ORIGINAL ARTICLE

# Nutritional Surveillance in Tuscany: eating habits at breakfast, mid-morning and afternoon snacks among 8-9 y-old children

G. LAZZERI, D. GIALLOMBARDO, C. GUIDONI, A. ZANI, A. CASORELLI, A. GRASSO, T. POZZI, S. ROSSI, M. GIACCHI
"CREPS", Center of Research for Health Education and Promotion, University of Siena, Italy

Key words

Childhood obesity • Children's eating behaviours • Mother's education level

Summary

***Introduction.*** *The prevalence of overweight and obesity in children is rapidly increasing in many countries. For that it has been interesting to investigate the eating habits of 8-9 y-old Tuscany children by paying attention to their meals frequency per day and their food choices in total and in relation to children's Body Mass Index (BMI) classes. In addition we considered some environment factors that could affect the children eating behaviours, such as mother's BMI and their education level.*

***Methods.*** *A statistical sample of 3,076 (1,583 males, 1,493 females), 8-9 year-old school-children was collected; weight and height were measured using standardized personnel and instruments. BMI classes were calculated using Cole et al.'s cut-off for children and adolescents. In order to evaluate the consumption frequency of individual meals and various foods, a Food Frequency Questionnaire (FFQ) was used, which was completed by the children themselves at school. A self-administered questionnaire revealed the weight and height of parents and their educational levels. Three educational levels were established: high, medium and low.*

***Results.*** *The results showed that 92.3% of children ate breakfast from 4-7 times a week, the vast majority at home, while only 3% declared consuming breakfast never or almost never. The most preferred breakfast consisted of milk and biscuits for all children's BMI classes. 95.9% of children reported having mid-morning snack at school; fruit juice and tea are the most frequently consumed liquid foods, and pizza, salami sandwiches and pre-packaged snacks are the most frequently consumed solid foods in all BMI classes. 93.6% ate afternoon snack for the most part at home, even if 12% of children reported consuming it elsewhere; fruit juice and tea with pizza, sandwiches and pre-packaged snacks are still the most highly consumed foods by all children's BMI classes. The consumption frequency of breakfast ($P < 0.001$), mid-morning ($P < 0.05$) and afternoon snack ($P < 0.05$) of 8-9 y-old Tuscany children decrease with increase the children's BMI classes. The same tendency may be noted for the consumption frequency of breakfast in relation to mother's BMI ($P < 0.05$) and their education level ($P < 0.05$). This data strengthens the thesis that some home environments can affect the children's eating behaviours.*

***Conclusion.*** *No substantial differences in food choices at the meals analyzed were determined among normal weight, overweight and obese children. Children of normal weight had a greater tendency to consume meals more regularly. Mother's BMI and their education level can have influence on children'eating behaviours.*

## Introduction

The prevalence of overweight and obesity in children is rapidly increasing in many countries; in the last 25 years a notable increase has been observed in economically developed countries (from 2.3 to 3.3% in the United States and from 2.0 to 2.8% in England); this phenomenon has also been found subsequently in less economically developed areas; for instance, in Egypt, an increase of 3.9% has been recorded in the last 18 years [1]. A recent survey on the prevalence of overweight in children 7-11 years old in 21 European countries indicated a trend from North to South, with Southern European countries having a higher rate of overweight children (England 20%, Sweden 18%, Germany 16%, France 19%, Italy 36%, Spain 34%, Greece 31%, Cyprus 27%, Malta 35%) [2] and Italy, therefore, ranks as the highest in Europe. In Tuscany, the rate of overweight and obesity in 8-9 years old children ranks at 31.7% [3]. Childhood obesity has been associated with numerous negative health and psychological outcomes including non insulin-dependent diabetes [4], hypertension [5], sleep apnea [6], depression [7] and disturbed body image [8, 9]. In recent years, therefore, attention has been focused on the possible causes and risk factors associated with childhood obesity. Genetic predisposition and environmental factors interact in the multifactorial etio-pathogenesis of the weight excess; it is usually assumed that a basic imbalance in energy intake and energy expenditure can lead to an excess of adipose tissue. Studies have suggested that several characteristics of dietary behaviour, such as eating frequency, the temporal distribution of eating events across the day, breakfast skipping, and the frequency of meals eaten away from home, together referred to as an "eating pattern", may influence body weight [10-12]. A lower obesity risk was observed among subjects reporting larger numbers of eating episodes per day. Furthermore, skipping breakfast was

associated with an increased risk of obesity [13]. A Nicklas's et al. [14] study showed that the average total energy intake was significantly lower for children who consumed breakfast at home compared with children who consumed breakfast at school. Another study demonstrated that 10-year-old children who consumed a breakfast that furnished 25% of their necessary caloric intake had a superior performance in creativity tests than those who consumed a breakfast that covered only 10% of their necessary caloric intake [15]. A diet with a regular breakfast consumption provides more adequate micronutrient intakes and better dietary quality than one without breakfast [16, 17]. Eating a nutritious breakfast may help control body weight due to a reduced dietary fat intake and minimized impulsive snacking [18, 19]. International and national recommendations agree upon the importance of a correct distribution of calories throughout the span of the day, achieved by a regular meal consumption of breakfast, mid-morning snack, lunch, afternoon snack and dinner [20]. It has been suggested that during the mid-morning and afternoon snacks, children have a greater possibility to eat foods with a higher energy density and lower nutritional value, which increase daily calorie intake with notable repercussions on the body weight of the child [21, 22]. In addition, other nutritional surveys have displayed how the children's eating habits can be influenced by some home environments such as eating patterns, BMI and educational level of parents, especially of the mothers, who, more than fathers, determine the children's behaviours [23-25].

In 2001/2002, the Tuscany Region participated in a National Pilot Project, called "Nutritional surveillance and consumption education based on local data for chronic disease prevention", promoted by the Italian Ministry of Health, aimed at sharing scientific models for a nutritional surveillance system in order to estimate nutritional status, physical activity and dietary patterns in children and to plan actions to prevent immediate and long-term health problems.

The survey considered several aspects of the problem; in this study we will describe the eating habits of 8-9 years old Tuscany children, at breakfast, mid-morning and afternoon snacks, and the association between the frequency of these meals and the child's BMI class, as well as the mother's BMI class and their educational level.

## Methods

The data we present are integral part of aforementioned project, in which, besides Tuscany, the regions of Puglia, Lombardy, Emilia Romagna, Campania, and Calabria also participated.

Among the project's main targets were the definition of the prevalence of overweight and obesity in 8-9 years old school children, the evaluation of specific development factors, and the risk levels in different regional circles.

In the Tuscany region, in order to guarantee a maximum level of territorial diffusion of the experiment, all twelve Local Health Units were invited and agreed to take part and collaborate in the project. After the formal adhesion phase, all twelve Local Health Units were gathered in order to illustrate the protocol and to arrange the operational formalities of the project in Tuscany [26]. In order to evaluate the consumption frequency of individual meals and various foods, a Food Frequency Questionnaire (FFQ) was used, which was completed by the children themselves at school. For both meals and single foods, consumption frequency could be indicated as: Every day (7 times a week), Almost every day (4-6 times a week), Sometimes (2-3 times a week) and Never or Almost never (0-1 time a week). The meal consumption frequency index is expressed by the cumulative frequency.

The relative consumption frequency of single food was calculated, by summing who responded "Every day" and "Almost every day" to the question related to a specific food and dividing for who responded to the question regarding the specific meal.

Via a self-administered questionnaire, mothers revealed their weight, height, and education level. The average age, weight and height of the mothers were, respectively: 37.7 ± 5.0 years, 61.1 ± 10.1 kg, 163.7 ± 5.9 cm. Weight in kilograms and height in meters were used in order to calculate Body Mass Index ($kg/m^2$); the parents' BMI classes (under-weight, normal-weight, overweight and obese) were established utilizing international cut-off points [27, 28]. For 214 (7%) mothers the BMI was not calculated due to the missing data.

Three education levels were then established: high (college degree), middle (middle school/high school) and low (elementary school certificate/no academic qualifications).

Data were analyzed using SPSS (version 10). Descriptive statistics (e.g. mean, proportion, standard deviation) were used in order to establish the characteristics of the sample. The $\chi^2$-test was utilized to explore the relationships between the meal frequency and: a) children's BMI classes, b) the mothers' BMI classes, c) mother's education level. The relative consumption frequency of each food at the meals was compared with the child's BMI classes.

## Results

In this study the overweight and obesity prevalence among 8-9 years old Tuscan children resulted, respectively, 22.9% and 9.5% in males, 22.7% and 8.2% in females; however, the differences between the two genders did not result as being statistically significant [3]. The distribution of the mothers' BMI classes was: 4.4% under-weight, 72.2% normal-weight, 18.6% overweight, and 4.8% obese. Only 9% of the mothers had achieved the highest education level (college degree), 45.6% the high school diploma, 40.4% the middle school diploma, 4.6% the elementary school certificate, and 0.4% resulted as having no academic qualifications [17].

Table I reports the consumption frequency and location of the meals we have taken into consideration. The information reported by the children states that breakfast is consumed (4-7 times a week) by 92.3% and most at home; a reported 3% never or almost never consumes breakfast. If we evaluate the mid-morning and afternoon snack consumption frequency, we may note how the percentages are similar to those of breakfast (95.9% and 93.6% respectively); low is the percentage of those who consume mid-morning and afternoon snack 0-1 times a week. The afternoon snack is more frequently consumed at home, even if 11.6% of children declared consuming it elsewhere.

Relating the breakfast, mid-morning and afternoon snack frequency in relation to children's BMI classes, we observed how normal-weight children generally tend to consume these meals more frequently than overweight and obese children. This tendency is evident, in particular, for breakfast ($P < 0.001$), while it is less notable, but still significant, for morning ($P < 0.05$) and afternoon snack ($P < 0.05$). Furthermore, it appears that, though the consumption frequency of these three meals is elevated, breakfast is the meal less consumed by normal weight children as well as by overweight and obese children.

The association of the consumption frequency of breakfast, mid-morning and afternoon snack of children in relation to the mothers' BMI classes, demonstrates that children of overweight and obese mothers consume breakfast less frequently than children of underweight and normal weight mothers. The same tendency may also be noted for the afternoon snack, even though the difference between the BMI classes is not statistically significant. Instead, no particular differences were revealed in the consumption frequency of mid-morning snack by the children in relation to the mothers' different BMI classes.

The association between the breakfast, mid-morning and afternoon snack frequency and the mother's education level indicates how children of mothers with a low education level consume breakfast less frequently than those of mothers with a middle and high education level. A similar trend may also be observed for afternoon snack, even if the differences in consumption frequency among children of mothers of various education levels are not statistically significant. The morning snack, instead, seems to be the meal most generally consumed by children, independent of the mother's education level. With regards to the association between the breakfast, mid-morning and afternoon snack frequency and the child's gender, no statistically significant difference was shown.

The analysis of food frequency questionnaires points out which foods are generally consumed at breakfast by children ages 8-9, in total and in relation to the children's BMI classes (Tab. II, III). The top five liquid foods most consumed are reported in Table II; milk is by far the most consumed food product at breakfast. We may observe the same order of consumption in the different children's BMI classes; however, we may note that obese children are less accustomed to having milk than overweight and normal weight children ($P < 0.001$, data not shown), while an increased consumption frequency of coffee and tea is recorded, although this carries no statistical significance. The solid foods most consumed overall are reported in Table III: a marked preference for biscuits is evident. The percentages of relative consumption frequency of the top five solid foods in relation to the children's BMI classes result as being less for obese than for over and normal weight children. In particular, there are statistically significant differences between the BMI classes for the consumption of biscuits and pre-packaged snacks (data not shown).

In Table IV, the top five liquid foods most frequently consumed in total and divided by the children's BMI classes at mid-morning snack are listed. We may again note how fruit juice is the most consumed beverage, both in total and by the children's BMI classes. Obese children consume tea more frequently than normal and overweight children, but the difference is not statistically significant. Table V lists the top five solid foods

**Tab. I.** Frequency and location of breakfast, mid-morning and afternoon snack consumption.

| | Breakfast | | | Mid-morning Snack* | | | Afternoon Snack | | |
|---|---|---|---|---|---|---|---|---|---|
| | N° | % | 95% CI | N° | % | 95% CI | N° | % | 95% CI |
| **Location** | | | | | | | | | |
| Home | 2,795 | 95.2 | 94.3-95.9 | - | - | - | 2,461 | 85.4 | 84.1-86.7 |
| School | 91 | 3.1 | 2.5-3.8 | - | - | - | 86 | 3.0 | 2.4-3.7 |
| Elsewhere | 50 | 1.7 | 1.3-2.3 | - | - | - | 334 | 11.6 | 10.5-12.8 |
| Total | 2,936 | 100 | | - | - | - | 2,881 | 100 | |
| **Frequency** | | | | | | | | | |
| 7 times/week | 2,465 | 83.1 | 81.7-84.4 | 1955 | 66.0 | 64.3-67.7 | 2,177 | 73.7 | 72.1-75.3 |
| 4-6 times/week | 273 | 9.2 | 8.2-10.3 | 886 | 29.9 | 28.3-31.6 | 588 | 19.9 | 18.5-21.4 |
| 2-3 times/week | 139 | 4.7 | 4.0-5.5 | 77 | 2.6 | 2.1-3.3 | 154 | 5.2 | 4.5-6.1 |
| 0-1 times/week | 89 | 3.0 | 2.4-3.7 | 44 | 1.5 | 1.1-2.0 | 35 | 1.2 | 0.8-1.7 |
| Total | 2,966 | 100 | | 2962 | 100 | | 2,954 | 100 | |

* the location of the mid-morning snack was not required because the survey was conducted during school time.

**Tab. II.** Liquid foods most frequently consumed at breakfast in total and by children's BMI classes.

| Food | Total % | Children's BMI class Normal weight % | Overweight % | Obese % |
|---|---|---|---|---|
| Milk | 75.0 | 77.4 | 71.1 | 67.8 |
| Coffee | 11.9 | 12.1 | 10.4 | 14.4 |
| Tea | 9.8 | 9.4 | 9.5 | 12.5 |
| Fruit juice | 8.5 | 9.0 | 8.3 | 6.1 |
| Fresh-squeezed fruit juice | 6.8 | 7.3 | - | 4.5 |
| Yogurt | - | - | 7.0 | - |

**Tab. III.** Solid foods most frequently consumed at breakfast in total and by children's BMI classes.

| Food | Total % | Children's BMI class Normal weight % | Overweight % | Obese % |
|---|---|---|---|---|
| Biscuits | 42.9 | 45.1 | 38.5 | 37.1 |
| Cocoa | 21.8 | 23.2 | 20.0 | 14.8 |
| Cereal | 20.6 | 20.2 | 23.1 | 17.0 |
| Pre-packaged snack | 12.2 | 13.6 | 9.3 | 9.5 |
| Toasted bread crackers | 9.0 | 9.2 | 8.9 | 8.0 |

**Tab. IV.** Liquid foods most frequently consumed at mid-morning snack in total and by children's BMI classes.

| Food | Total % | Children's BMI class Normal weight % | Overweight % | Obese % |
|---|---|---|---|---|
| Fruit juice | 26.7 | 27.5 | 25.1 | 23.5 |
| Tea | 13.7 | 13.3 | 14.0 | 16.3 |
| Milk | 3.2 | 3.5 | 2.4 | 3.4 |
| Carbonated beverage | 3.1 | 3.1 | 3.1 | 3.0 |
| Yogurt | 3.1 | 3.2 | 2.5 | 3.8 |

most frequently consumed overall at mid-morning snack. Pizza, a ham sandwich and pre-packaged snacks are preferred, so much that the relative consumption percentages are very similar. The same order of consumption is evident for the child's BMI class.
Table VI shows the top five preferred liquid foods in total and divided by the child's BMI class: it is still evident how fruit juice is the most consumed liquid food, in total and divided by the child's BMI class: the order of food frequency does not differ substantially among the BMI classes: tea and yogurt follow fruit juice by far. Worth noting, as we have already observed, though at a lower percentage than at mid-morning snack, is the entrance of carbonated beverages among the top five liquid foods most consumed in all children's BMI classes.
Table VII demonstrates the top five solid foods most frequently consumed in total and divided by children's BMI classes: the ham sandwich, pre-packaged snacks and pizza are the foods preferred in general by children for afternoon snack. About BMI classes, the order of solid foods changes only for the obese category, who seem to prefer pizza to ham sandwiches and pre-packaged snacks, which for normal and overweight children fall from second to fifth place. The differences in food frequency divided by the child's BMI class resulted as being statistically significant (data not shown).

## Discussion

In order to confront the relevant problem of childhood obesity, international, national and local level actions are necessary; from this viewpoint, there are efforts to develop nutritional surveillance systems that, through the systematic gathering of information and of its analysis and interpretation, may allow the priorities of intervention to be established. The distribution of the Food Frequency Questionnaire (FFQ) proved useful in order to have an idea of the eating habits of 3rd-grade children in Tuscany region. As for the way in which the

**Tab. V.** Solid foods most frequently consumed at mid-morning snack in total and by children's BMI classes.

| Food | Total % | Children's BMI class Normal weight % | Overweight % | Obese % |
|---|---|---|---|---|
| Pizza | 21.6 | 21.6 | 20.5 | 23.1 |
| Ham sandwich | 19.8 | 19.7 | 19.4 | 21.6 |
| Pre-packaged snacks | 19.1 | 19.9 | 18.0 | 15.5 |
| Salami sandwich | 12.2 | 12.2 | 12.1 | 11.4 |
| Crackers | 8.8 | 9.3 | – | 8.0 |
| Fresh fruit | – | – | 7.8 | – |

**Tab. VI.** Liquid foods most frequently consumed at afternoon snack in total and by children's BMI classes.

| Food | Total % | Children's BMI class Normal weight % | Overweight % | Obese % |
|---|---|---|---|---|
| Fruit juice | 22.9 | 23.0 | 23.1 | 21.7 |
| Tea | 12.9 | 12.8 | 12.7 | 14.8 |
| Yogurt | 8.5 | 8.1 | 9.9 | 7.6 |
| Carbonated beverages | 6.7 | 6.7 | 7.3 | 5.3 |
| Milk | 5.9 | 5.9 | 6.1 | 5.3 |

**Tab. VII.** Solid foods most frequently consumed at afternoon snack in total and by children's BMI classes.

| Food | Total % | Children's BMI class Normal weight % | Overweight % | Obese % |
|---|---|---|---|---|
| Ham sandwich | 19.2 | 19.2 | 19.9 | 17.5 |
| Pre-packaged snack | 16.7 | 18.2 | 14.7 | 10.6 |
| Pizza | 14.0 | 13.7 | 13.3 | 17.9 |
| Salami sandwich | 11.5 | 11.7 | 11.1 | 11.0 |
| Ice cream | 10.8 | 10.8 | 10.5 | 11.0 |

questionnaire was structured, the information obtained provided some indications of the quality of eating habits, but not about quantities of eaten foods for that it would be needed a nutrition diary. The children's reporting resulted that more than 92% consume breakfast from 4-7 times a week, the vast majority at home, while only 3% declared consuming breakfast never or almost never. Nutrition experts agree upon the importance of a breakfast that must cover at least 25% of one's necessary caloric intake and supply a quantity of balanced nutrients; it has also been observed that eating breakfast may influence a child's cognitive abilities, his or her memory in particular [29]. Having breakfast early in the morning may be a good way to control the body weight; it has been suggested that individuals who do not eat breakfast have a greater overall daily energy intake [30, 31]. The location of breakfast consumption resulted as being at home, in most cases; this must be positively interpreted, seeing that the child, thanks to the parents' guidance, may have nutritional, wholesome foods at his or her disposition. A study by Yunsheng's et al. has shown that a breakfast eaten away from home had more than 105 kcal, 7% more fat, 2.8% more saturated fat and 2.2 g less fiber per 1000 kcal than a breakfast eaten at home [13]. The most preferred breakfast overall by Tuscan children, even taking into consideration the slight differences in BMI classes, consists of milk and biscuits. Milk consumption is important for calcium intake, and its role is well-known for bone growth and the child's overall health. An inverse association between frequency of milk consumption and body mass in children has been shown in a recent Italian study [32]. The consumption frequency of cereal is also high, which signifies a positive eating behaviour, because the consumption of cereal at breakfast could promote the maintenance of a healthy body weight and nutrient intakes in children [33]. Instead, we may underline how insufficient the tendency is to

consume yogurt, fresh fruit and fresh-squeezed fruit juice at breakfast, foods which are nutritionally recommended for their contributions of live and active yogurt cultures, vitamins and minerals. Approximately 96% of children reported having mid-morning snack. The location of consumption of this meal is understood as being at school, as the questionnaire was completed during the academic year. It is important for children to consume mid-morning snack, as too much time may pass between breakfast and lunch, which may cause metabolic imbalances with a consequential drop in blood sugar level. Eating multiple, small meals may suppress hunger and overall serum insulin concentrations [34]. Furthermore, a recent study conducted in Israel observed that children who consumed a snack 30 minutes before a cognitive test obtained more positive results than those who only had breakfast at home or who did not have breakfast at all [35].

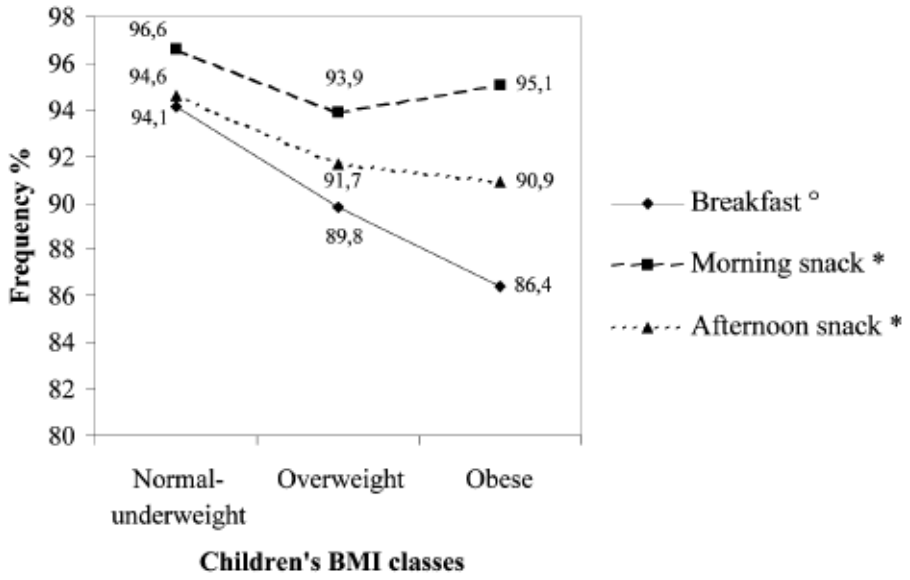
The mid-morning snack, we feel, may be placed under discussion; in fact, fruit juice and tea, which are sugar-sweetened beverages, are the most frequently consumed liquid foods, and pizza, salami sandwiches and pre-packaged snacks are the most frequently consumed solid foods. This is evident in all BMI classes. Even so, overweight and obese children did not demonstrate a significantly superior consumption frequency of these foods than normal weight children. Although the relationship between snack food and soft drink consumption and body weight remains controversial [36, 37], it is not unreasonable to believe that those who eat more "junk food" may, at least in part, have more of a chance of gaining weight. Again, fresh fruit and yogurt are consumed at a low rate; this may be partly due to the insufficient availability of these foods at the distribution centres in the schools, as well as a certain standardization of preferred eating behaviours in the school setting, which includes a tendency to imitate.

Afternoon snack also has a high level of consumption frequency, and is consumed for the most part at home, even if 12% of children reported consuming it elsewhere. Moreover, it is likely that children have more freedom in the afternoon, and therefore tend to consume afternoon snack outside of the home, which could represent a moment full of risk for nutritional errors. Similar eating behaviours of mid-morning snacks were noticed for afternoon snack, at which fruit juice and tea with pizza, sandwiches and pre-packaged snacks are still the most highly consumed foods by children; a tendency towards a lower consumption of pre-packaged snacks has been reported among obese children, which is difficult to interpret at this moment. Positive information comes from the suggestion that the consumption of yogurt and fresh fruit has increased; however, the consumption of carbonated beverages has also risen, which, with their high sugar content at high glycemic index, favour an insulin rebound that is considered a predisposing factor for accumulation of fat and a risk factor for chronic diseases [37, 38].

Consumption frequency of breakfast, mid-morning and afternoon snack were associated with the child's BMI class. Children of normal weight resulted as consuming these meals most frequently, which may indicate how these children have a more correct distribution of daily caloric intake than obese children. This is in line with Ma Y's study [13].

Moreover, many nutritional surveys report that adolescents with a consistent meal pattern were leaner than those with an inconsistent meal pattern [39]. This observation is in agreement with studies showing a link between obesity and skipping meals [11, 40].

**Fig. 1.** Breakfast, mid-morning and afternoon snack frequency in relation to children's BMI classes.




° P < 0.001
* P < 0.05

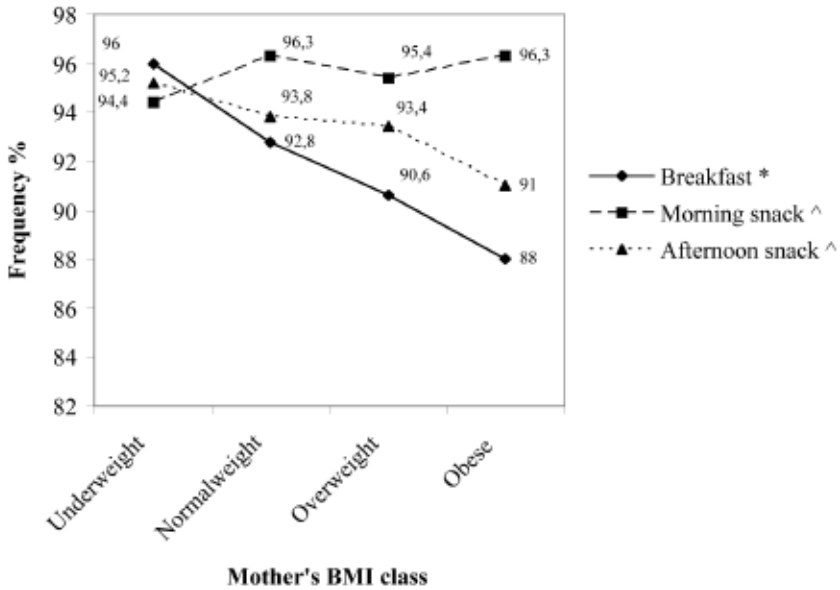
However, in general, even if consumption frequencies are elevated, breakfast is the least frequently consumed meal, which is evident in all BMI classes. This may be considered in light of several factors. First of all, there are more families in which both parents work, and the time limitation, when parents are in a hurry to get to work and to take the children to school, have become an important factor in determining whether to have breakfast and what types of foods to consume in the morning. In addition, we should keep in mind certain home environments which could have an effect on the way children eat, such as a family's incorrect eating habits, especially those of the mother, who normally passes on to the child most habits. We have observed that breakfast is less frequently consumed by children of overweight and obese mothers than children of normal and underweight mothers (Fig. 2); this may also testify to how unhealthy eating habits that lie behind excess weight may be "inherited" by children. We have underlined that children of mothers with a higher education level (and therefore, presumably, of a higher socio-economic status) consume breakfast more frequently than others (Fig. 3); this may be due to the mother's increased attention to the family's diet (that of the children in particular), an enhanced sensitivity to educational nutritional messages, and a superior nutritional knowledge, or at least a greater accessibility to correct nutritional and dietary information. This data is in line with other studies [23-25].

By contrast, the children's eating behaviours at mid-morning snack are not affected by the mothers. The place where children consume the meal is different from the home environment, so the determining factors of children's food choices are different. At mid-morning snack, the mother's BMI and educational level don't influence the children's eating behaviours anymore, as shown in Figures 2 and 3. Assuming that, at school, children are inclined to imitate each other, the percentages of the consumption frequency of a single more frequently eaten food are very close for all BMI classes at mid-morning snack (Tabs. IV, V).

On the other hand, at breakfast, we have noted statistically significant differences among certain foods consumed per BMI class. Milk, for example, is the most highly consumed beverage by children of all weight classes (Tab. II); however, there is a statistically significant drop in milk consumption in the children's overweight and obese BMI classes (data not shown). This information corresponds to the above-mentioned relationship between the mothers' BMI class and level of education and the children's breakfast consumption: both the fact that milk is consumed less by children of higher BMI classes, and that children of mothers of a higher BMI class and a lower education level consume breakfast less frequently, could demonstrate a correspondence between the BMI class and education level of the mother and the choices of a healthy breakfast (including milk) that the mother presents to her child in the home environment.

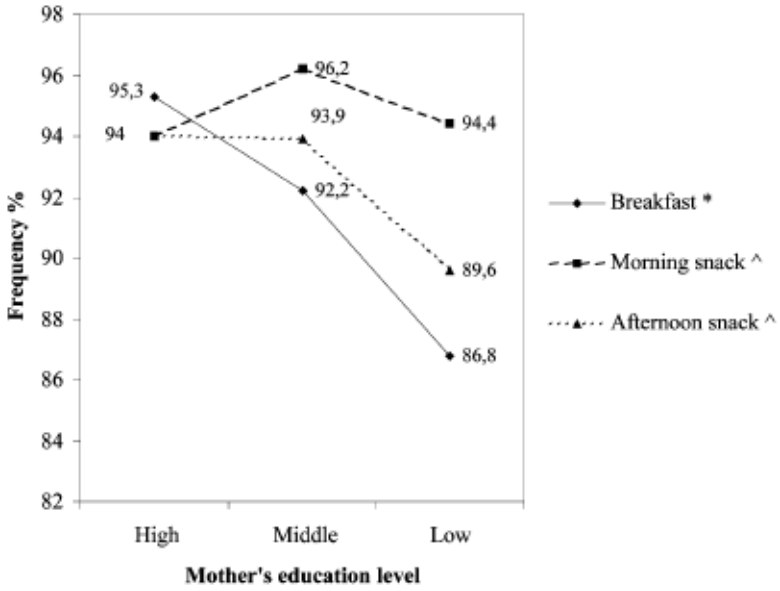
In this study, certain aspects of the eating behaviours of children ages 8-9 in Tuscany have been analyzed; these, in certain circumstances, may be considered healthy, but in others may reveal a necessity for appropriate eating behaviour interventions geared towards both parents and children. No substantial differences in food choices at the meals analyzed here were determined among normal weight, overweight and obese children. Children of normal weight had a greater ten-

**Fig. 2.** Breakfast, mid-morning and afternoon snack frequency of children in relation to the mother's BMI class.




* P < 0.05
^ not significant

Fig. 3. Breakfast, mid-morning and afternoon snack frequency of children in relation to the mother's education level.




* P < 0.05
^ not significant

dency to consume meals more regularly; this may lead us to believe that obese children tend to eat more frequently between meals, or that they have a habit of "munching" throughout the day. In order to confirm this data, further studies must be conducted specifically for this purpose.

## References


[1] Ebbeling CB, Pawlak DB, Ludwig DS. *Childhood obesity: public-health crisis, common sense cure*. Lancet 2002;360:473-82.

[2] Lobstein T, Frelut ML. *Prevalence of overweight among children in Europe*. Obes Rev 2003;4:195-200.

[3] Giacchi M, Lazzeri G, Zani A, Guidoni C, Giallombardo D, Cocco S, et al. *Nutritional Surveillance in Tuscany. Nutritional status among 8-9 y-old school children*. J Prev Med Hyg 2005;46:70-5.

[4] Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P. *Increased incidence of non-insulin-dependent diabetes mellitus among adolescents*. J Pediatr 1996;128:608-15.

[5] Rames LK, Clarke WR, Connor WE, Reiter MA, Lauer RM. *Normal blood pressure and the evaluation of sustained blood pressure elevation in childhood: the Muscatine study*. Pediatrics 1978;61:245-51.

[6] Mallory GB Jr, Fisher D, Jackson R. *Sleep-associated breathing disorders in morbidly obese children and adolescents*. J Pediatr 1989;115:892-7.

[7] Wallace WJ, Sheslow D, Hassink S. *Obesity in children: a risk for depression*. In: Williams CL, Kimm SYS, eds. *Annals of the New York Academy of Science: Prevention and Treatment of Childhood Obesity.* New York, NY: New York Academy of Sciences 1993, pp. 301-302.

[8] Hill AJ, Draper E, Stack J. *A weight on children's minds: body shape dissatisfactions at 9-years old.* Int J Obes Relat Metab Disord 1994;18:383-9.

[9] Mendelson BK, White DR. *Relation between body-esteem and self-esteem of obese and normal children.* Percept Mot Skills 1982;54:899-905.

[10] Jenkins DJ, Jenkins AL, Wolever TM, Vuksan V, Rao AV, Thompson LU, et al. *Low glycemic index: lente carbohydrates and physiological effects of altered food frequency*. Am J Clin Nutr 1994;59:706s-9s.

[11] Bellisle F, Rolland Chachera M, Deheeger M, Guilloud Bataille M. *Obesity and food intake in children: evidence for a role of metabolic and/or behavioural daily rhythms*. Appetite 1988;11:111-8.

[12] Fabry P. *The frequency of meals: its relation to overweight, hypercholesterolemia and decrease glucose tolerance*. Lancet 1964;2:614-5.

[13] Ma Y, Bertone ER, Stanek EJ 3rd, Reed GW, Hebert JR, Cohen NL, et al. *Association between eating patterns and obesity in a reef living US adult population*. Am J Epidemiol 2003;158:85-92.

[14] Nicklas TA, Bao W, Webber LS, Berenson GS. *Breakfast consumption affects adequacy of total daily intake in children*. J Am Diet Assoc 1993;93:886-91.

[15] Wyon DP, Abrahamsson L, Jartelius M, Fletcher RJ. *An experimental study of the effects of energy intake at breakfast on the test performance of 10-year-old children in school.* Int J Food Sci Nutr 1997;48:5-12.

[16] Nicklas TA, O'Neil CE, Berenson GS. *Nutrient contribution of breakfast, secular trends, and the role of ready-to-cereals: a review of data from the Bagalusa Heart Study.* Am J Clin Nutr 1998;67:757S-6S.

[17] Sampson AE, Dixit S, Meyers AF, Houser Jr R. *The nutritional impact of breakfast consumption on the diets of inner-city African-American elementary school children.* J Natl Med Assoc 1995;15:195-202.

[18] Ortega RM, Redondo MR, Lopez-Sobaler AM, Quintas ME, Zamora MJ, Andres P, et al. *Associations between obesity, breakfast-time food habits and intake of energy and nutrients in*

*a group of elderly Madrid residents.* J Am Coll Nutr 1996;15:65-72.

[19] Schlundt DG, Hill JO, Sbrocco T, Pope-Cordle J, Sharp T. *The role of breakfast in the treatment of obesity: a randomized clinical trial.* Am J Clin Nutr 1992;55:645-51.

[20] National Research Council. *Recommended dietary allowances. 10th edn*. Washington DC: National Academy Press 1989.

[21] St-Onge MP, Keller KL, Heymsfield SB. *Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights.* Am J Clin Nutr 2003;78:1068-73.

[22] Wildey MB, Pampalone SZ, Pelletier RL, Zive MM, Elder JP, Sallis JF. *Fat and sugar levels are high in snacks purchased from student stores in middle schools.* J Am Diet Assoc 2000;100:319-22.

[23] Piffer S, Kaisermann D, Pasquazzo MT. *Dietary habits in primary school children. Role of school meals and parents's social class.* Ann Ig 2003;15:1097-108.

[24] Haapalahti M, Mykkanen H, Tikkanen S, Kokkonen J. *Food habits in 10-11-year-old children with functional gastrointestinal disorders*. Eur J Clin Nutr 2004;58:1016-21.

[25] Birch LL, Davison KK. *Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight.* Pediatr Clin North Am 2001;48:893-907.

[26] Lazzeri G, Zani A, Guidoni C, Giallombardo D, Cocco S, Amato C, et al. *Nutritional Surveillance in Tuscany. Relationship between 8-9 y-old school children BMI with parent's educational level and BMI*. J Prev Med Hyg 2005;46:145-52.

[27] World Health Organization. *Physical status: the use and interpretation of anthropometry. Report of a WHO Export Committee*. World Health Organ Tech Rep Ser 1995;854:1-452.

[28] World Health Organization. *Obesity. Preventing and managing the global epidemic. Report of a WHO Consultation on obesity*. WHO/NUT/NCD/98 1, Geneva: World Health Organization.

[29] Pollitt E, Mathews R. *Breakfast and cognition: an integrative summary.* Am J Clin Nutr 1998;67:804S-13S.

[30] Stanton JL, Keast DR. *Serum cholesterol, fat intake and breakfast consumption in the United States adult population*. J Am Coll Nutr 1989;8:567-72.

[31] Morgan KJ, Zabik ME, Stampley G. *The role of breakfats in diet adequacy of the US adult population.* J Am Coll Nutr 1986;5:551-63.

[32] Barba G, Toiano E, Russo P, Venezia A, Siani A. *Inverse association between body mass and frequency of milk consumption in children*. Br J Nutr 2005;93:15-9.

[33] Albertson AM, Anderson GH, Crockett SJ, Goebel MT. *Ready-to-eat cereal consumption: its relationship with BMI and nutrient intake of children aged 4 to 12 years.* J Am Diet Assoc 2003;103:1613-9.

[34] Jenkins DJ, Wolever TM, Vuksan V, Brighenti F, Cunnane SC, Rao AV, et al. *Nibbling vs gorging: metabolic advantages of increased meal frequency.* N Engl J Med 1989;32:929-34.

[35] Vaisman M, Voet H, Akivis A, Vakil E. *Effect of breakfast timing on the cognitive functions of elementary school students.* Arch Pediatr Adolesc Med 1996;150:1089-92.

[36] Field AE, Austin SB, Gillman MW, Rosner B, Rockett HR, Colditz GA. *Snack food intake does not predict weight change among children and adolescents.* Int J Obes Relat Metab Disord 2004;28:1210-6.

[37] Ludwing DS, Peterson KE, Gortmaker SL. *Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis.* Lancet 2001;357:505-8.

[38] Di Meglio DP, Mattes RD. *Liquid vs solid carbohydrates: effect on food intake and body weight*. Int J Obes Relat Metab Disord 2000;24:794-800.

[39] Siega-Riz AM, Carson T, Popkin B. *Three squares or mostly snacks – what do teens really eat? A sociodemographic study of meal patterns*. J Adolesc Health 1998;22:29-36.

[40] Wolfe WS, Campbell CC. *Food pattern, diet quality, and related characteristics of schoolchildren in New York State*. J Am Diet Assoc 1993;93:1280-4.

■ Received on June 7, 2005. Accepted on February 2, 2006.

■ Acknowledgements: This project was supported by grants from the Tuscany Region (Issue: N° 1300 of 11/26/2001, N° 6771 of 11/13/2003) and "Nutritional surveillance based on local data for the prevention of chronic disease", promoted by the Ministry of Health, was included in the project.
The Authors wish to thank the Local School Authorities for their permission to measure and weigh children in their districts and the personnel of the Local Health Units (LHU) for their collaboration in the project, in particular:
*LHU Massa*: Patrizia Carignani (UO/UF IAN), Manuela Terreni, Maria Giuseppina Galli, Paola Antonioli;
*LHU Lucca*: Fausto Morgantini, Alessandro Scacchiotti, Bianca Maria Mulini;
*LHU Pistoia*: Paola Piccioli (UO/UF IAN Pistoia), Monica Tognarelli (UO/UF IAN Valdinievole), Alda Isola, Franca Moretti, Elena Tomassetto, Stefania Vezzosi;
*LHU Prato*: Giuseppe Vannucchi (UO/UF IAN), Riccardo Innocenti, Domenico Mariani, Roberta Gestri, Patrizia Medea;
*LHU Pisa*: Eleonora Virgole (UO/UF IAN), Margherita Brunetti, Elena Griesi, Cristina Verdini, Mariacristina Baldocchi;
*LHU Leghorn*: Maria Grazia Rastelli, Mauro Fiorini (UO/UF IAN), Marinella Frasca, Giuliano Baldacci, Atonia Amici, Paola Fatighenti;
*LHU Siena*: Simonetta Sancasciani (UO/UF IAN), Alessandra Bagnoli, Antonella Bellugi, Alfea Pinzuti;
*LHU Arezzo*: Fulvio Armellini (UO/UF IAN), Chiara Cinughi de'Pazzi, Patrizia Baldacchini, Rossella Leonardi;
*LHU Grosseto*: Franca Narduzzi (UO/UF IAN), Rosalba Lorenzoni, Rita Cancelli;
*LHU Florence*: Patrizia Giannelli, Tiziana De Marco, Brunella Librandi, Alessandra Maggi, Rina Brunetti, Angela Ghelmi, Ilia Di Marco, Claudia Russo, Roberto Vigevano;
*LHU Empoli*: Maria Giannotti (UO/UF IAN), Claudio Baglioni, Francesca Chiaverini, Roberto Giannini, Cristiana Procuranti, Elena Corsinovi;
*LHU Viareggio*: Giovanna Camarlinghi (UO/UF IAN), Piero Cibeca, Paola Gridelli, Gianna Innocenti

■ Correspondence: Prof. Mariano Vincenzo Giacchi, Department of Public Health, Center of Research for Health Education and Promotion, via A. Moro, 53100 Siena, Italy - Tel. +39 0577 234088 - Fax +39 0577 234090 - E-mail: giacchi@unisi.it