Nutritional status, food consumption and physical activity among Chilean school children: a descriptive study

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Objective: To assess the nutritional status, food consumption and physical activity (PA) habits of Chilean school children, as a baseline for developing an educational intervention.
Design: Cross-sectional study.
Subjects: A total of 1701 children from 3rd to 7th grade in nine schools located in three geographical regions.
Methods: We determined body mass index, food consumption (quantified FFQ which we categorised into five groups), PA in terms of TV viewing and frequency of after school PA. The data were analysed according to age, nutritional status and gender. A logistic regression analysis was performed using obesity as outcome.
Results: Obesity was higher among boys; younger children presented higher prevalence in both genders. Daily intake of dairy products varied between 240 and 308 g, fruits/vegetables, between 197 and 271 g, energy-dense foods between 343 and 460 g. In all, 22.3 and 47% of the children watched over 3 h of TV during the week and weekend, respectively. Older children watched significantly more TV during the week, while on weekends all children increased this time significantly. Boys were more active than girls after school. The logistic regression analysis showed a significant association between obesity and low intake of dairy products.
Conclusions: Prevalence of obesity among Chilean children is high. Although TV time, intake of energy dense foods and fruits/vegetables appeared as risk factors for obesity, only dairy consumption was significantly associated with obesity.
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Introduction
During the last 2 decades, several important changes have occurred in the epidemiologic profile of the Chilean

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population. Life expectancy rose from 60 y in 1970 to 73 y in 2001 for men and from 65 y to 80 y for women during the same period. The country experienced simultaneously a demographic and epidemiologic transition, resulting in an ageing population and a shift from infectious to chronic diseases. Sedentary lifestyle and an elevated consumption of processed foods rich in fats, sugars, and salt and low in dietary fibre, all known risk factors for obesity, have also risen considerably (Uauy *et al*, 2001; Albala *et al*, 2002; Kain *et al*, 2002).

Between 1987 and 2000, the prevalence of obesity among school children entering first grade at public schools across the country increased from 5.1 to 14.7% for boys and from 4.0 to 15.8% for girls (based on the BMI-CDC $\geq$ P95) (CDC/NCHS, 2000; Chilean Ministry of Education, 2001; Kain *et al*, 2001a). In preschool children of low socioeconomic level, the prevalence of obesity increased from 6% in 1992 to

10.6% in 2000 (Chilean Association for Day Care Centers, 2001).

Considering that obesity is the main nutritional problem among Chilean children and that it has been demonstrated that being obese in childhood almost doubles the risk of having this condition during adulthood (Guo *et al*, 1994; Dietz, 1998), various health promotion initiatives are being developed to address this problem (Castillo *et al*, 1997; Vio & Albala, 2000). In this respect, a new strategy known as 'Healthy Schools' has been implemented for the last 3 y with the purpose of creating environmental conditions so as to promote healthier eating habits and physical activity among school children (Salinas & Vio, 2002).

It has been demonstrated that to prevent obesity, changes must occur in eating and physical activity habits at the earliest age possible. Therefore, the school represents the best opportunity to acquire a healthy lifestyle not only through knowledge, but also attitudes and behaviour (Lytle, 1995; CDC, 1996; WHO, 1998). Nonetheless, the primary school programmes of the Chilean Ministry of Education rarely include content focused on nutrition education and do not contain objectives oriented towards forming healthy eating habits (Chilean Ministry of Education, 1999).

The main barriers to implementing nutrition education programs for primary school children in developing countries are the teachers' lack of nutrition knowledge, inappropriate educational materials, and finally the difficulty in obtaining governmental support to address this issue with an adequate methodology (Olivares *et al*, 1998). Taking these barriers into consideration, the fact that 90% of the teachers are very interested in acquiring knowledge in nutrition (FAO/Ministry of Education/INTA, TCP/CHI/0065, 2003), the Ministry of Education, and the Institute of Nutrition and Food Technology (INTA) of the University of Chile requested Food and Agriculture Organization of the United Nations (FAO) to jointly design and implement a technical cooperation project to incorporate food and nutrition education into the curriculum of 3rd–8th grade. The development of the educational model considers the epidemiologic situation of the children, the national policy on health promotion, the existing curriculum and the baseline information reported in this article (Salinas & Vio, 2002; FAO/Ministry of Education/INTA, TCP/CHI/0065, 2003).

The purpose of the present study was to evaluate the nutritional status, food consumption and physical activity habits of school children, so as to orient the contents and learning activities of the educational model.

Materials and methods

This was a cross-sectional study which included variables such as nutritional status, food consumption, TV viewing and after school physical activity (PA).

Sample

Nine public schools from low-income neighbourhoods were selected to participate. The selection criteria included: (1) located in one of the three regions representative of the geographic variability of the country: North (Region I), Center (Metropolitan Region) and South (Region X); (2) in each region, schools from both rural and urban settings were selected; and (3) schools with a minimum of 30 students per grade (from 3rd to 7th grade).

The selected communities included Arica (Region I), Buin (Metropolitan Region), and Puerto Montt (Region X). In each community, three schools were selected (two urban, one rural) only after they agreed to participate in the study and received approval from the local and national educational authorities.

Students from one class (grades 3rd–7th) of each of the nine schools ($n = 1723$) participated in the study. Five children were not present when the anthropometric measures were taken and were therefore eliminated from the study; 22 children over 14 y of age were also eliminated, because they were much older than their classmates. Thus, 1701 children between the ages of 8 and 13 y were included. Data were analysed according to gender and three age groups (8–9, 10–11 and 12–13 y).

Table 1 shows the distribution of the children participating in the study by age and gender. The proportion of boys and girls was similar, while the average age was exactly the same, 10.6 ± 1.4 y for both genders.

Interviewers

In each city, three interviewers (nutritionists or teachers) were trained to evaluate the nutritional status and interview the children on their eating and physical activity habits. To standardise survey and measurement practices, each interviewer measured and weighed 12 children and carried out six surveys with children between the ages of 9 and 13 y from two schools that did not participate in the project. The average time each interviewer took to register all the information was approximately 30 min. Anthropometric measurements and surveys were performed between April and June of 2001.

Table 1 Sample characteristics by age and gender

	Boys		Girls	
Age (y)	N	%	N	%
8	160	17.2	128	16.5
9	165	17.8	159	20.5
10	189	20.4	145	18.7
11	175	18.9	144	18.6
12	199	21.5	152	19.7
13	39	4.2	46	6.0
Total	927	100.0	774	100.0

Nutritional status

Children's weight and height were measured using Seca Model 713 scales (sensitivity = 0.2 kg for weight and 1 mm for height). Nutritional status was determined using body mass index (BMI = kg/m^2). For each child, BMI was estimated by age and sex and compared to the North American BMI latest reference (CDC/NCHS, 2000). The cutoff percentiles used to classify the nutritional status of the children were those recommended by the North American Committee of Experts in Childhood Obesity (Barlow & Dietz, 1998); underweight, BMI $P < 10$; normal weight, BMI $P \geqslant 10 - < P85$; overweight, $P \geqslant 85 - P < 95$; obese, BMI $P \geqslant 95$. Although the CDC growth charts were developed to evaluate the nutritional status of US children, its use has been recently recommended for evaluating Chilean children 6 to 18 y of age (Chilean Ministry of Health, 2003). In addition, it will be possible to compare our results with those obtained from other studies.

Food consumption of selected foods

To evaluate daily food consumption, a quantified food frequency questionnaire (FFQ) (Thompson & Byers, 1994; FAO/WHO, 1996) including 19 selected food items was applied by trained interviewers on all children. We were interested in obtaining information on those foods recommended by the Chilean Dietary Guidelines (Castillo et al, 1997), that is, dairy products, fruits, vegetables, legumes and fish. In addition, we collected data on energy-dense foods such as snacks and beverages. We present in this article, the foods consumed more frequently grouped together into five food groups (dairy products, fruits and vegetables, bread, snacks and beverages). Dairy products included milk and yoghurt; snacks, energy dense foods such cookies, chocolates, crackers, mayonnaise; fruits and vegetables (raw and cooked), of which apples, bananas, oranges and lettuce, tomatoes, carrots, beets, respectively, were the ones more frequently consumed, while beverages included flavoured drinks (60%) and sodas (40%). We also included bread, because its consumption is extremely high in this country. Average values of daily total consumption are presented in grams (mean ± s.d.) and were calculated over the whole sample. The data were analysed according to age groups and gender, because of different nutritional requirements (National Research Council, 1989).

The FFQ has been widely applied in Chile since the 1960s. Arteaga et al, 1964 concluded that due to the high-correlation coefficient that this technique showed for both intra and interindividual variation for each food item, its use has been recommended in population studies. In addition, several authors (Thompson & Byers, 1994; Willet, 1994) have concluded that the FFQ method is more accurate when determining average intake for those food items that present a large day-to-day variability.

To obtain reliable information on the amounts of fruits and vegetables consumed, a specially designed booklet with pictures showing food portions was used. This booklet was developed in Argentina (Vásquez & Witriw, 1997) and shows the weights per portion of different fruits and vegetables, legumes, potatoes, french fries, fish, poultry, meats, pasta and rice. Because this booklet had not been previously used in Chile, we assessed if the food portions consumed by a small sample (12 children) coincided with the weights provided in this booklet. Results showed that the coincidence varied between 83% and 100%; the lowest was for vegetable (10 children), while the highest was for fruit (all children). With regard to snacks and dairy products, children selected from the different packages shown by the interviewer and with respect to the weight of bread, this is standard in this country. It is important to point out that the foods consumed by Chilean children are very similar, regardless of urban/rural considerations or location (Yáñez et al, 2001).

PA habits

To estimate the PA habits, students were asked about the number of hours spent watching television during a school day and a typical weekend day, and about the frequency of after school PA, such as running, jumping, jogging, bicycle riding, or playing soccer. Although, we acknowledge that a proportion of children walked to and from school, we did not determine it. Unfortunately, children have increasingly abandoned this habit due to security concerns in both urban and rural areas. TV viewing was calculated adding the total number of shows watched on a daily basis, as has been done in previous studies (Olivares et al, 1999).

Statistical analysis

The present analysis was designed to describe nutritional status of school children, risk factors for obesity and study possible associations among them. We used analysis of variance (ANOVA) to compare BMI by gender among the three geographical regions and urban vs rural setting. χ^2-statistics were used to determine if there was a relationship between nutritional status and age, while test of proportions were used to compare obesity prevalence by gender. Consumption of food groups was described as means and standard deviations; unpaired Student's t-tests were used to determine if there were gender differences by age group and nutritional status, if data followed normal distribution, otherwise nonparametric test (Mann–Whitney test) was applied. TV viewing and PA were analysed using χ^2-statistics and the differences among study groups were assessed through Kruskal–Wallis test. We evaluated the effect of the interaction among independent variables, adjusting for age and gender. These variables included the consumption of selected foods, PA and TV viewing. Independent risk factors for obesity (outcome variable) were computed by multiple logistic model of all univariate significant variables and potential confounders as gender and age. Data analysis was

performed using the SAS (SAS Online Doc 8.2; SAS Institute, 2002) and the STATA 7.0 statistical package (Stata Statistical Software, 1999).

Results

The results presented here consider the sample as a whole, because analyses showed no significant differences when comparing nutritional status among the three geographical regions and between urban vs rural setting.
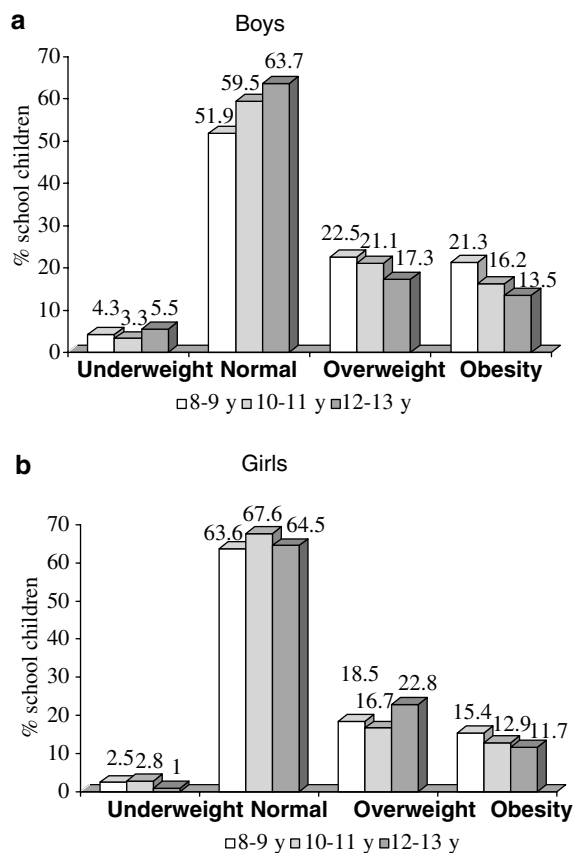

Figure 1 Nutritional status of Chilean school children by age group. (a) $P < 0.05$, (b) in girls, no significant differences were found ($P=0.444$).

Nutritional status

Figure 1 shows the nutritional status in both boys (Figure 1a) and girls (Figure 1b) by age group (8–9, 10–11 and 12–13 y). In boys, significant differences in nutritional status were found according to age with a shift to overweight among the younger children ($\chi^2 = 12.37$ $P < 0.05$). In girls (Figure 1b), no differences were observed according to age.

Although the prevalence of obesity was significantly higher in boys for the whole group, when analysed according to age, this difference was only noted in the 8–9 y (test of proportions $P < 0.03$). Younger children exhibited higher prevalence in both genders, but the difference between younger and older group was greater in boys.

Food consumption for selected foods

Table 2 presents the average daily food intake of the total sample, expressed in g/day (mean $\pm$ s.d.), by age and gender. Intake of dairy products and fruits and vegetables was low. Boys consumed significantly more of these products in both 10–11 and 12–13 y groups. It should be noted that there was a high consumption of bread, significantly higher in boys across age groups. Intake of snacks and beverages was high and similar for boys and girls in the younger group. In the older groups, boys consumed significantly more than girls.

Intake of fish and legumes was very low (18 and 20 g, respectively); these figures did not allow any statistical analysis.

When we analysed if there were differences in intake between these food groups and nutritional status, only the consumption of dairy products was significantly greater among the nonobese for both genders across age groups ($P < 0.005$).

PA habits

TV viewing during a school day was only analysed by age categories, as no differences were found by gender (Figure 2). Results showed that about 10% of the children reported never watching TV, about a half watched 1–2 h/day, and between 17 and 28.6% watched over 3 h. Older groups watched significantly more ($\chi^2 = 26.27$, $P < 0.001$).

Table 2 Selected food intake by Chilean school children, by age group and gender (mean $\pm$ s.d. in g/day)

	8–9 y N = 611		10–11 y N = 654		12–13 y N = 436	
Food groups	Boys N = 324	Girls N = 287	Boys N = 365	Girls N = 289	Boys N = 238	Girls N = 198
Milk and yoghurt	308.3 ± 192.2	299.3 ± 182.3	281.7 ± 180.6**	242.5 ± 167.5	267.1 ± 171.1**	240.9 ± 155.9
Fruits and vegetables	197.4 ± 135.9	220.4 ± 149.9*	237.2 ± 153.7*	210.7 ± 129.7	271.3 ± 183.6*	238.1 ± 145.7
Legumes	19.4 ± 10.8	19.2 ± 9.8	20.9 ± 10.0	18.9 ± 9.7	20.8 ± 10.2	18.5 ± 10.4
Bread	269.6 ± 97.6**	232.1 ± 94.1	295.8 ± 112.7**	255.4 ± 112.2	324.6 ± 133.2**	270.1 ± 117.8
Snacks (sweet and salty)	113.0 ± 79.7	111.3 ± 81.3	118.6 ± 85.4*	106.7 ± 70.1	135.4 ± 99.7*	124.2 ± 94.0
Beverages	218.3 ± 167.1	219.3 ± 176.2	279.0 ± 184.8*	250.9 ± 173.0	301.1 ± 199.9*	295.8 ± 229.4

Student's t-test: * $P < 0.05$, ** $P < 0.001$ for higher statistical differences between boys and girls

During the weekend, the proportion of children who watched more than 3 h per day increased considerably, to 47% (not shown). The difference in TV viewing between a weekend day and a week day was highly significant ($\chi^2 = 567.15$, $P < 0.000$)
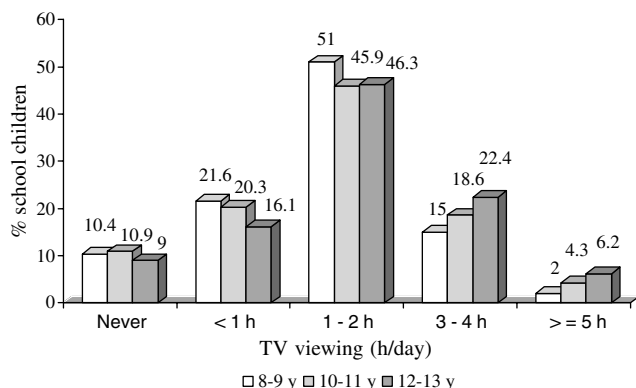

Figure 2 Comparison of TV viewing during school days by Chilean school children by age group. $P < 0.001$.
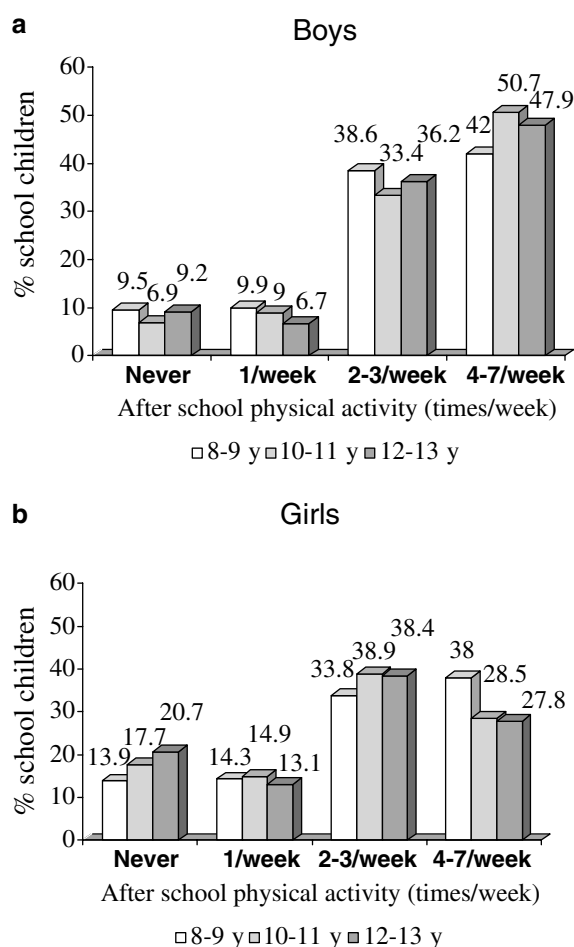

Figure 3 Frequency of after school physical activity by Chilean children by age group. (a) $P = 0.103$, (b) $P < 0.03$.

The time children spent in after school PA varied according to age and gender. Figure 3a shows that in boys, between 7 and 9.5% never engaged in this activity and around the same proportion only once a week. Approximately, one-third engaged 2–3 times a week, and approximately half, over four times a week. In boys, no differences were noted across age groups. In girls (Figure 3b), the proportion that never engaged in after school PA was around double when compared to boys. Significant differences were observed between the younger and both older groups, that is, younger girls were significantly more active ($\chi^2 = 7.08$, $P < 0.03$).

When analysed if there was an association between after-school PA and nutritional status according to age and gender, an association was found only among the younger boys ($\chi^2 = 14.83$, $P < 0.02$), that is, among the 8–9 y-old boys, the nonobese were more active than their obese counterparts (not shown).

The distribution of TV viewing was analysed in relation with after school PA. There was an association between these two variables, that is, the more time children spent in PA, the less time they devoted to TV watching ($\chi^2 = 36.2$, $P < 0.001$). TV viewing was not associated with nutritional status neither by age or gender (not shown).

In the logistic model, only age (OR = 0.871 95%, CI = 0.794–0.955), gender (OR = 0.661 95%, CI = 0.499–0.873), and consumption of dairy products (OR = 0.998 95%, CI = 0.997–0.998) were significant.

Discussion

Nutritional status

The present study shows that obesity in Chilean school children is high and reaffirms what other authors have observed in similar population groups. There are few recent publications that include data on the prevalence of obesity in large samples of Latin American school children. However, in Brazil (Wang et al, 2002) found in a representative sample of children between 10 and 18 y of age that the prevalence of overweight and obesity determined in 1997 by the IOTF Reference (Cole et al, 2000) was less than what we observed in our study, 13.1% in boys and 14.8% in girls. It should be noted that when the IOTF reference is used to determine the prevalence of obesity in Chilean school children, the numbers drop from 14.7 to 7.2% in boys and from 15.8 to 7.5% in girls (Kain et al, 2002).

The prevalence of childhood obesity among Chilean children is similar to those observed in the United States. Along with a high prevalence of obesity, the rate at which obesity has increased over the last decades has been significantly higher when compared with the majority of other developing and developed countries (Bellizzi et al, 2001; Kain et al, 2001a). In the United States, for example, Strauss & Pollak (2001) determined the rate of increase in obesity (between 1986 and 1998) in children between ages 4 and 12 y based on race and gender. Among Hispanic

children, the prevalence of obesity (BMI, $P \geqslant 95$, CDC), increased from 10 to 21.8%; the same increase has been observed in Chilean children over the past 6 y (Kain *et al*, 2002).

In our study, the overall prevalence of obesity was significantly higher in boys, but when comparing by age group, this comparison remained significant only in the 8–9 y group. Younger children exhibited higher obesity prevalence in both genders. As described by Bellizzi *et al* (2001) who analysed anthropometric data in school children between 1980 and 1986 in some European and Asian countries, overall, the prevalence of obesity in 10 y olds was also greater in boys.

The fact that obesity prevalence is higher in prepubertal children may be partly explained by secular trends; obesity is now affecting progressively younger children, whereas historical, older cohorts may have been less affected. Probably as income increases, sedentary behaviour and richer diets become more prevalent at earlier ages (Kain *et al*, 2001a).

Food consumption for selected foods
We used the FFQ methodology to estimate the average intake of selected foods. This technique has been found valuable to orient most nutrition education programmes (van Staveren & Burema, 1982), which is the ultimate purpose of this descriptive study. As stated by these authors, the FFQ accurately groups individuals into broad categories according to intake of selected foods.

The intake of dairy products was low; the amount consumed was equivalent to approximately 1.2–1.5 servings/day. This consumption was much lower than the one reported by Kennedy *et al*, in 1995 for US children. Based on data collected by the USDA Continuing Survey of Food Intake by Individuals (CSFII) in 1989–1990, the authors found that children 5–14 y, consumed on average, 2.5 servings/day; this amount was slightly lower than the recommendation for adolescents indicated by the US Food Guide Pyramid, which is 3 servings/day (United States Department of Agriculture/United States Department of Health and Human Services, 2000).

In this study, dairy consumption was associated with obesity; this result is on line with several epidemiologic studies where an inverse association has been found between dairy consumption and risk of being overweight (Zemel *et al*, 2000).

Intake of fruits and vegetables was low in all age groups, approximately 2.2, 2.4 and 2.8 servings/day (adding both) for the 8–9, and 10–11 y respectively. Other studies have found similar results (Atalah *et al*, 1998; Kain *et al*, 2001b; Yañez *et al*, 2001). Ironically, Chile is not only a fruit exporting country, but fruits are relatively cheap. This shows the urgent need to implement nutrition education programmes that address the importance of consuming these foods. Studies conducted elsewhere have also shown low intakes for both fruits and vegetables, although not as low as the ones we found. For example, Brady *et al* (2000) in a study that included 110 African-American and Caucasian 10-y-old children, only 5% covered the recommendation for fruit. Kennedy *et al* (1995) found that in 5–14 y children, fruit and vegetable intake was 1.41 and 2.04 servings/day, respectively; these are lower than those recommended by the US Food Guide Pyramid, which are 2–4 servings and 3–5 servings/day respectively.

Intake of bread was very high; boys ate significantly more than girls. This has been found consistently in other studies done in the country (Atalah *et al*, 1999; Olivares & Vio, 2001; Yáñez *et al*, 2001), as well as with data provided by the National Food Expenditure Survey carried out in 1998 (Crovetto, 2002). Based on the Chilean Food Pyramid, the Ministry of Health (Castillo *et al*, 1997) recommends a total daily intake of cereals (apart from bread, this group includes pastas, rice, potatoes, corn) of 350 and 300 g for 6–9 y boys and girls respectively, while for children 10–13 y, this recommendation is 375 and 325 g. In this study, only bread accounted for around 80% of the total recommendation; adding other foods from this group, which constitute the staple of our diet, obviously increases the calorie intake. We were able to find only a couple of studies reporting intake of bread among children. One of them, Vásquez *et al* (1995) in a study including school children from Madrid, Spain, reported a significantly lower intake of bread than the one we found, probably due to the fact that the Spanish children belonged to a better socio-economic level. In that study, bread intake was also higher among boys.

Intake of snacks rich in fat and sugar was very high. This is similar to the figures found in school children by Vásquez *et al* (1995) in Madrid and Yáñez *et al* (2001), while Kain & Andrade (1999) reported approximately the same among preschool children (350–500 kcal). In addition, a study about food advertisement and preferences in this age group showed that french fries, sweet and salty snacks, soft drinks and fast foods were the products most often remembered and purchased by the children (Olivares *et al*, 1999). In the USA, Nielsen *et al* (2002) analysed data from the CSFII (1977–1996) and found that there was a clear increase in snack consumption mostly produced by a shift away from regular meals across all age groups. A study conducted in Leeds, England also in school children (Sahota *et al*, 2001) found that boys ate on average 10 snacks/day, while girls consumed eight; this is obviously a large amount. Increased consumption of foods rich in sugars and fats is a phenomenon of concern in both developed and developing countries (Langlois, 2003).

PA
One of the most important contributing factors to the increase in childhood obesity is PA (Uauy *et al*, 2001; Albala *et al*, 2002). In this study, we analysed hours spent watching television and after school PA. With respect to TV, children

not only watched a considerable amount of time during weekends, but also during school days. The amount of time children spent watching television is of considerable concern; obviously television influences PA (Dietz & Gortmaker, 1985). This was demonstrated in our study, as in children who watched TV less than 1 h/day, almost half were active more than four times a week compared to 32% in those who watched over 3 h. Although, in this study no differences were observed in TV time with nutritional status, numerous studies have reported an association between obesity and TV viewing. Crespo *et al* (2001) examined caloric intake, obesity and PA in a representative sample of North American children between the ages of eight and 16 y from the NHANES III database (1988–1994). They found that the number of hours girls spent watching television was directly related with the increase in caloric intake and prevalence of obesity. This relationship was not found among boys. Saelens *et al* (2002) found that more than 2 h of television daily was a risk factor for obesity. In that study, the number of hours spent watching television was more strongly associated with obesity than the episodes of moderate or intense PA. The authors explain that this could be due in part to the lack of sensitivity of the survey that registered PA. In our study, we found no association between nutritional status and television viewing. It should be remembered, however, that this is a cross-sectional study and thus determining the causes of the development of obesity is impossible. As Kriska & Caspersen (1997) found, estimates obtained from questionnaires are useful in relative terms and can serve to rank individuals in a population from the most active to the least active.

As expected, after school PA differed between boys and girls, across ages. Boys have consistently been found to be more active than girls. Sallis (1993) in a review of 54 studies on children ratified this finding. In addition, the authors found that PA declines with age, more so among girls, thus the gender gap widens with age. Although, we do not have information on the time children spent on after school PA, results from this study suggest that the proportion of children who were active at least twice a week was around 84% and 68% for boys and girls respectively. These data differ from those published from the Survey of Socio-economic Characterisation of the Chilean population. This was a representative survey of the whole population, conducted in 2000, which reported that only 8.6% of individuals over the age of 15 claimed to do 30 min of physical activity (Chilean Ministry of Planning, 2001). A survey of 11-y-old European children showed large variations among countries; on average between 46% and 93% of the children reported exercising at least twice a week (WHO, 2000). Our data are similar to this one.

In conclusion, results from this baseline study show that the prevalence of obesity among Chilean children is high and unrelated to geographical area or urban/rural setting. Average intake of fruits and vegetables was low, while consumption of energy-dense foods was very high. In addition, a high proportion of them watched excessive TV; this was associated with declining after school physical activity levels. This background information plus other complementary studies on teachers' needs and training interests, constituted the core to defining an educational strategy that will be applied in primary school children, oriented towards modifying their behaviour and eventually also that of their families.

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