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Influence of the Intake of Fortified Breakfast Cereals on Dietary Habits and Nutritional Status of Spanish Schoolchildren

Abstract

A study was performed on the breakfast habits of 200 schoolchildren between 9 and 13 years of age. The subjects were classified into two groups: group C, children who consumed fortified breakfast cereals (65 boys and 35 girls), and group NC, children who did not (64 boys and 36 girls). The different dietary habits and the nutritional status of the two groups were analyzed. Haematological, biochemical, anthropometric, and dietary data were collected, the latter involving a 5-day food record. The children of the C group were found not only to have a more complete and nutritive breakfast, but also showed better dietary patterns for the rest of the day. Their lipid intake (% kJ) was lower and the carbohydrate intake (g/d and % kJ) higher than in the NC children. The intakes of thiamine, pyridoxine, folates, and β-carotenes were also higher in group C. Better dietary habits were reflected in higher blood levels of some important compounds. Group C children had higher retinol, serum folate, and riboflavin levels than NC children. The percentage of children with hypercholesterolaemia (serum cholesterol >4.5 mmol/l) was higher amongst those of the NC group: 37% as compared with 18% of the C children.

Key Words

Schoolchildren, breakfast
Nutrition survey
Food intake
Energy intake
Nutrient intake
Biochemical parameters
Haematological parameters

Introduction

Skipping breakfast is a common problem and has been the focus of attention of many studies [1–4].

Several authors [5–7] have indicated that the omission of breakfast, or the consumption of an inadequate breakfast, are factors contributing to dietary inadequacies. These inadequacies are rarely made up by other meals taken during the course of the day.

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Breakfast consumption has been identified as an important factor in nutritional well-being [8–10]. This study compares the daily food and nutrient intakes and nutritional status of children with different breakfast consumption profiles. More specifically, given the rising consumption of breakfast cereal in Spain, the study was designed to analyze the influence of fortified cereal consumption at breakfast upon dietary habits throughout the rest of the day and upon subjects' nutritional status.

Materials and Methods

Sampling and Protocol

The study sample consisted of 200 schoolchildren between 9 and 13 years of age from the Autonomous Community of Madrid (Spain). Children were classified into two groups: C, those who consumed fortified breakfast cereals every day (65 boys and 35 girls), and NC, those who did not (i.e. subjects who never consumed this type of food; 64 boys and 36 girls). The different dietary habits and the nutritional status of the groups were analyzed.

The children investigated belonging to medium and medium-high socio-economic levels, were selected from a larger sample of 742 children from four different schools in Madrid whose characteristics have been described in an earlier publication [11]. The children answered a questionnaire on their food intake habits at breakfast time both for schooldays and holidays. The questionnaire was then used to select the final sample.

The 100 C subjects were selected from 170 schoolchildren who ate fortified breakfast cereals everyday. The 100 NC children were selected from 252 who never consumed this type of food. In order to facilitate analysis of the results, the 320 children who declared they ate fortified breakfast cereals occasionally were eliminated from the study.

Multistage sampling was used, so that the selection of the NC subjects showed age range and proportion of boys to girls similar to that of the C subjects. None of the subjects had any known chronic or serious illness, and none took any medication or supplements that might have interfered with the results. Any selected subject who chose not to participate was substituted by another. 129 C children and 138 NC children were required to provide the final 100 subjects of each group.

After presentation of the study protocol, written consent to proceed was obtained from the parents. The study was approved by the Human Research Review Committee of the Pharmacy Faculty, Complutense University of Madrid.

Dietary Survey

A prospective method involving the keeping of a 'weighed food record' was followed over 5 consecutive days (including a Sunday). The selected children and their parents were invited to a meeting on the occasion of which the investigation was explained. Kitchen scales were provided to all the subjects' families to facilitate the weighing of food.

Qualified nutritionists remained at the school throughout the study period in order to answer any doubts the subjects' parents had with respect to filling in the weighed food record. When records were completed, they were returned in person and inspected by a nutritionist to ensure that they were complete and that sufficient details had been recorded. In the same interview a 'food frequency intake' questionnaire was completed in order to contrast subjects' answers with the results of their 5-day dietary record, and an explanation was requested if answers were inconsistent. The food frequency intake questionnaire asked the number of times (per day, week, or month) that different foods were consumed, following a modified version of the method used by Mullen et al. [12]. Also during this interview inquiries were made into how long the subjects spent at breakfast for each of the 5 days of the study.

Energy and nutrient contents of all food ingested were determined using the 'Spanish Food Composition Tables' [13]. The 'Tables of Recommended Intakes of Energy and Nutrients for the Spanish Population', issued by the Department of Nutrition [14], were used to calculate the recommended dietary intakes (RDI) for this population group. Comparison between observed intakes and RDI values were used to assess the adequacy of the diets.

Anthropometric Survey

Weight and height (without shoes and wearing only underwear) were determined using a digital electronic scale (Seca Alpha GmbH & Co., Igny, France; range 0.1–150 kg) and a model 450 digital stadiometer (Harpender Pfifter, Carlstadt, N.J., USA; range 70–205 cm), respectively. From the anthropometric data the body mass index (kg/m^2) was calculated. All measurements were made at the school first thing in the morning and following norms set out by the World Health Organization [15].

Haematological and Biochemical Survey

Blood was drawn first thing in the morning, without stasis, by venipuncture (antecubital fossa) after an overnight (12-hour) fast. All extractions were performed at school.

Blood samples were analyzed for red blood cells, haemoglobin, haematocrit, mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration using a Coulter counter S-plus [16].

Total serum proteins were determined by spectrophotometry using the biuret method (coefficient of variation, CV = 2.3%) [17]. The albumin content was determined by reacting with bromocresol green (CV = 1.7%) [18]. The serum ferritin concentration was measured using solid-phase immunoradiometry (CV = 4%) [19]. Serum transferrin was determined by immunochemical-nephelometric methods [20] (CV = 3.4%). Glucose was quantified by the glucose oxidase-peroxidase method [21, 22] (CV = 1.8%).

Total cholesterol and high-density lipoprotein cholesterol were determined by enzymatic-colorimetric methods [23] (CV = 2.8%). The high-density lipoprotein cholesterol content was determined after precipitation of all other lipoproteins of serum with phosphotungstic acid and magnesium ions [24] (CV = 2.9%). Triglycerides were measured by enzymatic hydrolysis (method GPO/PAP; CV = 3.1%) [25]. By dividing triglyceride values by 5, the level of very-low-density lipoprotein cholesterol was calculated [26]. Low-density lipoprotein cholesterol was calculated using the formula of Friedewald et al. [27].

The biochemical determinations of proteins, albumin, glucose, triglycerides, cholesterol, and high-density lipoprotein cholesterol were performed using a Drought Chemistry analyzer (Kodak XR-700) [21, 28].

Serum retinol, tocopherol [29] (CV = 1.6%), and pyridoxine levels [30] (CV = 1.9%) were determined using high-performance liquid chromatography.

Serum folate concentrations and serum cyanocobalamin levels were quantified using solid-phase radioimmunoassays (DPC on solid phase, no Boil-Dual count) [31] (CV = 3%). Erythrocyte folate was measured by the same method after collecting blood in vacutainers containing EDTA and diluting it by 1:10 in a 1% ascorbic acid solution. Samples were protected from light [32] (CV = 3.9%).

Thiamine and riboflavin statuses were determined using the activation coefficients of erythrocyte transketolase and erythrocyte glutathione reductase, respectively [33].

The serum vitamin C content was determined by colorimetry (Boehringer Mannheim Biochemicals) [34] (CV = 4.2%). Iron [28] (CV = 2.5%), calcium (CV = 1.2%), magnesium (CV = 1.3%), and phosphorus (CV = 1.6%) were quantified by colorimetry [35] using a Drought Chemistry analyzer (Kodak XR-700) [21, 28].

Statistical Analysis

Mean values, standard error, range, and deficiency percentages are shown. The degree of significance of the differences between mean values was calculated using the Student t test. Where the distribution of results was not homogeneous the Mann-Whitney test was used. In order to contrast the statistical differences between proportions, an approximation of the binomial distribution to normal, employing continuity correction [36], was used. The results were considered significant if $p < 0.05$.

Results

Table 1 shows the personal and anthropometric data of the study population.

Table 2 shows the breakfast composition of the final sample of children. Foodstuffs are grouped into the following classes: (1) Dairy products, including milk (complete and low-fat) and milk products (cheese, yogurt, etc.). (2) Cereals, including rolls, bread, biscuits, and breakfast cereals. The latter were fortified with different vitamins and iron. The quantities provided by 100 g of breakfast cereal were: 0–60 mg of vitamin C, 1.5–18 mg niacin, 0–2 mg pyridixine, 1.3–1.6 mg riboflavin, 0.2–1.4 mg thiamine, 167–250 μg folic acid, 0–4.2 μg vitamin D, 0–1 μg vitamin B_{12}, and 7–14 mg iron. (3) Fruits: both fresh fruits and fruit juices. (4) Protein groups, including meats, sausage, eggs, etc.

In both groups, C and NC, dairy products and cereals were the most usual foodstuffs taken for breakfast, along with their typical accompaniments (e.g. sugar, coffee, cocoa, butter, jam). Breakfasts which included more than three food groups were not very usual

Table 1. Personal and anthropometric data (mean ± SE)

	Total	C	NC
n	200	100	100
Age, years	11.98±0.10	11.97±0.13	11.99±0.14
Weight, kg	46.78±0.77	46.45±1.18	47.10±1.00
Height, m	1.53±0.01	1.53±0.01	1.53±0.01
Body mass index, kg/m^2	19.70±0.20	19.53±0.28	19.85±0.28

No differences were seen between C and NC subjects using the Student t test or the Mann-Whitney test (where the distribution of results was not homogeneous.).

Table 2. Time spent, number, and combinations of food groups consumed at breakfast

	Total	C	NC
Time spent at breakfast, min (mean ± SE)	12.62±0.6	14.20±1.00*	11.16±0.82*
Number of consumed food groups (mean ± SE)	1.85±0.05	2.12±0.04*	1.56±0.08*
Combination of consumed groups, %			
Dairy products	20.0	0	40.0
Dairy products-cereals	59.5	79.0**	40.0**
Dairy products-cereals-fruits	11.0	18.0**	4.0**
Dairy products-cereals-fruits-protein groups	0.5	0	1.0
Dairy products-fruits	1.0	0	2.0
Dairy products-fruits-protein groups	0	0	0
Dairy products-protein groups	0	0	0
Dairy products-cereals-protein groups	2.5	0	5.0
Cereals-protein groups-fruits	0.5	0	1.0
Fruits-cereals	1.5	3.0	0
Cereals	0.5	0	1.0
Fruits	0	0	0
Skipping breakfast	3.0	0	6.0

* $p < 0.05$ (significant) between C and NC subjects using the Student t test and the Mann-Whitney test (where the distribution of results was not homogeneous).

** $p < 0.05$ (significant) between C and NC groups using an approximation of the binomial distribution to the normal, employing continuity correction.

(11%), but more frequent in the C ($p < 0.01$) than in the NC group (table 2).

C children demonstrated better breakfast habits by consuming a wider range of foodstuffs ($p < 0.05$; 2.12 food groups) than NC children (1.56 food groups). Among NC children 6% never had breakfast, and 40% only drank a glass of milk (table 2).

The descriptive data of food consumption presented in table 3 show that C children con-

Table 3. Daily food intake (g/day; mean ± SE)

	Total	C	NC
Total food	1,488.3±27.6	1,526.6±37.6	1,450.0±40.2
Dairy products	417.3±14.3	441.3±20.8	393.4±19.5
Cereals	183.7±5.5	190.0±6.7	177.3±8.7
Eggs	29.5±1.2	28.4±1.7	30.6±1.9
Fats and oils	28.1±0.9	28.4±1.2	27.8±1.4
Vegetables	212.6±5.4	211.6±7.6	213.6±7.8
Legumes	12.3±0.7	12.6±1.0	11.9±1.1
Fruits	212.6±11.9	234.0±18.5[a]	191.3±14.9[a]
Meats	153.7±4.1	152.3±5.6	155.1±5.9
Fish	52.6±3.0	54.5±3.8	50.8±4.6
Beverages	89.7±7.0	74.6±9.3*	104.8±10.2*
Various	67.2±3.7	67.1±4.6	67.3±5.9
Precooked	18.8±2.0	19.3±2.8	18.3±2.9

[a] $p < 0.1$ (almost significant); * $p < 0.05$ (significant) between C and NC subjects using the Student t test and the Mann-Whitney test (where the distribution of results was not homogeneous).

sumed greater amounts of dairy products (NS), cereals (NS), and fruits ($p < 0.1$) and lower amounts of beverages ($p < 0.05$) than NC children.

With respect to energy and nutrient intake, C children had lipid intakes (% kJ) lower and carbohydrate intakes (g/day and % kJ) higher than NC children. The intakes of thiamine, pyridoxine, folates, β-carotenes ($p < 0.05$), riboflavin ($p < 0.1$), and iodine ($p < 0.1$) were also higher in group C (tables 4, 5).

Haematological and biochemical results are more favourable in C than in NC children. There are significant differences for retinol, folate, and riboflavin (table 6).

Discussion

Eating breakfast is recognized as a healthy habit by most authors [8–10]. It is, therefore, necessary to encourage the taking of this meal and to make its composition reflect recommendations that would contribute to the improvement of the health of schoolchildren.

Several authors [8, 37] have suggested that individuals interested in their health will follow several forms of healthy behaviour. It is likely that the parents who are more concerned about health and diet of their children may take more care over what they eat for breakfast.

Better breakfast habits were observed among C than among NC children. C children spent more time eating breakfast ($p < 0.05$) and also consumed a larger number of foodstuffs ($p < 0.001$; table 2).

Even though the percentage of children that skipped breakfast is lower than reported in other studies [1, 7], 6% of the NC children skipped breakfast, and 40% drank only a glass of milk (table 2). This insufficient food consumption, early in the morning, could influence the physical and intellectual performance of children [38], but could also condition their food intake along the day and their nutritional status [5, 6, 39, 40].

Table 4. Daily energy and nutrient intake: proportion of energy derived from macronutrients and fatty acids (mean ± SE)

	Total	C	NC
Energy and macronutrient intake			
Energy kJ	9,073±139	9,246±179	8,900±213
kcal	2,168±33	2,209±43	2,126±51
Proteins, g	83.5±1.3	84.6±1.7	82.4±2.1
Lipids, g	100.1±1.8	99.7±2.3	100.6±2.7
Carbohydrates, g	244.6±4.5	254.4±6.3*	234.8±6.3*
Fibre, g	21.0±0.6	20.3±0.7	21.6±0.9
Proportion of energy derived from			
Proteins, % kJ	15.5±0.1	15.4±0.2	15.6±0.2
Lipids, % kJ	41.6±0.3	40.7±0.5*	42.5±0.4*
Carbohydrates, % kJ	42.2±0.4	43.1±0.6*	41.4±0.4*
SFA, % kJ	13.8±0.2	13.5±0.2[a]	14.1±0.2[a]
MUFA, % kJ	17.0±0.2	16.3±0.3*	17.6±0.3*
PUFA, % kJ	5.6±0.1	5.5±0.2	5.7±0.2
Cholesterol, mg/4,186 kJ	158.7±3.2	156.6±4.3	160.8±4.8
Vitamin intake			
Ascorbic acid, mg	109.0±4.2	114.7±5.6	103.2±6.2
Thiamine, mg	1.22±0.03	1.28±0.04*	1.16±0.04*
Riboflavin, mg	1.68±0.04	1.74±0.05[a]	1.62±0.05[a]
Pyridoxine, mg	1.50±0.03	1.59±0.05*	1.42±0.04*
Niacin, mg	28.2±0.5	28.7±0.7	27.8±0.7
Folates, µg	149.9±4.2	163.9±6.1*	136.0±5.5*
Cyanocobalamin, µg	5.4±0.4	5.3±0.4	5.4±0.6
Vitamin A, µg	975.9±65.2	1,003.4±108.6	948.4±72.7
Retinol, µg	644.8±64.7	698.2±107.8	590.4±71.0
β-Carotene, µg	1,542.2±81.6	1,710.9±126.8*	1,373.6±100.4*
Vitamin D, µg	2.5±0.1	2.6±0.2	2.4±0.2
Vitamin E, mg	10.3±0.2	10.6±0.3	10.0±0.3
Mineral intake			
Calcium, mg	883.0±21.5	913.6±29.3	852.4±31.2
Magnesium, mg	289.9±6.5	286.9±8.7	292.8±9.8
Iron, mg	12.0±0.2	12.1±0.3	11.8±0.3
Zinc, mg	10.2±0.2	10.2±0.2	10.3±0.3
Iodine, µg	330.9±13.1	355.7±19.4[a]	306.1±17.3[a]
Sodium, g	2.3±0.3	2.2±0.1	2.5±0.5
Potassium, g	6.6±3.5	3.1±0.1	10.0±7.0

SFA = Saturated fatty acids; MUFA = monounsaturated fatty acids; PUFA = polyunsaturated fatty acids.

[a] $p < 0.1$ (almost significant); * $p < 0.05$ (significant) between C and NC subjects using the Student t test and the Mann-Whitney test (where the distribution of results was not homogeneous).

Table 5. Mean daily nutrient intakes expressed as percentage RDI

	Total		C		NC	
	% RDI (mean ± SE)	% intake lower than RDI	% RDI (mean ± SE)	% intake lower than RDI	% RDI (mean ± SE)	% intake lower than RDI
Protein	185.0±3.0	3.0	187.7±3.8	2.0	182.4±4.6	4.0
Ascorbic acid	181.6±7.0	20.0	191.2±9.4	16.0	172.0±10.3	24.0
Thiamine	119.9±2.4	25.5	125.8±3.3*	19.0	114.1±3.4*	32.0
Riboflavin	108.4±2.2	41.0	112.6±3.1[a]	35.0	104.2±3.2[a]	47.0
Pyridoxine	86.2±2.0	71.5	90.9±3.1*	70.0	81.5±2.5*	73.0
Niacin	168.9±2.9	4.0	172.0±4.1	3.0	165.8±4.2	5.0
Folates	124.9±4.5	38.5	135.1±6.1*	33.0	114.7±6.6*	44.0
Cyanocobalamin	267.3±17.2	2.5	266.5±20.5	1.0	268.1±28.0	4.0
Vitamin A	159.9±11.4	34.0	155.9±12.8	34.0	163.9±18.9	34.0
Vitamin D	98.7±5.6	63.5	102.3±8.9	65.0	95.1±6.9	62.0
Vitamin E	99.0±2.2	56.0	101.8±3.2	54.0	96.2±3.1	58.0
Calcium	108.0±2.6	41.5	111.7±3.5	39.0	104.3±3.8	44.0
Magnesium	83.9±1.9	81.5	82.7±2.3	83.0	85.1±3.1	80.0
Iron	83.4±2.0	69.0	85.1±2.9	67.0	81.6±2.7	71.0
Zinc	68.3±1.2	96.0	67.8±1.5	96.0	68.7±1.8	96.0
Iodine	266.0±10.4	10.0	284.8±15.0[a]	8.0	247.2±14.2[a]	12.0

[a] $p < 0.1$ (almost significant); * $p < 0.05$ (significant) between C and NC subjects using the Student t test and the Mann-Whitney test (where the distribution of results was not homogeneous).

When comparing subjects' dietary habits to practices recommended to ensure a varied and balanced diet [41], it was seen that C children consumed greater amounts of dairy products (NS), cereals (NS), and fruits ($p < 0.1$) than did NC children. Although the differences are small, the dietary habits of C children are closer to recommended practices (table 3).

Several investigations [5, 6, 39, 40] have suggested that omission of breakfast or consumption of an inadequate breakfast may be factors contributing to dietary inadequacies and that the accompanying nutritional losses are rarely made up by other meals taken over the rest of the day. Morgan et al. [5] showed that for all age/sex classes, consumption of ready-to-eat cereals at breakfast increased the average daily intake levels of the underconsumed nutrients. Further, persons who regularly consumed fortified cereals at breakfast had lower average daily intakes of fat and cholesterol.

The results of this investigation agree with those of other authors [5, 6, 39, 40] in that group NC (with the less adequate breakfast) showed a less satisfactory proportion of energy derived from macronutrients; calories from lipids were higher ($p < 0.01$), and calories from carbohydrates were lower ($p < 0.05$) than in group C (table 4).

For the majority of nutrients, differences in intake between C and NC subjects are small (approximately 10% of RDI). However, NC schoolchildren had lower intakes of thiamine ($p < 0.05$), riboflavin ($p < 0.1$), pyridox-

Table 6. Haematological and biochemical data (mean ± SE)

	Total	C	NC
Red blood cells, $\times 10^{12}$/l	4.92±0.03	4.91±0.03	4.85±0.03
Haemoglobin, g/l	140.0±0.7	140.7±0.9	139.4±1.1
Haematocrit	0.41±0.002	0.41±0.003	0.40±0.003
MCH, pg	28.6±0.2	28.7±0.2	28.6±0.2
MCV, fl	83.7±0.5	84.0±0.4	84.0±0.6
MCHC, g/l	341.1±0.9	340.9±1.4	341.3±1.2
Total protein, g/l	76.3±0.3	76.6±0.4	75.9±0.4
Albumin, g/l	49.8±0.3	49.7±0.5	49.9±0.4
Transferrin, g/l	3.4±0.04	3.4±0.04	3.3±0.04
Ferritin, µg/l	37.4±3.6	37.0±4.1	38.0±3.0
Glucose, mmol/l	5.1±0.04	5.1±0.05	5.1±0.04
Triglycerides, mmol/l	0.73±0.02	0.74±0.03	0.71±0.03
Cholesterol, mmol/l	4.25±0.06	4.17±0.08	4.32±0.10
HDL cholesterol, mmol/l	1.50±0.04	1.49±0.06	1.52±0.06
LDL cholesterol, mmol/l	2.34±0.07	2.24±0.06	2.46±0.12
VLDL cholesterol, mmol/l	0.33±0.01	0.33±0.01	0.33±0.01
Vitamin A (retinol), µmol/l	0.91±0.02	0.96±0.03*	0.86±0.04*
Vitamin E (α-tocopherol), µmol/l	10.9±0.5	11.1±0.8	10.6±0.6
Vitamin B_{12}, pmol/l	501.3±19.0	536.2±26.1[a]	468.0±26.9[a]
Serum folates, nmol/l	16.1±5.0	18.1±6.1*	14.0±2.5*
Erythrocyte folates, nmol/l	763.9±33.3	827.3±46[a]	714.5±46.3[a]
α-ETK	1.02±0.01	1.02±0.01	1.03±0.01
α-EGR	1.04±0.01	1.00±0.02*	1.07±0.01*
Vitamin B_6 (pyridoxal), nmol/l	56.2±4.5	59.1±6.5	52.6±4.9
Ascorbic acid, µmol/l	35.4±2.0	37.8±3.6	33.0±2.0
Iron, µmol/l	18.6±0.5	18.6±0.7	18.6±0.6
Calcium, mmol/l	2.5±0.02	2.5±0.02	2.5±0.02
Magnesium, mmol/l	0.9±0.04	0.9±0.08	0.8±0.04
Phosphorus, mmol/l	1.6±0.03	1.5±0.03	1.6±0.03

MCH = Mean corpuscular haemoglobin; MCV = mean corpuscular volume; MCHC = mean corpuscular haemoglobin concentration; HDL = high-density lipoprotein; LDL = low-density lipoprotein; VLDL = very-low-density lipoprotein; α-ETK = activation coefficient of erythrocyte transketolase; α-EGR = activation coefficient of erythrocyte glutathione reductase.

[a] $p < 0.1$ (almost significant); * $p < 0.05$ (significant) between C and NC subjects using the Student t test and the Mann-Whitney test (where the distribution of results was not homogeneous).

ine ($p < 0.05$), folates ($p < 0.05$), and iodine ($p < 0.1$) than C children (tables 4, 5). The percentage of intakes inferior to those recommended is also higher in NC children (table 5). This is in agreement with the results obtained by Morgan et al. [5], Nicklas et al. [7], and Hanes et al. [39] who found that nutritional deficiencies occurred more usually among children with lower intakes at breakfast. Dietary habits and energy and nutrient intake in this group were similar to those found in other studies on Spanish children [42–46].

With respect to the intake of riboflavin, which is greater in C subjects ($p < 0.1$), the consumption of fortified cereals and the greater consumption of milk products in C subjects (NS; table 3) both play a part. Cereals provide 0.37 ± 0.04 mg/day of riboflavin in C subjects and 0.12 ± 0.01 mg/day in NC subjects ($p < 0.05$); milk products provide 0.84 ± 0.4 mg/day in C subjects and 0.75 ± 0.04 mg/day in NC subjects ($p < 0.1$).

A tendency was observed, already described by other authors, relating breakfast habits to the plasma total cholesterol content. Resnicow [47], in a study on 530 children from 9 to 19 years of age, observed that children who skipped breakfast had significantly higher levels of serum cholesterol (172 mg/dl as compared with those who usually ate breakfast (160 mg/dl). In the present study, the total serum cholesterol levels were lower (NS) in C children than in NC children (table 6), and the percentage of hypercholesterolaemic levels (serum cholesterol >4.5 mmol/l) was higher among the NC group (37% as compared with 18% in the C group). These results show that the consumption of fortified cereals at breakfast, or the consumption of an adequate breakfast, can play a beneficial role in the control of blood cholesterol levels. The serum lipid levels were similar to those found by Resnicow [47] and other Spanish researchers [42, 48] (table 6).

Biochemical results showed that C children had a better status ($p < 0.05$) for retinol, cyanocobalamin, serum and erythrocyte folate, and riboflavin than did NC children (table 6). The better nutritional status of C children may provide them long-term advantages, both functional and in terms of personal health [1, 9, 49].

Deficiencies in retinol, folates, and riboflavin have often been documented in Spanish schoolchildren [44]. Anything that increases intake may be considered beneficial to their nutritional and health status.

These results agree with those of other studies [49], suggesting that people with healthier life-styles have a more appropriate diet and care more about their breakfast composition and their general state of health. It may be that fortified breakfast cereal consumers are people who care about their nutrition. The results suggest that children who consumed these products may have overall healthier conducts and dietary habits.

The consumption of cereal products at breakfast would be an excellent alternative for increasing the intake of complex carbohydrates and decreasing the intake of fat in the eating patterns of school-age children. Further, it could help to increase the intake of several underconsumed nutrients [5]. These findings have implications for the development of health promotion amongst schoolchildren.

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