the latter coming from lard and vegetable oils, such as palm oil (Moreiras *et al.* 1996; Mataix *et al.* 1998). Most sweetened soft drinks are rich in sugar and some of them in Na; yogurt is characterized by its saturated fat, sugar and Na content (Moreiras *et al.* 1996; Mataix *et al.* 1998). In the USA, sweetened soft drinks form the greatest single source of sugars in the diet of 6–11-year-old children, followed by sweets, candies and bakery products (Guthrie & Morton, 2000). Furthermore, dairy products provide half of all dietary saturated fats (Troiano *et al.* 2000). A study on adults has also suggested that consumption of energy-dense nutrient-poor foods, such as bakery products and sweetened soft drinks, is associated with enhanced energy intake and poorer compliance with healthful diet guidelines (Kant, 2000).

Accordingly, we hypothesize that higher consumption of bakery products, sweetened soft drinks and yogurt is linked to higher intake of energy, saturated fats, sugars and worse overall diet quality among Spanish children. If this hypothesis is true, consumption of these foods could contribute to the rise in the prevalence of obesity observed in Spanish children (Ríos *et al.* 1999; Moreno *et al.* 2000) and the deterioration in the quality of their diet in recent years (Gorgojo *et al.* 1999). Presently, the prevalence of overweight and obesity among children aged 6.0–7.0 years is remarkably high. The percentage of children who are overweight ranges from 28·9 to 34·5 %, and the percentage of obese children ranges from 8·5 to 15·7 %, depending on the locality of residence (Rodríguez Artalejo *et al.* 2002). Spanish children's dietary habits lie midway between a typically Mediterranean pattern and one more typical of Anglo-Saxon countries. Their diet has an excess of lipids and proteins, and a relative deficit in the contribution of carbohydrates to total energy intake (Gorgojo *et al.* 1999). Thus, children aged 6.0–7.0 years show scant compliance with the macronutrient goals for healthy eating (Royo-Bordonada *et al.* 2002).This is the first study in Spain and, to our knowledge, in Mediterranean countries, to examine the association between consumption of bakery products, sweetened soft drinks and yogurt on the one hand, and energy, nutrient and food intake, and overall diet quality in children aged 6.0–7.0 years, on the other.

Methods

Study design and subjects

Briefly, this was a cross-sectional study on representative samples of children aged 6.0–7.0 years in four Spanish cities (Cadiz, Murcia, Madrid and Orense) over the period 1998–9 (Rodríguez Artalejo *et al.* 2002). The children were selected through random cluster-sampling of schools, stratified by sex and socio-economic level (i.e. public *v.* private ownership of schools). Six schools were selected in each city, and in each school almost all 6.0–7.0-year-old-children were invited to take part (approximately fifty per school). The final sample was 1112 children. The study protocol complied with Helsinki Declaration guidelines and Spanish legal provisions governing clinical research on human subjects, and was approved by the Clinical Research Ethics Committee of the Fundación Jiménez Díaz in Madrid.

Data collection

The study was presented orally to the Board of Governors (Consejo Escolar) of each of the schools. Following this, a letter was circulated to all parents, outlining the study goals and procedures, and asking for their written authorization. In each of the four cities, fieldwork was carried out over a 6-week period by a team comprising a physician and a nurse, who carried out the physical measurements, and administered a food-frequency questionnaire (FFQ) to the child's mother or person in charge of supervising their food.

Measurements were taken with children lightly dressed and barefoot. Height was measured to the nearest 1 mm using a portable stadiometer, and weight was measured to the nearest 0·1 kg using a standardized electronic digital scale. From these measurements, BMI (weight divided by the square of the height (k/m^2) was then computed.

Information on food and nutrient intake was obtained through a FFQ initially developed for use on adults and previously validated by Martín-Moreno *et al.* (1993). The FFQ was adapted for use on children by amending the list of foods and portion-sizes consumed. In particular, alcoholic beverages were removed and some foods frequently found in children's diet were added (e.g. pizzas, hamburgers, some types of bakery products, etc.) These amendments were based on a systematic review of child-population food surveys in Spain (Gorgojo *et al.* 1999). The final version of the FFQ included seventy-seven food items grouped in eleven sections according to nutrient affinity. For every food item, the standard amount consumed was defined (e.g. a cup of milk, equivalent to 170 ml, or a plate of lentils, equivalent to 60 g dry weight of lentils). Frequency of consumption considered the following categories: times per d, per week, per month, per year and never. Food quantities were converted into nutrients by applying standard Spanish food-composition tables (Moreiras *et al.* 1996; Mataix *et al.* 1998).

Bakery products were defined as the food group comprising biscuits, ensaimadas (a turban-shaped bun), doughnuts, croissants, cakes and pastries, churros (an oil-fried pastry), chocolates, pastas (assorted cookies) and mantecados (a type of shortbread). Sweetened soft drinks included both the carbonated and non-carbonated variety, but excluded any beverages that were 100 % natural fruit juice. Under the heading of yogurt, we included all the varieties of this foodstuff (e.g. skimmed, whole-milk, with fruit and with cereals).

Overall diet quality was measured with the healthy-eating index (HEI; Kennedy *et al.* 1995). This is made up of ten components drawn from the US Department of Agriculture's dietary guidelines (US Department of

Agriculture, Human Nutrition Information Service, 2000). The first five components cover consumption of foods (cereals, vegetables, fruit, dairy products, meat and fish), the following four pinpoint the intake of certain nutrients (total fats, saturated fats, cholesterol and Na) and the last component assesses the variety in the diet. Each component is scored from 0 to 10, denoting the degree to which a person's diet complies with guideline serving recommendations, with a value of 0 denoting total non-compliance and a value of 10 denoting optimal compliance. Intermediate values reflect proportional compliance. The closer to 100 the sum of the individual scores obtained by the ten index components, the higher the diet quality.

Statistical analysis

To calculate the HEI, we converted FFQ-based food-consumption frequencies and amounts into servings (Estudio 4 Provincias, 2001*b*). The recommended energy intake for children aged 6–7 years is 8340 kJ (2000 kcal)/d (Departamento de nutrición de la Universidad Complutense de Madrid, 1985, 1994). The number of servings needed for an energy level of 8340 kJ (2000 kcal)/d was obtained through interpolation of the USA Food Guide Pyramid serving recommendations for 6672 and 9174 kJ (1600 and 2200 kcal)/d), and was as follows: cereals 7·8, vegetables 3·7, fruit 2·7, dairy products 2·0, meat 2·3 (Bowman *et al.* 1998). In addition, the maximum energy value of fats considered healthy was raised from 30 to 35 %, as most fat consumed in Spain is of the olive-oil-based monounsaturated type (Aranceta, 1995; Kris-Etherton, 1999). Finally, to assess variety in the diet, we included only foods with a consumption frequency of at least one serving per month (Estudio 4 Provincias, 2001*b*; McCullough *et al.* 2000*a*,*b*). To score dietary variety, we calculated the distribution in deciles and awarded one point per decile.

Total energy intake, BMI, the proportion of energy supplied by each macronutrient, food consumption and the HEI were calculated in quintiles of consumption of bakery products, sweetened soft drinks and yogurt. The association of the consumption of these three foods with BMI, energy and nutrient intake, consumption of some foods and the HEI was summarized as the value of the difference between the fifth and the first quintile of consumption (dq) of bakery products, sweetened soft drinks or yogurt. For nutrient intake and food consumption, such differences were adjusted for energy intake and BMI. Adjustment was performed using linear regression models, where the dependent variables were a nutrient or a food, and the independent variables were energy intake, BMI and one of the following: consumption of bakery products, sweetened soft drinks or yogurt. Energy intake and BMI were modelled as continuous variables, while quintiles of consumption of bakery products, sweetened soft drinks or yogurt were modelled as dummies. We decided not to adjust HEI for energy intake and BMI because its association with such variables was very modest or null, and because calculation of HEI took into account the amount of energy intake recommended for children 6–7 years old. Finally, due to the large number of statistical tests performed, statistical significance was established at $P<0·01$.

Analyses were performed with the SAS package (version 6.2, 1996; SAS Institute Inc., Cary, NC, USA).

Results

The overall survey response rate was 85 %, being similar for all four cities. The sample comprised 557 boys (50·1 %) and 555 girls (49·9 %), having a mean age of 6.7 years, with no substantial differences between cities. Distribution by city of origin was as follows (%): Cadiz 22·5, Murcia 25·5, Madrid 24·5, Orense 27·6. Bakery products, sweetened soft drinks and yogurt supplied 15·5, 1·0 and 5·6 % energy intake respectively.

Table 1 compares the study children's dietary characteristics against nutrition and food guidelines (Departamento de nutrición de la Universidad Complutense de Madrid, 1985, 1994; Aranceta, 1995). Total energy intake was 8878 kJ (2129 kcal)/d with 37·4 % of subjects exceeding 8340 kJ (2000 kcal)/d. Fats accounted for 45·9 % energy intake and saturated fats 17 %. Cholesterol density was 170 mg/4170 kJ (1000 kcal). While consumption of carbohydrates was very low, supplying only 38 % energy, consumption of sugars was high, accounting for 21 % total energy intake. However, mean consumption of fruits, vegetables and dairy products, as well as Ca, vitamins A and C and folic acid, were all above the recommended minimums. Over 95 % of the children exceeded the recommended intakes of Ca, vitamins A and C and folic acid. Intake of Na was very high, rising to 2700 mg/d. Finally, the HEI was 65, indicating moderate diet quality (a good quality diet would correspond to an HEI value 80–100; Bowman *et al.* 1998).

Table 2 shows the association of consumption of bakery products with BMI, nutrient and food intake, and the HEI. The greater the consumption of bakery products, the greater the total energy intake (dq 2140 kJ (514 kcal)/d, $P<0·001$). Despite energy intake exceeding the age-based energy requirement (8340 kJ (2000 kcal)/d) as from the third quintile of bakery products, reaching 10 200 kJ (2448 kcal)/d in the top quintile, consumption of bakery products was not associated with BMI. Bakery products showed a negative association with energy intake from fats (dq −3·35 %, $P<0·001$), though this far exceeded the guideline level even in the top quintile of bakery products, in which 44 % energy intake was fat-based. Bakery products also showed a positive association with total intake of carbohydrates and sugars, yet consumption of the former was low and that of the latter very high across all quintiles of bakery-product consumption. Finally, consumption of bakery products was associated negatively with that of Ca, vitamin C, fruits and vegetables, but consumption of these nutrients and foods was adequate in all bakery products quintiles. Consumption of bakery products displayed no association with the HEI.

Table 3 shows the association of the consumption of sweetened soft drinks with BMI, consumption of nutrients and foods, and the HEI. Consumption of sweetened soft drinks was associated with energy intake (dq 910 kJ (209 kcal)/d, $P<0·001$), but not with BMI. Sweetened

Table 1. Observed and recommended mean daily energy and nutrient intakes, and healthy eating index for 1112 children aged 6.0–7.0 years*†
(Mean values and standard deviations)

	Observed intakes		
	Mean	SD	Recommended intakes‡
Energy (kJ)	8878	2096	8340
Fat (% energy)	46	4	≤35
Saturated fat (% energy)	17	3	<10
Carbohydrate (% energy)	38	6	>50
Sugars (simple carbohydrate) (% energy)	21	6	<10
Protein (% energy)	17	2	<15
Cholesterol (mg/4170 kJ)	170	53	<150
Na (mg)	2733	965	<2400
Ca (mg)	1575	590	800
Vitamin A (μg)	664	190	400
Vitamin C (mg)	197	87	55
Folic acid (μg)	208	63	100
Fruits (g)	319	204	>240
Vegetables (g)	327	213	>250
Dairy products (g)	628	257	>400
Healthy eating index§	65	7	>80
BMI (kg/m^2)	17·0	2·4	≤17·6‖

* Mean age 6·7 years.
† For details of subjects and procedures, see Rodríguez-Artalejo *et al.* (2002) and p. 420.
‡ See Departamento de nutrición de la Universidad Complutense de Madrid (1985, 1994) and Aranceta (1995).
§ See Kennedy *et al.* (1995).
‖ See Cole *et al.* (2000).

soft drinks were negatively associated with Ca intake, which nevertheless exceeded the recommended maximum across all quintiles of sweetened soft drinks. Furthermore, a negative association was in evidence for milk consumption (dq −87·6 ml/d, $P<0·001$), though this is offset partially by a rise in the consumption of dairy products other than milk (dq 36·54 ml/d, $P<0·001$). While consumption of sweetened soft drinks was associated with worse diet quality, the difference in the HEI between the top and bottom quintiles of sweetened soft drinks was very modest (dq −2, $P<0·01$).

Table 4 shows the association of the consumption of yogurt with BMI, consumption of nutrients and foods, and the HEI. Consumption of yogurt was associated with total energy intake (dq 1739 kJ (417 kcal)/d, $P<0·001$), though not with BMI, despite values for energy intake exceeding the age-based energy requirement in the top two yogurt quintiles. There was an association between yogurt consumption and intake of saturated fat and sugars, though intake of all these nutrients was excessive even in the lowest yogurt quintile, and registered scant interquintile variation. Despite being negatively associated with vitamin C and total milk consumption, the difference in vitamin C and milk consumption between the highest and lowest yogurt quintiles was only 33 mg and 80 ml respectively, and was appropriate in both cases including the lowest yogurt quintile. Consumption of yogurt was also associated with consumption of dairy products, excluding milk and yogurt, and with fruit juices. Finally, the HEI did not show any significant variation with consumption of yogurt.

Finally, it should be noted that even for the associations observed, the differences in the intake of nutrients and foods across quintiles of consumption of bakery products, sweetened soft drinks and yogurt were usually very small, despite a fairly large variation in consumption of bakery products, sweetened soft drinks and yogurt (Tables 2–4). In some cases, there were notable discrepancies between the crude and energy- and BMI-adjusted differences in nutrient intake and food consumption across quintiles of bakery products, soft drinks and yogurt. This mainly reflects the strong association between energy intake and the intake of all macronutrients and many foods.

These results were similar when the analyses were performed separately for each sex.

Discussion

Based on a representative sample of children aged 6.0–7.0 years in four Spanish cities, our present study shows that consumption of bakery products, sweetened soft drinks and yogurt was associated with higher energy intake but not with higher BMI. In addition, associations were shown between: consumption of bakery products and higher intake of sugars; consumption of sweetened soft drinks and lower consumption of milk and Ca, and worse overall diet quality; consumption of yogurt and greater intake of saturated fats and sugars. However, the magnitude of most of these associations tended to be small.

Higher consumption of bakery products was not linked to a worse HEI. This is because the HEI does not include energy intake and, indeed, scores positively the decrease in fat-derived energy intake brought about by the increase in carbohydrate-derived energy intake in the form of cereals from bakery products. Similarly, the HEI does not reflect

Table 2. BMI, nutrient and food intake per d, and healthy eating index, by quintiles of consumption of bakery products in 1112 children aged 6.0–7.0 years†

	Intake (g)		BMI (kg/m^2)	Total energy (kJ)	Fat (% energy)	Saturated fat (% energy)	Carbohydrate (% energy)	Sugars (% energy)	Protein (% energy)	Cholesterol (mg/4170 kJ)	Na (mg)	Ca (mg)	Vitamin A (μg)
	Mean	SD											
Bakery products (quintiles)													
≤42 g	28	10	17·4	8060	48	17	36	20	17	171	2440	1445	602
>42 and ≤62 g	53	6	16·9	8321	47	17	37	21	17	170	2595	1525	628
>62 and ≤84 g	73	6	16·9	8687	46	16	38	21	17	168	2651	1539	651
>84 and ≤118 g	99	10	16·8	9093	45	17	39	23	17	178	2810	1600	691
>118 and ≤695 g	183	78	16·8	10 200	44	17	41	22	16	161	3169	1769	747
dq			−0·6‡	2140***‡	− 3·4***	0·3	4·5***	2·0***	−0·9***	−0·8	103·7	−127·8**	6·2

Table 2. *Continued.*

	Vitamin C (mg)	Folic acid (μg)	Fruits (g)	Vegetables (g)	Total milk (ml)	Whole milk (ml)	Semi-skimmed milk (ml)§	Dairy products (excluding milk and yogurt) (g)	Fruit juices (natural and canned) (ml)	Healthy eating index‖
Bakery products (quintiles)										
≤42 g	183	188	317	334	350	262	88	97	166	64
>42 and ≤62 g	193	196	311	337	379	291	88	92	168	64
>62 and ≤84 g	197	203	312	330	366	292	73	104	172	65
>84 and ≤118 g	194	210	339	307	378	301	77	114	168	64
>118 and ≤695 g	223	240	315	330	421	345	77	112	189	66
dq	−18·6**	1·5	−77·5***	−86·3***	−8·3	−5·6	−2·7	−14·7	13·4	2·0‡

dq, difference of the fifth minus the first quintile adjusted for energy intake and BMI.
**$P<0·01$, ***$P<0·001$.
† For details of subjects and procedures, see Rodríguez-Artalejo *et al.* (2002) and p. 420.
‡ Difference of the fifth minus the first quintile without adjustment for energy intake and BMI.
§ Semi-skimmed milk has 15 g fat/l.
‖ See Kennedy *et al.* (1995).

Table 3. BMI, nutrient and food intake per d, and healthy eating index, by quintiles of consumption of sweetened soft drinks in 1112 children aged 6.0–7.0 years†

	Intake (ml)		BMI	Total energy	Fat	Saturated fat	Carbohydrate	Sugars	Protein	Cholesterol	Na	Ca	Vitamin
	Mean	SD	(kg/m^2)	(kJ)	(% energy)	(% energy)	(% energy)	(% energy)	(% energy)	(mg/4170 kJ)	(mg)	(mg)	A (μg)
Sweetened soft drinks (quintiles)													
≤1 ml	0		17·1	8433	47	17	37	20	18	175	2608	1560	641
>1 and ≤13 ml	9	4	16·5	8605	45	17	39	22	17	162	2509	1560	646
>13 and ≤28 ml	27	3	16·9	8930	46	17	39	21	17	166	2733	1582	667
>28 and ≤59 ml	51	10	16·9	9086	46	16	38	21	17	170	2766	1591	682
>59 and ≤801 ml	188	151	17·5	9343	46	17	38	21	17	175	3061	1586	687
dq			0·4‡	910***	0·1	−0·3	0·7	1·3	−0·7**	6·3	172·7	−174·7***	−15·9

Table 3. *Continued.*

	Vitamin C (mg)	Folic acid (μg)	Fruits (g)	Vegetables (g)	Total milk (ml)	Whole milk (ml)	Semi-skimmed milk (ml)§	Dairy products (excluding milk and yogurt) (g)	Fruit juices (natural and canned) (ml)	Healthy eating index‖
Sweetened soft drinks (quintiles)										
≤1 ml	185	199	291	308	389	304	85	93	175	64
>1 and ≤13 ml	197	205	284	344	385	302	83	84	135	66
>13 and ≤28 ml	197	207	336	334	388	296	92	95	162	65
>28 and ≤59 ml	211	218	330	346	383	293	90	104	181	65
>59 and ≤801 ml	202	210	355	307	346	294	52	144	214	62
dq	−6·9	−8·7	40·5	−36·6	−87·6***	−53·1	−34·5	36·5***	35·6	−2·0**‡

dq, difference of the fifth minus the first quintile adjusted for energy intake and BMI.
**$P<0·01$, ***$P<0·001$.
† For details of subjects and procedures, see Rodríguez-Artalejo *et al.* (2002) and p. 420.
‡ Difference of the fifth minus the first quintile without adjustment for energy intake and BMI.
§ Semi-skimmed milk has 15 g fat/l.
‖ See Kennedy *et al.* (1995).

Table 4. BMI, nutrient and food intake per d, and healthy eating index, by quintiles of consumption of yogurt, in 1112 children aged 6.0–7.0 years†

	Intake (g)		BMI	Total	Fat	Saturated fat	Carbohydrate	Sugars	Protein	Cholesterol	Na	Ca	Vitamin A
	Mean	SD	(kg/m^2)	energy (kJ)	(% energy)	(% energy)	(% energy)	(% energy)	(% energy)	(mg/4170 kJ)	(mg)	(mg)	(μg)
Yogurt (quintiles)													
≤53 g	31	18	16·6	8182	46	16	38	20	17	169	2531	1396	608
>53 and ≤107 g	78	15	17·2	8536	46	17	38	20	17	171	2598	1519	636
>107 and ≤132 g	126	4	17·1	8535	46	17	38	22	17	165	2608	1498	648
>132 and ≤250 g	187	47	17·1	9279	46	17	38	22	17	172	2841	1675	693
>250 and ≤650 g	324	90	16·8	9921	45	17	39	23	17	172	3122	1810	742
dq	293***		0·2	1739***	−0·1	1·8***	−0·4	2·0***	0·4	11·9	44·1	101·3	33·3

Table 4. *Continued.*

	Vitamin C (mg)	Folic acid (μg)	Fruits (g)	Vegetables (g)	Total milk (ml)	Whole milk (ml)	Semi-skimmed milk (ml)§	Dairy products (excluding milk and yogurt) (g)	Fruit juices (natural and canned) (ml)	Healthy eating index‖
Yogurt (quintiles)										
≤53 g	193	197	293	329	378	284	94	85	147	65
>53 and ≤107 g	198	201	290	327	389	306	82	98	150	65
>107 and ≤132 g	191	202	330	315	378	294	84	87	187	65
>132 and ≤250 g	197	212	341	323	384	317	67	108	176	64
>250 and ≤650 g	213	227	341	344	363	287	76	145	207	63
dq	−32·9***	−11·1	−6·0	−44·6	−80·3***	−48·2	−32·1	34·4**	47·3**	−2·0

dq, difference of the fifth minus the first quintile adjusted for energy intake and BMI.
**$P<0·01$, ***$P<0·001$.
† For details of subjects and procedures, see Rodríguez-Artalejo *et al.* (2002) and p. 420.
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the reduction in fruit and vegetable intake that accompanied the rise in consumption of bakery products, because the former remained optimal throughout. Nonetheless, the higher intake of energy and sugars, and the lower consumption of fruits and vegetables that are associated with consumption of bakery products, suggest that consumption of this type of product should be moderated.

It has been suggested that sweetened soft drinks may displace milk and fruit juice in the diet (Harnack *et al.* 1999). Moreover, consumption of sweetened soft drinks has been linked to lower intake of Ca, riboflavin, vitamin A, P (milk nutrients), folates and vitamin C (fruit nutrients) (Harnack *et al.* 1999; Ballew *et al.* 2000*a*). In our present study, sweetened soft drinks were associated with a lower consumption of milk, yet this was offset in part by increased consumption of dairy products. Our present results do not, however, agree with those reported by other authors (Harnack *et al.* 1999; Ballew *et al.* 2000*a*), in that the association between sweetened soft drinks and 100 % fruit juice drinks proved positive (although NS). Similarly, our present results apparently fail to support the hypothesis that foods rich in vitamins and minerals are displaced by sweetened soft drinks, since there was no clear evidence of a reduced intake of such micronutrients in the upper sweetened-soft-drink quintiles. The lower consumption of milk and Ca associated with soft drinks is probably the principal reason for the slight worsening in the HEI. It is difficult to interpret a two-point decrease in the HEI, although it does not seem likely that such a small decrease (2 % of the index range) would influence the health of the children in the short term. Nevertheless, it points to the advisability of moderating children's consumption of these types of beverages.

As expected, consumption of yogurt was associated with an elevated intake of saturated fats and sugars. However, the interquintile variation for saturated fats and sugars was very small; furthermore, intake of yogurt did not modify the proportion of total fat in the diet. Accordingly, while a reduction in the consumption of yogurt would not appear necessary, it would seem reasonable to prioritize the consumption of the skimmed-milk variety. Additional support for such a policy is the fact that correct intake of energy and nutrients is not compromised by a reduction of up to 8·5 % in the intake of saturated fats (Dixon *et al.* 1997), and that children's diets that are moderate in fats are not associated with a higher risk of nutritional deficit (Ballew *et al.* 2000*b*). Furthermore, adequate Ca intake can be ensured through consumption of skimmed-milk dairy products (Kennedy & Powell, 1997).

With regard to the study's limitations, these are a consequence of its design and of the measuring instruments used. A cross-sectional study cannot demonstrate causality. Hence, the observation of lower consumption of fruits and vegetables among consumers of bakery products, or of lower consumption of milk among the greatest consumers of sweetened soft drinks, cannot be interpreted as displacement of some foods by others, and should be regarded as mere associations (Dixon *et al.* 1997). In fact, since food consumption is highly correlated, as shown in part by our own results, our present findings cannot be attributed to a direct effect of bakery products, sweetened soft drinks and yogurt. For example, Table 3 shows that those in the fourth quintile of consumption of sweetened soft drinks (mean value 51 ml/d) take in 653 kJ (115 kcal)/d more than those in the first quintile of consumption of such drinks (0 ml/d). This is not probably explained directly by the consumption of only 51 ml sweetened soft drinks, but by the higher consumption of dairy products and fruit juice associated with soft drinks. In addition, some observed associations could be explained by uncontrolled confounders. For instance, the greater energy intakes in the higher quintiles of bakery products, soft drinks and yogurt might reflect the greater amount of all food eaten, which could be due to higher physical activity in that subgroup of children. Unfortunately, we did not collect information on physical activity that could have allowed for its adjustment in the analyses. In addition, other uncontrolled factors, such as socio-economic status, could influence the results. A recent national study observed an inverse socio-economic gradient, as measured by parental education level, for consumption of yogurt among children and adolescents in Spain, although it was not observed for bakery products and soft drinks (Serra Majem & Aranceta Bartrina, 2002).

It is difficult to generalize about the validity and reproducibility of the different diet assessment methods (McPherson *et al.* 2000). While some studies show an overestimate of the energy intake among children (Stein *et al.* 1992), others indicate that it is possible to measure correctly the intake of energy and nutrients through FFQ (Treiber *et al.* 1990; Hammond *et al.* 1993). There is also evidence that mothers furnish reliable information on meals made for children at home (Klesges *et al.* 1987; Treiber *et al.* 1990). Although our FFQ has not been specifically validated in children, it has been piloted to ensure that the children's mothers (or adults in charge of supervising children's menus) fully understood the questionnaire and were able to complete all the questionnaire items. In most cases, the children's mothers prepared the meals, but where they were prepared by other persons (e.g. grandmother, a maid), information was obtained directly from these people. In addition, our present estimates of the nutrient and food intake among children aged 6.0–7.0 years were similar to those reported by a national study, carried out during the same time period, using both a 24 h recall questionnaire and a FFQ (Serra Majem & Aranceta Bartrina, 2002).

Consumption of sweetened soft drinks and bakery products may have been underestimated, either because they tend to be consumed between meals and are thus inadvertently forgotten, or because they are perceived by mothers as being somewhat unhealthy (Gibson, 1990). If such errors would affect those with higher consumption of soft drinks and bakery products more, they would tend to underestimate the observed associations. On the other hand, we think that it is unlikely that such errors would vary systematically with the intake of other nutrients and foods studied; we therefore believe that the associations observed are not biased thereby. We also acknowledge that the FFQ is not the standard method to assess Na intake, although some studies have found good correlations for Na intake between the questionnaire and urinary

excretion (Willett, 1998). Moreover, we have made a particular effort to measure Na intake properly, because our FFQ and food-composition tables considered both the Na arising from the generic food items and that coming from salt directly added to the food. Our present FFQ does not distinguish between regular, low-fat or low-sugar yogurt. However, most of the yogurt consumed in Spain is of the regular variety, and therefore our present results concerned mainly this type of yogurt.

Finally, several of the HEI components, including dietary variety, were prospectively validated and shown to be associated with general, cardiovascular or cancer-related mortality in adults (Kant, 1996). Furthermore, there is evidence of association between other indicators of overall diet quality and general mortality (Kant *et al.* 2000), although the HEI only shows a weak association with the risk of chronic disease (McCullough *et al.* 2000*a*,*b*).

In conclusion, our present results suggest that the impact of the consumption of bakery products, sweetened soft drinks and yogurt on the quality of the diet of Spanish children is only modest, although it may contribute to the aggravation of certain unhealthy characteristics of their diet, particularly the excess in energy, saturated fats and sugars. Therefore, consumption of bakery products and sweetened soft drinks should be moderated, and priority given to consumption of low-fat, low-sugar yogurt.

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