

Child's food consumption and physical exercise: Results from a Portuguese descriptive study

Goreti Marques, PhD, MBus, RN^{a,*}, Constança Festas, PhD, MSc, RN^b,
Carla Sílvia Fernandes, PhD, MSc, RN^c, Daniela Simões, PhD, MSc, PT^a, Fátima Ferreira, MSc, RN^a,
Sara Pinto, PhD, MSc, RN^a, Áurea Jorge, RN^d, Gustavo Ferreira, MD^d

Abstract

Aims: To describe food consumption in Portuguese primary school children, to analyze the influence of food consumption on the body mass index (BMI), and to analyze the relationship between physical exercise and the child's food consumption.

Method: A quantitative, descriptive, exploratory, and cross-sectional study was conducted in 2 primary schools of the north of Portugal (n= 109 child). The use of a food register for 5 consecutive days and anthropometric evaluation of the children were used.

Results: The vast majority of children had a normal weight (65.10%). However, 34.90% of the children presented significant changes in their BMI (14.70% with low weight, 11.90% overweight, and 8.30% with obesity). Children who engage in physical activity drink more water and consume less sugary products. However, they also consume less meat, fish, and eggs than those who do not perform regular physical activity.

Conclusions: The study highlights the emergence of new problems, such as the increasing prevalence of underweight children. The prevention of these problems, overweight, or underweight children, should be addressed among healthcare providers, local authorities, families, and teachers.

Keywords: child, feeding behavior, health behavior, nursing

Highlights

- Childhood obesity is an important problem of public health
- Thinness is an emergent problem among developed countries
- Prevention is the key
- A global and interdisciplinary strategy should be implemented

Background

Childhood obesity, outlined by the World Health Organization (WHO)¹ as abnormal or excessive fat accumulation that presents a risk to health, is a significant public health issue in the twenty-first century, since it is one of the most prevailing diseases in the pediatric age group.² It is estimated that, across the world, about 200 million school age children are overweight and 40 to 50 million are obese.² WHO considered childhood obesity a new epidemic, with serious implications on the global health and quality of life of the child.³

Childhood and adolescence are important stages in which nutrition assumes extraordinary significance, not only in preventing illnesses but also in the occurrence of chronic disease during adult age and in the rise of obesity among young adults.² Early nutritional education and the evaluation of food consumption are singled out as fundamental interventions to decrease the prevailing chronic diseases, namely childhood obesity, and promote the choice of nutritional behavior that lasts throughout adult life.^{4,5} Scientific evidence has documented that being overweight at a pediatric age is associated with a higher incidence of arterial hypertension, hyperglycemia, hypercholesterolemia, cholelithiasis, sleep apnea, and orthopedic malfunction in adulthood.^{2,6,7}

Family and school are important factors with a strong influence on the child's food consuming patterns.⁸ However, the high consumption of processed food, and the hectic lifestyle of modern societies also seem to contribute to a change in the nutritional pattern both in children and in adults.⁹ Several studies have acknowledged that the consumption of fried food, sweets, and candies is related to the increase of the energetic density of meals, raising the risk of childhood obesity.² The decrease of physical activity and increased sedentary activities, such as watching TV

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^a Escola Superior de Saúde de Santa Maria, ^b Universidade Católica Portuguesa, ICS, Escola de Enfermagem-Porto, ^c Universidade Fernando Pessoa-Porto, ^d ACES Grande Porto III—Maia /Valongo, ARS Norte IP

* Corresponding author. Travessa Antero Quental no. 173/175, 4049-024 Porto. E-mail address: goreti.marques@santamariasau.de.pt (Goreti Marques).

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and playing console games, are also determining factors in childhood obesity. Thus, the improvement of healthy living standards, such as physical exercise, water ingestion, eating fruits, and vegetables, are determinant for the promotion of a healthier lifestyle for children.²

Early intervention must, therefore, be included in the strategic plan of the healthcare teams, in order to fight this new epidemic of the twenty-first century more efficiently.¹⁰

According to the Childhood Obesity Surveillance Initiative (COSI)/World Health Organization Regional Office for Europe,² 31.6% of Portuguese children are overweight and 13.9% are obese. Moreover, there has also been an increase in the prevalence of underweight children in the period between 2008 and 2013. These data are particularly pertinent in the scope of the childhood healthcare and pediatric programs, whose main challenge is the promotion of healthy lifestyles. Within this context, this study aims to describe the food consumption of Portuguese children currently attending primary school; to analyze the influence of the food consumption on the child's body mass index (BMI), and to analyze the relationship between the practice of physical exercise and the child's food consumption.

Methodology

Study design and sample

A descriptive, exploratory, and cross-sectional study, with a quantitative approach was conducted in 2 primary schools of an urban area in the north of Portugal. Primary school children were the target population. A convenience sample including all the children that, at the date of the study, were attending the 3rd grade of the institutions mentioned above (n=109) was composed.

Data collection

The instruments for data collection include a questionnaire with the following variables (a) sociodemographic characterization (sex, age, household composition, and practice of regular physical exercise outside school, measured by a dichotomous question); (b) anthropometric evaluation (weight, height, and BMI), and (c) a booklet to register the child's food consumption. The food consumption diary was designed by an expert's committee that included nutritionists, nurses, physiotherapists, and lay members, and it was based on a list of food from the "New food wheel"¹¹: (i) dairy products; (ii) meat, fish, and eggs; (iii) cereals and derivatives, tubers; (iv) fruit and vegetables; (v) fat and oils; (vi) sugary and salty food; and (vii) water. The instrument was completed at school over 5 consecutive days.

The anthropometric data were collected through a weight balance (Tanita Segmental Body Composition model BC-601 or BC-545N), for measuring body weight and percentage of fat mass. Stature was measured through a portable estadiometer and the waist circumference through a Flexible Measuring Tape.

The data collection was carried out by trained and properly identified collaborators. Each training session lasted for 2 hours and focused on the standardization of anthropometric procedures, weight and height instrument calibration, and the use of the questionnaires. The children's individual evaluation occurred in an office provided by the school, which should comply with the following requirements: silence; enough space to allow the freedom of movements, proper lighting for the correct visualization of the numbers, room temperature between 21°C and 23°C;

with a still air environment; flat floor space to change clothes. The register of the food consumption was performed at school in collaboration with the children's teachers. The individual anthropometric evaluation occurred on the last day of data collection.

Ethical considerations

The favorable agreement of the children was obtained as well as the informed consent of their legal representative, ensuring the possibility of withdrawal at any time. The confidentiality of the data and the privacy of the participants were preserved. The research project was approved by an independent ethics committee (Authorization number T559), and additionally by the National Data Protection Commission (NDPC no. 1704/2015). The formal permission of the direction of the institutions involved was assured. Each teacher was a point of connection between the research team, the children, and their legal representatives.

Data analysis

These data were analyzed using the SPSS program version 24.0 for Windows. A critical significance level of .05 (*P*) and a confidence interval of 95% were assumed for all the tests.

Data were analyzed through nonparametric tests, according to the studied variables, since the frequency of weekly consumption did not follow a normal distribution.

Results

Sociodemographic characterization

The study includes 109 children attending the 3rd year of primary education. Age ranged between 7 and 8 years, and most children were male (n=58; 53.2%). The vast majority live with their father and mother (25.70%), but 5 children (4.60%) live with a single-parent and 2 children live in an extended family (1.80%). Most children have at least, 1 sibling (n=84; 77.10%), but only 73.40% of them (n=80) live with their siblings.

Anthropometric characterization

The participants weighed, on average 28.50 kg (standard deviation=6.38; minimum=19.4 kg; maximum=59.2 kg) and a height of 131.60 cm (standard deviation=5.04 cm; minimum=131.6 cm; maximum=143 cm). Table 1 shows the BMI and the percentile of the sample, according to the sex of the participants. The classifications used for both the BMI and the percentile are based on the guidelines suggested by WHO and by the Portuguese Health Authority (Direção Geral da Saúde).^{12,13}

To analyze the relationship between the sex of the children and their BMI, the Fisher exact test was applied, as the conditions for use of the chi-squared test were not fulfilled (<20% of the cells with expected value <5 and no cell with expected value <1). Nevertheless, no statistically significant differences were found between the variable sex and the BMI of the child (*P*=.703).

Food consumption

The list of food items that were more commonly consumed every week includes a broad spectrum of products (Table 2). Among those which were considered healthy were fruit and vegetable soup, but it is also possible to observe a frequent consumption of

Table 1**Distribution of BMI and sample percentile by sex (n=109).**

	Categories of BMI	Total sample, n (%)	Female sex, n (%)	Male sex, n (%)
Low weight	Percentile < 5	16 (14.70)	9 (17.60)	7 (12.10)
Normal weight	5 ≤ percentile < 85	71 (65.10)	32 (62.70)	39 (67.20)
Ponderal overweight	85 ≤ percentile < 95	13 (11.90)	7 (13.70)	6 (10.30)
Obesity	Percentile ≥ 95	9 (8.30)	3 (5.90)	6 (10.30)

BMI = body mass index.

biscuits and bread. The most consumed drinks were water, milk, and natural orange juice.

Physical activity

The practice of physical exercise included the regular practice of sports during, at least, 60 minutes per week and outside the school timetable. It was found that 77.10% of the participants (n=84) perform physical exercise on a regular basis. Among these, 66.70% (n=56) practice only one type of sport, whereas

25.00% (n=21) practice 2 different types of sports and 8.30% (n=7) practice 3 different sports activities per week. The more frequent sport activities are swimming (n=55; 50.46%), football (n=21; 19.27%), dance (n=10; 9.17%), and martial arts (karate) (n=7; 6.42%).

BMI and food consumption

The Mann–Whitney *U* test was used to analyze the relationship between the BMI and food consumption. These data highlight the

Table 2**Characterization of weekly food consumption.**

How often I ate or drank...	Weekly minimum	Weekly maximum	Weekly total median (P25; P75)
Dairy products	0	42	11.0 (8.0; 15.5)
Glass or cup of milk	0	32	5.0 (1.0; 6.0)
Small carton of white milk	0	10	0.0 (0.0; 2.0)
Small carton of chocolate milk	0	10	0.0 (0.0; 2.5)
Small carton of chocolate milk provided by the school	0	4	0.0 (0.0; 0.0)
Yoghurt	0	15	4.0 (1.5; 5.0)
Ice cream	0	5	0.0 (0.0; 1.0)
Meat, fish, and eggs	2	24	10.0 (8.0; 12.0)
Meat	0	12	5.0 (3.5; 6.0)
Fish	0	7	2.0 (1.0; 3.0)
Egg	0	9	0.0 (0.0; 1.0)
Spam or ham	0	10	1.0 (0.0; 3.0)
Sausage	0	6	0.0 (0.0; 1.0)
Cereals and their derivatives, tubers	5	47	20.0 (15.5; 24.0)
Bread	0	28	6.0 (4.0; 8.0)
Cereals	0	9	2.0 (0.0; 5.0)
Biscuits	0	30	1.0 (0.0; 3.0)
Rice	0	8	4.0 (2.0; 5.0)
Potato	0	10	1.0 (1.0; 3.0)
Pasta	0	8	2.0 (1.0; 4.0)
Fries	0	10	1.0 (0.0; 2.0)
Fruit and vegetables	0	65	24.0 (16.0; 31.0)
Piece of fruit	0	35	10.0 (7.0; 3.5)
Natural juice	0	27	0.0 (0.0; 2.0)
Salad or cooked vegetables	0	14	4.0 (2.0; 7.0)
Vegetable soup	0	22	8.0 (4.0; 10.0)
Fat and oils	0	15	2.0 (0.0; 4.0)
Butter	0	15	2.0 (0.0; 4.0)
Sugary and salty products	0	43	6.0 (4.0; 12.0)
Cookies	0	24	0.0 (0.0; 1.0)
Simple cakes, individual, or sliced	0	4	0.0 (0.0; 1.0)
Cakes with cream	0	4	0.0 (0.0; 0.0)
Jelly	0	10	0.0 (0.0; 2.0)
Chocolate mousse	0	4	0.0 (0.0; 0.0)
Chocolate	0	10	1.0 (0.0; 2.0)
Lollipops, sweets, and gums	0	13	0.0 (0.0; 1.0)
Soft drinks (ice tea, coke, juices)	0	21	1.0 (0.0; 2.0)
Rissoles or croquettes	0	6	0.0 (0.0; 1.0)
Varied puffs	0	6	0.0 (0.0; 0.0)
Water	1	98	22.0 (13.0; 33.0)

Table 3**Weekly food consumption, according to categories of BMI.**

How often I ate or drank . . .	Low weight, median (P25; P75)	Normal weight, median (P25; P75)	Overweight or obesity, median (P25; P75)	P
Dairy products	10.5 (9.3; 15.8)	11.0 (8.0; 16.0)	12.0 (8.8; 13.5)	.956
Meat, fish, and eggs	11.0 (9.3; 11.8)	10.0 (8.0; 12.0)	10.0 (7.5; 13.3)	.751
Cereals and their derivatives, tubers	20.5 (15.5; 24.0)	20.0 (16.0; 26.0)	20.5 (13.0; 24.0)	.661
Fruit and vegetables	28.5 (26.0; 35.8)	24.0 (16.0; 31.0)	16.5 (15.5; 23.3)	.010
Fat and oils	1.0 (0.0; 2.0)	3.0 (0.0; 5.0)	2.0 (0.0; 4.0)	.064
Sugary and salty products	4.5 (2.3; 6.0)	7.0 (4.0; 14.0)	7.0 (4.0; 11.3)	.204
Water	20.0 (15.8; 28.8)	22.0 (13.0; 32.0)	24.0 (9.8; 35.8)	.961

BMI = body mass index.

existence of significant statistical differences between the child's BMI and the consumption of fruit and vegetables ($P=.010$) (Table 3). To analyze the differences between groups, the Mann-Whitney U test was used. Data revealed that children with low weight eat significantly more fruit and vegetables than the children with normal weight ($P=.027$) or overweight or obese children ($P=.005$).

Physical activity and food consumption

To analyze the relationship between sports practice and food consumption, the Mann-Whitney U test was used. Although no statistically significant differences were observed between the practice of sports and food consumption ($P>.05$) (Table 4), data highlight that children who practice sports tend to drink more water and consume less sugary products. However, they also eat less meat, fish, and eggs than those who do not practice sports regularly (Table 4).

Discussion

Overweight children and child obesity have been documented as an important problem of public health.²

Data from this study match the national profile, highlighting that most children have a normal weight ($5 < \text{percentile} < 85$) (65.10%).^{14,15} However, it was found that 34.90% of the children have significant changes in their BMI (14.70% are underweight, 11.90% are overweight, and 8.30% are obese) which deserves the attention of pediatric health programs.

The results seem to be connected to the implementation of regional programs in the promotion of childcare, such as the great investment in the practice of sports activities outside the school environment. However, if for most children it has been a clearly positive intervention, the results have also pointed out that underweight trends tend to appear in children who practice sports intensely (2 or 3 sporting activities per week). Simultaneously, the food intake in this group does not appear to be adjusted to the needs inherent to their age nor to that for the

intensive practice of sports. Even though the children with greater sports activity are also those who tend to have a greater consumption of water, fruit, and vegetables, it was registered that these also tend to consume less sugary, salty, or fatty products, and also less products rich in proteins, such as the foods which integrate the group "meat, fish, and eggs."

Despite its small significance (small size and nonprobabilistic sample), the data highlighted a growing prevalence of being underweight in children of the female gender (17.60%) compared to those of the male gender (12.10%). The issues related to being underweight, particularly among children of the female gender, uncover another problem which is emerging in modern societies: the culture of extreme thinness and the consequences on the self-image and health of the child.^{16,17} In this way, the data raise awareness the need to establish integrated strategies involving the schools, the health teams, the councils, and the children, necessarily involving the family and the child. Indeed, it is important to consider that if overweight children and child obesity are a threat to the child's health, low weight is equally worrying and a cause of health problems.¹⁶⁻¹⁸ The practice of a sports activity cannot be dissociated from eating education programs and from the promotion of healthy lifestyles which include not only the struggle against being overweight but also against extreme thinness.

Another disturbing factor is related to the changing diet pattern within the family. Previous studies documented that the accelerated pace of modern societies seem to be related to an increase of the consumption of industrialized products (fast food), those with the best nutritional value.¹⁹ Nevertheless, previous studies have documented that processed food appears to be cheaper than natural products, such as fruit and vegetables.¹⁹⁻²¹

The issues related to the economy of the country such as the livelihood of the families must be the object of attention by national governments but also of city councils and of those schooling and health institutions which pursue an activity related to social care.

The results should, however, be analyzed with caution and prudence, due to the limitations of the study. First, it is important

Table 4**Weekly food consumption, according to sports practice.**

How often I ate or drank . . .	With sports practice, median (P25; P75)	Without sports practice, median (P25; P75)	P
Dairies	12.0 (8.0; 16.0)	11.0 (8.0; 4.5)	.542
Meat, fish, and eggs	10.0 (8.0; 12.0)	11.0 (9.0; 14.5)	.069
Cereals and their derivatives, tubers	20.5 (17.0; 24.0)	19.0 (14.5; 24.5)	.438
Fruit and vegetables	23.0 (16.0; 29.0)	25.0 (15.5; 33.5)	.721
Fat and oils	2.0 (0.0; 4.0)	1.0 (0.0; 4.0)	.982
Sugary and salty products	6.0 (3.0; 12.0)	7.0 (4.5; 14.0)	.252
Water	23.0 (14.0; 35.0)	20.0 (9.5; 30.0)	.194

to consider that data, despite its importance, may be undervalued. The sample is small and the sampling process was not random, being restricted to third-grade students. Thus, the student's perception of greater surveillance during data collection might have introduced a healthier diet during that period of time. For practical reasons, namely the fact that there is no school at the weekend, food consumption was registered only during the week, which may have introduced some bias. Further studies should include data from the weekend, in order to analyze whether this period is one of compensation when more eating mistakes are made or whether the greater amount of free time might be related to the wholesome of healthier and more work overload of meals.

The difficulties in the recruitment of collaborators (due to the overload of work teachers, and consequent less adherence to the study) constituted another important limitation, which obstructed a more expressive sample group. This limitation reveals the need to make teachers aware of the problems related to health during school age and of the need for them to be copartners in programs of pediatrics and child health. In fact, rather than a voluntary act or one that is accrued to their regular teaching activities, this should be an activity which is included in the formative curricula and in the curricula vitae of teachers, insofar as that they are by definition, the agent who spends most time with the child, other than the child's family.

Despite these considerations, the study makes important contributions to the mapping of the child's eating behavior and lifestyle during primary school.

Conclusion

During childhood, the child acquires and consolidates his/her eating habits. The study highlights the emergence of new problems, such as the prevalence of an increase in the number of underweight children. If overweight children and child obesity continue to represent an important problem for public health, underweight children are an equally serious and emerging problem. The prevention of these problems—whether it is overweight or underweight children—must be dealt with by both health teams and city councils, and also by those who have a closer relationship with the child: the family and teachers/educators. The problems which derive from the adoption of unhealthy lifestyles not only affect the health of the child, but also their future development, at the very least. In a long-term perspective, these habits will affect the public health and the normal growth of life in society.

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Author contributions

Conception and design of the work, acquisition of data (GM, CF, CSF, FF, AJ, GF); analysis and interpretation of data (GM, CF, DS, SP, GF); drafting the article or revising it critically for important intellectual content (GM, SP, GF); and final approval of the version to be published (GM, CF, CSF, DS, FF, SP, AR, GF).

Conflicts of interest

The authors declare no conflicts of interest.

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