Ann Ig. 2024 Jan 18. doi: 10.7416/ai.2024.2599. Online ahead of print

Eating and lifestyle habits and primary school health-related programs: a survey involving Italian children and teachers

Mattia Acito[1], Giovanni Cangelosi[2], Fabio Petrelli[3], Massimo Moretti[1], Milena Villarini[1], Anna Celestino[3], Eleonora Sordoni[3], Iolanda Grappasonni[3]

Received: 2023 December 14
Accepted after revision: 2024 January 9
Published online ahead of print: 2024 January 18

Keywords: Eating habits; lifestyle; health education; primary school; pupils; teachers
Parole chiave: Abitudini alimentari; stili di vita; educazione alla salute; scuola primaria; alunni; insegnanti

Abstract

Background. *Childhood overweight and obesity represent serious public health concerns in several countries worldwide, including Italy, where the highest prevalence in Europe of overweight and obesity among primary school children was recorded. Among others, primary schools represent suitable social environments for health education projects. In this perspective, to optimize resources and plan successful activities, it is necessary, first of all, to analyze the context of the intervention.*
Study design. *A pilot survey involving children and teachers was conducted in a primary school in Jesi (Le Marche Region, Italy).*
Methods. *A questionnaire was submitted by teachers between May and June 2023 to 104 pupils (aged 6–11) from the five different primary school system classes. A qualitative questionnaire was also filled out by the same teachers (n = 5) who were present while the children were filling the eating/lifestyle questionnaire.*
Results. *Most of the children (96.1%) had breakfast before school, with milk and cereal (51.5%) representing the preferred combination. During recess, 59.2% of pupils usually have a sandwich, 23.3% usually have sweet snacks, whereas only 2.9% have a fruit. Over 55% of the sample preferred drinking high-sugar beverages to water, and 15.5% declared going to a fast-food restaurant more than once a week. Over 17% of children did sport only once a week or less often. Over 64% of children habitually played videogames, and 77.6% normally watched TV or played with a tablet/smartphone while eating. Finally, the teachers' interview highlighted that there were no active health-related projects addressed to the pupils, and the school did not normally organize meetings with health professionals to increase children's and their parents' knowledge and awareness about healthy eating habits.*
Conclusions. *This preliminary investigation analyzed the context for a future health and nutrition education project and will assist researchers in planning successful activities and increasing the efficiency of the intervention.*

[1] *Department of Pharmaceutical Sciences, University of Perugia, Italy*
[2] *Unit of Diabetology, ASUR Marche, Fermo, Italy*
[3] *School of Medicinal and Health Products Sciences, University of Camerino, Italy*

Mattia Acito and Giovanni Cangelosi share the first authorship

Annali di Igiene : Medicina Preventiva e di Comunità (Ann Ig)
ISSN 1120-9135 https://www.annali-igiene.it

Introduction

Childhood obesity represents a serious public health concern, as it is associated with a higher probability of premature death and disability in adulthood (1, 2). Indeed, overweight and obese children are more likely to step overweight or obese into adulthood and to develop noncommunicable diseases (NCDs) like diabetes and cardiovascular diseases at a younger age. Moreover, other short-term and long-term health consequences that overweight and obese children are more likely to suffer in their lives include ambulatory difficulty, musculoskeletal disorders, and endometrial, breast, and colon cancer (1). In addition, childhood obesity is associated with an increased risk of psychological problems, reduced self-esteem, and lower quality of life (3, 4).

Overweight and obesity are complex and multifactorial conditions, whose onsets are linked to several factors, including unhealthy eating habits, insufficient physical activity levels, insufficient sleep, genetics, and social determinants of health (*e.g.*, food security, living conditions, household income, education, etc.) (5). Among others, education, despite its compelling link with well-being, health, and pathological conditions – including obesity (6–8) – remains a neglected social determinant of health (9).

According to the WHO (10), the mean age-standardised prevalence of overweight and obesity among primary school children (5–9 years old) in the WHO European Region is 29.5% and 11.6%, respectively. In Italy, values rise to 42.0% and 17.8%, representing the highest values recorded in Europe, and outlining an alarming scenario that makes it imperative to intervene.

In recent years, many people – including children – living in the Mediterranean area moved towards a 'Western Diet' model, with a remarkable intake of simple carbohydrates, saturated fats, and processed foods (11). In addition, data from the Italian Surveillance System *Okkio alla Salute* showed that, in Central Italy, only 32.3% of schoolchildren do vigorous physical activity at least three times a week, whereas 16.5% of them do not even do the same once a week (12). The same report also showed that 43.8% of schoolchildren in Central Italy spend more than two hours a day in front of a screen. A higher screen exposure than in the past is also contributing to the increase in overweight/obesity prevalence. Indeed, higher screen exposure is associated with sleep deprivation, higher children's energy intake ('*eating while viewing*'), fewer fruit and vegetable consumption, and higher intake of energy-dense snacks, drinks, and fast food (13).

As stated in the Ottawa Charter for Health Promotion, '*Health is created and lived by people within the settings of their everyday life; where they learn, work, play, and love*' (14). Along with family, primary schools represent the most suitable social environments for health education interventions that can help children to increase their knowledge and awareness about healthy choices, including healthy food choices and active living.

In primary school settings, teachers should be directly involved in any lifestyle program because, as role models, they have the power to influence children's behaviour through the promotion of healthy choices and the dissuasion of unhealthy practices. A prerequisite is the awareness of the teachers about health promotion topics and health-related school activities.

Collecting data and information through surveys is a necessary precursor step to planning, as well as an essential strategy to efficiently start a project (15). In this perspective, to optimize resources, increase efficiency and plan successful activities, it is necessary to begin with an analysis of the context of the future intervention, involving both children and teachers.

Considering the above, the aim of the present study was a preliminary context analysis in an Italian primary school of the small city of Jesi, through an investigation on:

(i) the eating habits and the lifestyle of the pupils, using a questionnaire addressed to the children;
(ii) the services and the current activities of the school in terms of obesity prevention and healthy lifestyle promotion, through a series of questions addressed to the teachers.

Methods

Setting and Participants

The setting of this study was a primary school in Jesi, a town with nearly 40,000 inhabitants in Le Marche Region (Central Italy).

The questionnaire investigating lifestyle and dietary habits was submitted by teachers between May and June 2023 to 104 children aged 6–11, belonging to the five different classes of the primary school system (first, second, third, fourth, and fifth class). The study followed the international ethical recommendations contained in the Declaration of Helsinki and was approved by the ethics committee of Le Marche Region (CERM-2018 64 F99-F99). After obtaining

the approval from the school headmaster, a form for the informed consent was sent to the parents of the children involved in this study.

A qualitative questionnaire exploring the school's infrastructures, services, and current activities in terms of obesity prevention and healthy lifestyle promotion was also filled out by the same teachers (n = 5) who were present while the children were filling out the eating/lifestyle questionnaire.

Study questionnaires

Eating and lifestyle habits of the children

In this study, pupils' lifestyles and dietary habits were explored through an adaptation of the questionnaire used in *Okkio alla Salute* (16). Specifically, the questionnaire consisted of three sections (Supplementary Tab. S1):

1) In the first section, children were asked to fill in questions about their weight, height, and which class of primary school they attended;
2) The second section investigated the eating habits of the pupils through a series of yes/no questions (*i.e.*, *Do you usually have breakfast before school?*; *Do you usually eat sweet snacks?*; *Do you usually eat fruit and vegetables?*; *Have you ever been to a fast-food restaurant?)* and multiple-choice items (*i.e.*, *What do you usually have for breakfast?; What do you usually have during recess;? How many times a week do you eat fruit and vegetables?; Which drink do you usually have more frequently?; How often do you go to a fast-food restaurant?*);
3) The third section explored the lifestyle habits of the children through a series of yes/no questions (*i.e.*, *Do you practise any sports?; Do you attend physical education courses at school?; Do you usually watch TV in your bedroom?; Do you usually play videogames?; Do you use or play with a smartphone?)* and multiple-choice questions (*i.e.*, *How do you go to school?; Which sport do you do?; How many times a week do you practise sports?; How many hours a week do you practise physical activity at school?; How many hours a day do you usually watch TV?; How many hours a day do you usually play videogames?; While eating, do you usually watch TV or play with a tablet / smartphone?*).

When needed, pupils attending the First Class (6–7 years old) were guided by the teachers in filling out the questionnaire. Children attending the other classes filled out the questionnaire autonomously, without any kind of teacher intervention.

Health-related services and activities of the school

Teachers who were present when children were filling out the questionnaire answered a series of questions about health-related services/activities of the school. Five items were structured as yes/no questions, whereas five other items were submitted as open-ended questions. The survey was structured as a written interview, and information was subsequently collected by the researchers using a pre-set scheme (Supplementary Tab. S2).

Statistical analysis

Answers to the questionnaire filled out by the pupils were collected and transferred onto a Microsoft Excel® (Redmond, WA, USA) document. Categorical variables were described using frequencies and percentages. The Fisher's exact test was performed to assess differences between each class (the First Class was chosen as a reference). The level of statistical significance was set at $p < .05$.

GraphPad Prism (GraphPad Software, Inc., San Diego, CA, USA) was used as the graphing software.

Results

Eating and lifestyle habits of the children

One hundred and three children (58 boys and 45 girls) out of 104 have filled out the questionnaire (Tab. 1).

Data concerning weight and height have not been reported, as 74 children (76.2%) did not complete this section, or gave unrealistic values. Results concerning children's eating habits are shown in Tab. 2.

Most children (96.1%) have breakfast before school, with milk and cereal (51.5%) representing the preferred combination. Also, fruit juice and biscuits, and bread and chocolate cream represent widespread food choices for breakfast. During recess 59.2% of the pupils usually have a sandwich, 23.3% usually have sweet snacks, whereas only 2.9% have fruit. Sweet snacks are widely consumed among children (43.7%), whereas a daily-like intake of fruit and vegetables was declared by 36.9% of the sample. Nearly one child out of ten never eats fruit and vegetables (8.7%). When considering classes separately, results showed that in the Second Class, more than one child out of four (26.3%) never eats fruit and vegetables (13.3%) or eats them only once a week (13.3%) (Fig. 1 and Supplementary Tab. S3). In this class,

Table 1. The number (n) of pupils (n = 103) who filled out the questionnaire was classified according to the class they attended (M = males; F = females).

Class	M (n)	F (n)	Total (n)
First Class (children aged 6–7)	8	11	19
Second Class (children aged 7–8)	10	5	15
Third Class (children aged 8–9)	12	10	22
Fourth Class (children aged 9–10)	14	9	23
Fifth Class (children aged 10–11)	14	10	24
Total	58	45	103

Table 2. Dietary habits of the 103 primary school children involved in this study. Results are expressed as number (n) and percentage (%) (M = males; F = females).

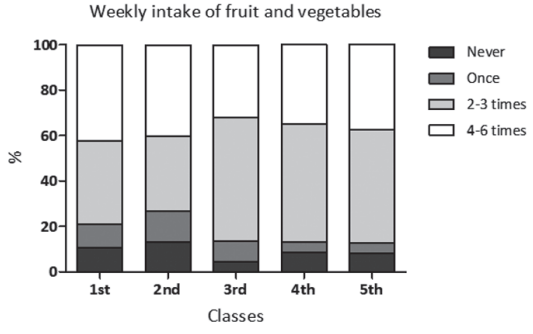
	M (n)	F (n)	Total (n)	Total (%)
Do you usually have breakfast before school?				
Yes	56	43	99	96.1
No	2	2	4	3.9
What do you usually have for breakfast?				
Milk and cereal	29	24	53	51.5
Fruit juice and biscuits	8	4	12	11.7
Yoghurt and fruit	2	2	4	3.9
Rusks and jam	4	3	7	6.8
Bread and chocolate cream	10	4	14	13.6
Other	3	6	9	8.7
I don't have breakfast	2	2	4	3.9
What do you usually have during recess?				
Sandwich	34	27	61	59.2
Sweet snacks	16	8	24	23.3
Fruit	2	1	3	2.9
Yoghurt	0	0	0	0.0
Fruit juice	0	0	0	0.0
Biscuits	3	2	5	4.9
Carbonated sugar-sweetened beverages	0	0	0	0.0
Water	1	0	1	1.0
Other	2	7	9	8.7
Do you usually eat sweet snacks?				
Yes	29	16	45	43.7
No	29	29	58	56.3
Do you usually eat fruit and vegetables?				
Yes	53	41	94	91.3
No	5	4	9	8.7

How many times a week do you eat fruit and vegetables?				
Never	4	5	9	8.7
Once a week	7	1	8	7.8
Twice-three times a week	28	20	48	46.6
Four-six times a week	19	19	38	36.9
Which drink do you usually have more frequently?				
Coke	18	7	25	24.3
Fruit juice	15	9	24	23.3
Orange Soda	5	3	8	7.8
Water	20	26	46	44.7
Have you ever been to a fast-food restaurant?				
Yes	46	40	86	83.5
No	12	5	17	16.5
How often do you go to a fast-food restaurant?				
Never	12	5	17	16.5
Less than once or once a week	36	34	70	68.0
More than once a week	10	6	16	15.5

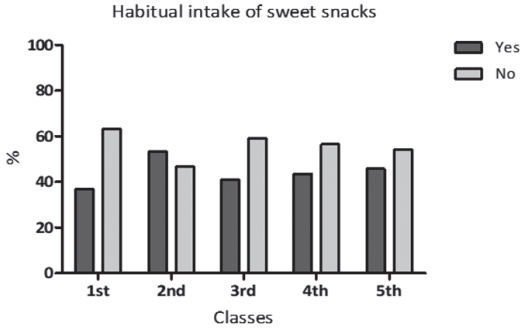
we also recorded the highest percentage of children eating sweet snacks regularly (53.3%) (Fig. 2 and Supplementary Tab. S4). The highest prevalence of pupils eating fruit and vegetables with a daily-like frequency, as well as the lowest prevalence of sweet snacks intake, was recorded in the First Class (42.1% and 36.8%, respectively).

Water represents the most consumed drink among children (44.7%). Over 55% of the sample prefer drinking high-sugar beverages like Coke, fruit juice, or Orange Soda. More than 80% of the children have already been to a fast-food restaurant at least once in their life, with 15.5% of the sample declaring to go there more than once a week. The highest percentage

Figures 1-2. [1] Frequency (%) of the children's weekly intake of fruit and vegetables grouped according to the attended class; [2] Frequency (%) of the children who habitually eat sweet snacks, grouped according to the attended class.



1



2

of fast-food clients (90.9%) was recorded in the Third Class (Fig. 3 and Supplementary Tab. S5).

Results concerning children's lifestyle habits are shown in Tab. 3.

Over 90% of the children involved in this study practise sports during the week. In the Third Class, all the pupils stated that they practise sport ($p < .05$; reference = First Class). In the Fourth and Fifth Class, over 95% of the pupils practised sport ($p < .05$; reference = First Class), whereas, in the First Class, only 63.2% did it (Supplementary Tab. S6). Except for the First Class (pupils aged 6–7) where 31.6% of children do not practise any sports (*i.e.*, the highest

Figure 3. Frequency (%) of the children who have already been to a fast-food restaurant at least once in their life.

Table 3. Lifestyle habits of primary school children involved in this study. Results are expressed as number (n) and percentage (%) (M = males; F = females).

	M (n)	F (n)	Total (n)	Total (%)
How do you go to school?				
By car or school bus	40	35	75	72.8
By bike	0	0	0	0.0
Walking	18	10	28	27.2
Do you practise any sports?				
Yes	51	43	94	91.3
No	7	2	9	8.7
Which sport do you practise?				
I don't practise any sports	7	2	9	8.7
Football/Soccer	20	0	20	19.4
Volleyball	2	3	5	4.9
Swimming	8	9	17	16.5
Gymnastics	2	22	24	23.3
Other sport(s)	19	9	28	27.2
How many times a week do you practise sports?				
I don't practise any sports	7	2	9	8.7
Once a week	5	4	9	8.7
Twice-three times a week	37	38	75	72.8
More than three times a week	9	1	10	9.7
Do you attend physical education courses at school?				
Yes	56	43	99	96.1
No	2	2	4	3.9

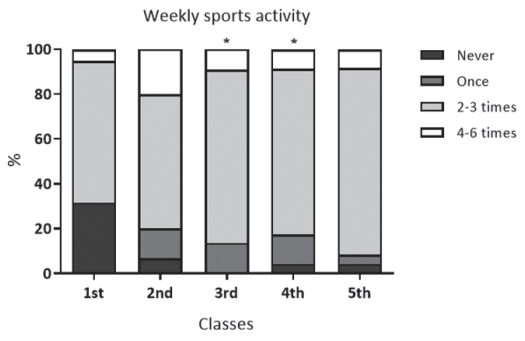
How many hours a week do you do physical activity at school?				
I don't do physical activity at school	2	2	4	3.9
One hour	56	43	99	96.1
Two hours	0	0	0	0.0
How many hours a day do you usually watch TV?				
One-two hours	41	40	81	78.6
More than two hours	17	5	22	21.4
Do you usually watch TV in your bedroom?				
Yes	21	15	36	35.0
No	37	30	67	65.0
Do you usually play videogames?				
Yes	50	16	66	64.1
No	8	29	37	35.9
How many hours a day do you usually play videogames?				
I don't play videogames	8	29	37	35.9
One-two hours	38	13	51	49.5
More than two hours	12	3	15	14.6
Do you use or play with a smartphone?				
Yes	26	23	49	47.6
No	32	22	54	52.4
While eating, do you usually watch TV or play with a tablet/smartphone?				
Never	14	9	23	22.3
Sometimes	29	25	54	52.4
Always	15	11	26	25.2

frequency recorded), in the other classes most of the children practise sports twice or three times a week, with values ranging from 60.0% (Second Class) to 84.0% (Fifth Class) (Fig. 4 and Supplementary Tab. S7). Remarkably, 17.4% of children practise sport once a week or less often. Physical education courses at school (1 hour/week) are attended by 96.1% of the children.

When considering screen exposure, data show that 35% of pupils have a TV set in their bedroom, and 21.4% of them watch TV more than two hours a day, with the highest percentages recorded in the Second Class (33.3%) and in the Fifth Class (29.2%) (Fig. 5 and Supplementary Tab. S8). Almost two-thirds

Figure 4. Frequency (%) of the children's weekly sports activity, grouped according to the class attended

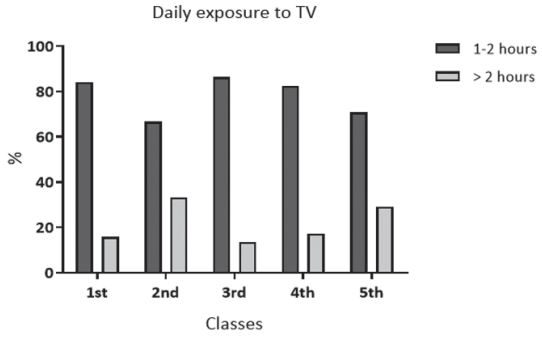
* Fisher's exact test, $p < .05$ (reference = First Class)



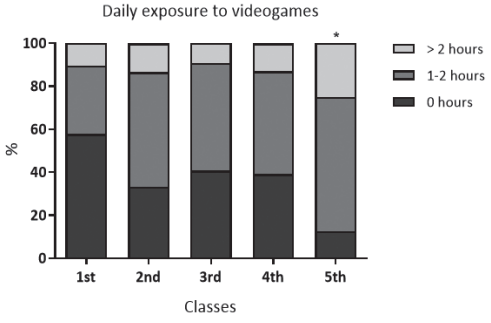
(64.1%) of the children regularly play videogames. The highest percentages were recorded in the Fifth Class, where 62.5% of pupils play videogames for 1-2 hours a day, and 25.0% do it for more than two hours a day ($p < .05$; reference = First Class) (Fig. 6 and Supplementary Tab. S9). Higher frequencies of prolonged TV viewing and videgames playing were observed among males. Finally, almost half of the children regularly use a smartphone (47.6%), and more than three-fourths of the samples (77.6%) watch TV or play with a tablet/smartphone while eating (sometimes: 52.4%; always: 25.2%).

Figures 5-6. [5] Frequency (%) of the children's daily exposure to TV, grouped according to the class attended [6]. Frequency (%) of the children's daily exposure to videogames, grouped according to the class attended

* Fisher's exact test, $p < .05$ (reference = First Class)



5



6

Health-related services and activities of the school

The services and the current activities of the school in terms of obesity prevention and healthy lifestyle promotion were also investigated through a written survey submitted to the teachers.

All the teachers answered that they were aware of a nationwide governmental project named "*Frutta e Verdura nelle Scuole*" ("Fruit and vegetables at school", http://www.fruttanellescuole.gov.it/home), which consists in a series of initiatives aimed at encouraging schoolchildren to eat more fruit and vegetables (*e.g.*, distribution of fruit along with explanations of health benefits, distribution of portions of fruit to take home, etc.). The school initially joined the project but did not participate during that specific school year.

Furthermore, all the teachers answered that, as far as they knew, there were no active health-related projects addressed to primary school pupils, and the school did not adopt any specific strategy to fight paediatric age overweight and obesity.

When asked about the presence of a school canteen, the teachers stated that they did not use it, as the interviewed classes only had lessons in the morning. They highlighted that there is a canteen in another complex belonging to the same school, which hosts the full-time school curriculum (lessons both in the morning and in the afternoon). They also knew that the school canteen service was managed by the local health authority, so they supposed that a health specialist planned the weekly menu.

About physical education courses, the teachers answered that the courses consisted in one hour of physical activity a week, during which children practise various kinds of sports – including indoor activity, thanks to the presence of a gym. Specifically, in the First Class, lessons are focused on psychomotricity methods.

Finally, teachers declared that, as far as they knew, the school did not organize meetings with health professionals to increase pupils' and their parents' knowledge and awareness about healthy eating habits, paediatric overweight and obesity topics.

Discussion

Fighting paediatric obesity is nowadays a major matter of public health urgency worldwide (17). Several programs have been implemented over the years (18) and, in most cases, primary schools were

chosen as ideal social settings for health-related projects addressed to the children. To plan successful activities, it is necessary preliminarily to analyze the context of the intervention, involving children and teachers. In this context, our study aimed to conduct a preliminary investigation on the eating habits and lifestyle in primary school pupils, as well as on the services and the activities of the school in terms of preventing obesity and promoting healthy lifestyles.

One of the most remarkable observations we made concerns the weight and height data: more than three-quarters of the children did not complete this section, or gave unrealistic values. This unequivocally indicates that the children interviewed are largely unaware of their weight and height. It is crucial to consider education programs to raise body weight awareness both in children and parents. A scarce or null self-perception of weight in children is probably a reflection of poor family communication, inappropriate knowledge/awareness about the issue, and parental misperception of children's weight. Parental awareness of overweight in their children is an essential first step in obesity prevention. However, Italian data suggest that 52% of overweight children and 14% of obese children are perceived by their mothers as normalweight. In Central Italy, only 39.3% of overweight/obese children are correctly perceived by their mothers (12). Results from a large transcontinental study showed that maternal misperception rates were highly variable across countries, but – on average – mothers classified 89% of overweight children and 52% of obese children as normalweight (19). Another study showed that mothers were more aware of overweight when their children were 16 years old rather than when they were 7, making primary school children potentially more vulnerable than adolescents to maternal misperception (20).

When considering eating habits, our results showed that most of the children usually had breakfast before school, and all of them ate something during recess. However, children's preferences focused on unhealthy choices, with only 6.8% and 2.9% having fruit at breakfast and recess, respectively. The quality of breakfast is a topic that should be monitored, as a balanced breakfast has been associated with a lower prevalence of obesity in Italian schoolchildren (12).

More than four children out of ten (43.7%) declared that they ate sweet snacks during the day, with the highest percentage (53.3%) recorded in the Second Class. These data are in line with *Okkio alla Salute*, which recorded that 45.3% of schoolchildren in Le Marche Region used to eat sweet snacks more than three times a week (12). Furthermore, over 55% of the children declared to regularly drink high-sugar beverages like Coke (24.3%), fruit juice (23.3), and Orange Soda (7.8%) in place of water. These data highlighted a more alarming scenario compared with that shown by *Okkio alla Salute*, where only 11.8% of the children were reported to drink sugar-sweetened beverages for more than three days a week (12). Taken together, these habits show that most of the pupils tend to exceed the benchmark levels of daily free sugars intake recommended by the WHO. In addition to the general recommendation to reduce the intake of free sugars throughout life, the WHO strongly recommends reducing the intake of free sugars to less than 10% of total energetic intake, also suggesting a further reduction to less than 5% (21). Additionally, more than 80% of the children declared that they had already been to a fast-food restaurant at least once in their life, with 15.5% of the sample stating that they go to these kinds of restaurants more than once a week. This is quite remarkable, as a recent meta-analysis has shown that a higher intake of sugar-sweetened beverages (OR = 1.20, 95% CI [1.09–1.33]) and fast food (OR = 1.17, 95% CI [1.07–1.28]) were identified as significant dietary risk factors for overweight and obesity in children and adolescents (22). According to the Centers for Disease Control and Prevention of the Federal US Government, being overweight is one of the most relevant risk factors for developing type 2 diabetes (23). Although type 2 diabetes is still more commonly diagnosed in adults, in the last decades the prevalence in children is alarmingly increasing in parallel with the increasing childhood obesity (24). Given the overwhelming financial burden of this disease ($ 412.9 billion in 2022 in the USA) (25) and the necessity and importance of setting up multidisciplinary strategies for the clinical and healthcare management and support that goes beyond the conventional approach (*e.g*, Lifestyle Medicine, Case Management, etc.) (26–31), it's quite clear that primary prevention must be pursued from an early age. Moreover, an *in vitro* study showed that high concentrations of glucose create unfavourable cellular conditions for the maintenance of genome integrity (32), which is in turn implicated in the aetiology of cancer and other diseases (33).

Given that most of such wrong habits arise outside school – *e.g.,* no child said that they drink sugar-sweetened beverages during recess – it would be extremely important to involve parents in meetings/activities with health professionals to suggest some potentially successful strategies. Indeed, parents have

a key role in the determination of the food preferences of their children (34), but some common-sense parental strategies are often counterproductive (35). Given that Southern Italy was considered by the UNESCO, along with Greece, Spain, Morocco, Croatia, Cyprus and Portugal, the cradle of the *Mediterranean Diet* (36), parents should be instructed to educate their children to follow the Mediterranean Diet, intended as a healthy lifestyle which includes, among others, the intake of plant-based and low-sugar seasonal food products. Children should also be led on to the consumption of local (*i.e.*, Central Italy) plant-based products, some of which have been shown to possess interesting properties (37–40).

Another way to indirectly induce positive changes in pupils' food choices is to implement nutrition education programs for teachers and to create a team of teachers with solid nutrition education skills. As suggested by other works, in addition to the development of teachers' knowledge and to a potential direct effect on their health, nutrition training for teachers can also lead to positive changes in pupils' eating habits (41, 42). Therefore, teachers' nutrition education should be considered as a part of broader efforts to improve the health of schoolchildren.

Almost three-quarters of the pupils went to school by car or school bus. Rather than a matter of sedentary attitude, these results might be mainly linked to the hilly nature of that territory and to the lack of a widespread system of cycle lanes/tracks and footpaths. In the absence of such infrastructures, this behaviour sounds reasonable and understandable. A structural intervention by the local authorities, accompanied by a focused awareness campaign may help to reverse this attitude.

Only 8.7% (n = 9/103) do not practise any sports. Most of them (n = 6) are 6–7 years old and attend the First Class, suggesting that this specific population may be more vulnerable than the other ones. Parents should be involved in meetings to raise their awareness of the importance of physical activity, active playing, and dancing at this stage of development. Moreover, the school should follow the WHO tips, trying to create opportunities for physical activity during recess and lunchtime, and trying to incorporate physical activity into classrooms (43). Clearly, through a whole-of-school approach, pupils from all classes will benefit from these initiatives. The school headmaster should also consider extending the time dedicated to physical activity from one to two hours a week. According to *Okkio alla Salute* (12), in Le Marche Region, only 43.8% of schools planned two hours a week of physical activity for their pupils. This is a common issue that should likewise be faced in other Regions in Central Italy (Lazio: 38.7%; Umbria: 29.7%), which are below the mean Italian value (52.9%).

This survey also investigated children's exposure to interactive screens. In particular, more than one child out of five watched TV more than two hours a day, whereas 14.6% played videogames for more than two hours a day. Although average data are less alarming than those reported in *Okkio alla Salute* for Central Italy (43.8% of children spend more than two hours a day in front of the TV or play videogames) (12), in some classes these behaviours were more marked than in others, defining different scenarios. Particularly, in the Fifth Class we recorded the second-highest percentage of children watching TV for more than two hours a day. In the same Class, 62.5% of pupils usually played videogames for 1-2 hours a day, and 25.0% did it for more than two hours a day, suggesting a higher screen exposure in this specific class age ($p < .05$; reference = First Class).

Finally, almost half of the children consistently used a smartphone (47.6%), and more than three-fourths of the sample (77.6%) normally watched TV or played with a tablet/smartphone while eating. This is quite remarkable, as these behaviours undermine conviviality and social interactions during meals, which are basic cornerstones of the Mediterranean Diet (44–46). Excessive smartphone use should be monitored starting from an early age, as mobile phone addiction is an alarming fact among children, adolescents, and university students (47, 48). Given that daily screen exposure seems to be an unavoidable and, sometimes, necessary part of everyday life, developing specific mobile apps may become an important channel for education and a bright strategy for health-promoting interventions. Generally, educational apps have been shown to reduce the cognitive load on learners through effective concepts and contents with a faster flow of information (49–51). Brilliant strategies may lie in the implementation of web-based Community-based participatory research (CBPR) and integrated knowledge translation approaches. These approaches emphasise the importance of creating partnerships between researchers and the people for whom the research is ultimately meant to be of use, intending to achieve social change to improve health outcomes (52). CBPR have been carried out in several populations (53, 54), including children (55), and fit well also as research models to encourage parental engagement and involvement in their children's education (56). Previously published examples of

web-based CBPR have been shown to successfully engage and involve the knowledge users (57–61), thus integrating research findings into the community, and suggesting that this strategy may also be pursued in children, their parents, and teachers.

In this regard, researchers should take their cue from programs and research experiences implemented in other European countries (*e.g.*, Finland and the UK) where the current attentiveness on health-related programs aimed at fighting childhood obesity is far higher than in Italy (18).

An intriguing future research line may also lie in the integration of the above-mentioned reasoning within biomonitoring studies intended to assess the association between environmental exposures (*e.g.*, particulate matters and other air pollutants) and individual factors and biomarkers of early biological effect in children (62–64) using non-invasive sampling procedures (65).

Finally, the teachers' survey highlighted that there were no active health-related projects addressed to the pupils, and the school did not normally organise meetings with health professionals to increase the children's and their parents' knowledge/awareness about healthy eating habits. However, the school canteen (although in another complex) and the gym represent essential facilities for the implementation of a wide range of health-related projects.

This study has some weaknesses. Firstly, the consumption of energy drinks, which represents an alarming trend among children (66, 67), was not investigated. As this behaviour has been observed not only in older children, adolescents and young adults (68, 69), the assessment of this kind of beverage intake in younger children might also be considered in future studies. Secondly, the small sample does not allow us to generalise our findings. However, as this research was intended to retrieve information to optimise resources and increase efficiency to plan successful activities, we believe that the data we have collected represent a solid ground for future health-based projects.

Conclusion

In summary, this preliminary investigation highlighted the critical issues and analysed the context for a future health/nutrition education intervention. We highlighted some remarkable differences among the different classes involved (*e.g.*, videogames exposure), indicating that, for some particular health and lifestyle goals, specific interventions in each class would be more appropriate than a wide and general health-related school project. In other cases (*e.g.*, promotion of physical activity), a whole-of-school approach might ensure benefits for pupils from all classes. The collected information also suggests that setting up a team of teachers with solid nutrition education skills might help in this purpose.

To sum up, this work will assist researchers in planning successful and precise activities, optimising resources and increasing the efficiency of the intervention.

Acknowledgements

This work has been funded by the European Union – NextGenerationEU under the Italian Ministry of University and Research (MUR) National Innovation Ecosystem grant ECS00000041 - VITALITY - CUP J13C22000430001.

The authors would like to thank Adjunct Professor Chiara Severini (University of Macerata) for her essential support to language editing.

The authors would also like to thank all the teachers involved in this study.

Riassunto

Abitudini alimentari, stili di vita e programmi di promozione della salute nella scuola primaria: un'indagine su bambini e insegnanti italiani

Introduzione. Il sovrappeso e l'obesità infantile rappresentano un grave problema di sanità pubblica in molti stati nel mondo, inclusa l'Italia, dove è stata registrata la più alta prevalenza europea di bambini sovrappeso e obesi a livello di scuola primaria. La scuola primaria rappresenta un ambiente ideale per progetti di educazione sanitaria. In questa prospettiva, con lo scopo di ottimizzare le risorse e pianificare attività mirate che abbiano successo, è necessario analizzare preliminarmente il contesto dell'intervento.

Disegno dello studio. Un'indagine preliminare è stata condotta in una scuola primaria di Jesi (Regione Marche, Italia).

Metodi. Un questionario è stato somministrato dalle insegnanti tra maggio e giugno 2023 a 104 bambini (età compresa tra 6 e 11 anni) frequentanti 5 diverse classi della scuola primaria (prima, seconda, terza, quarta, quinta). Inoltre, un questionario qualitativo è stato compilato dalle stesse insegnanti (n = 5) che erano presenti in classe mentre i bambini compilavano il questionario relativo alle abitudini alimentari e allo stile di vita.

Risultati. La maggior parte dei bambini (96.1%) fa colazione prima di recarsi a scuola, perlopiù con latte e cereali (51.5%). Durante la ricreazione, il 59.2% dei bambini di solito mangia un panino, il 23.3% merendine, mentre solo il 2.9% consuma frutta. Oltre il 55% del campione preferisce bere bevande zuccherate al posto dell acqua, e il 15.5% dichiara di frequentare ristoranti fast food più di una volta a settimana. Oltre il 17% dei bambini pratica sport soltanto una volta a settimana, o meno spesso. Oltre il 64% dei bambini gioca abitualmente ai videogiochi, e il 77.6%, durante i pasti, guarda la televisione o gioca con il tablet o con lo smartpho-

ne. Infine, le interviste alle insegnanti hanno evidenziano che, al momento dell'intervista, non vi era alcun progetto di promozione della salute attivo rivolto ai bambini, e che la scuola, generalmente, non organizza incontri con professionisti sanitari per accrescere, sia nei bambini, che nei genitori, la loro conoscenza e consapevolezza riguardo la sana alimentazione.

Conclusioni. Questa indagine preliminare ha analizzato il contesto per un futuro progetto di educazione sanitaria e nutrizionale e agevolerà i ricercatori nella pianificazione di attività di successo e nell'aumentare l'efficienza dell'intervento.

References

1. World Health Organization (WHO). Noncommunicable diseases: Childhood overweight and obesity. Available from: https://www.who.int/news-room/questions-and-answers/item/noncommunicable-diseases-childhood-overweight-and-obesity [Last accessed: 2023 Dec 12].
2. Ricci G, Tomassoni D, Pirillo I, Sirignano A, Sciotti M, Zaami S, et al. Obesity in the European region: social aspects, epidemiology and preventive strategies. Eur Rev Med Pharmacol Sci. 2018 Oct;**22**(20):6930-6939. doi: 10.26355/eurrev_201810_16163.
3. Bleich SN, Vercammen KA, Zatz LY, Frelier JM, Ebbeling CB, Peeters A. Interventions to prevent global childhood overweight and obesity: a systematic review. Lancet Diabetes Endocrinol. 2018 Apr;**6**(4):332-346. doi: 10.1016/S2213-8587(17)30358-3. Epub 2017 Oct 20.
4. Sutaria S, Devakumar D, Yasuda SS, Das S, Saxena S. Is obesity associated with depression in children? Systematic review and meta-analysis. Arch Dis Child. 2019 Jan;**104**(1):64-74. doi: 10.1136/archdischild-2017-314608. Epub 2018 Jun 29.
5. Centers for Disease Control and Prevention (CDC). Causes and Consequences of Childhood Obesity Available from: https://www.cdc.gov/obesity/basics/causes.html [Last accessed: 2023 Dec 12].
6. Organisation for Economic Co-operation and Development (OECD). Exploring the Relationship Between Education and Obesity. Available from: https://read.oecd-ilibrary.org/economics/exploring-the-relationship-between-education-and-obesity_eco_studies-2011-5kg5825v1k23 [Last accessed: 2023 Dec 12].
7. UNICEF Latin America and Caribbean. The role of schools in preventing overweight and obesity among students. Available from: https://www.unicef.org/lac/en/reports/role-of-schools-in-preventing-overweight-and-obesity-among-students. [Last accessed: 2023 Dec 12].
8. Centers for Disease Control and Prevention (CDC). Promoting Healthy Behaviors - CDC Healthy Schools. Available from: https://www.cdc.gov/healthyschools/healthybehaviors.htm [Last accessed: 2023 Dec 12].
9. The Lancet Public Health. Education: a neglected social determinant of health. Lancet Public Health. 2020 Jul;**5**(7):e361. doi: 10.1016/S2468-2667(20)30144-4.
10. World Health Organization (WHO). WHO European Regional Obesity Report 2022. Available from: https://apps.who.int/iris/bitstream/handle/10665/353747/9789289057738-eng.pdf [Last accessed: 2023 Dec 12].
11. Archero F, Ricotti R, Solito A, Carrera D, Civello F, Di Bella R, et al. Adherence to the Mediterranean Diet among School Children and Adolescents Living in Northern Italy and Unhealthy Food Behaviors Associated to Overweight. Nutrients. 2018 Sep 18;**10**(9):1322. doi: 10.3390/nu10091322.
12. Istituto Superiore di Sanità (ISS). Childhood obesity and lifestyle: OKkio alla SALUTE 2019. Available from: https://www.iss.it/documents/20126/6682486/22-27+web.pdf/659d3d23-9236-e3ff-fbbf-0-e06360e3e71?t=1670838825602 [Last accessed: 2023 Dec 12].
13. Robinson TN, Banda JA, Hale L, Lu AS, Fleming-Milici F, Calvert SL, Wartella E. Screen Media Exposure and Obesity in Children and Adolescents. Pediatrics. 2017 Nov;**140**(Suppl 2):S97-S101. doi: 10.1542/peds.2016-1758K.
14. World Health Organization (WHO). First International Conference on Health Promotion, Ottawa, 21 November 1986. Available from: https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference [Last accessed: 2023 Dec 12].
15. Alexander M. Survey, Surveillance, Monitoring and Recording. In: Management Planning for Nature Conservation: A Theoretical Basis & Practical Guide. Dordrecht: Springer Netherlands; 2008. Available from: https://doi.org/10.1007/978-1-4020-6581-1_5 [Last accessed: 2023 Dec 12].
16. Istituto Superiore di Sanità (ISS). OKkio alla salute. Available from: https://www.epicentro.iss.it/okkioallasalute/ [Last accessed: 2023 Dec 12].
17. Nittari G, Scuri S, Sagaro GG, Petrelli F, Grappasonni I. Epidemiology of Obesity in Children and Adolescents. Teamwork in Healthcare. IntechOpen; 2021. Available from: https://ideas.repec.org//h/ito/pchaps/214688.html [Last accessed: 2023 Dec 12].
18. Nittari G, Scuri S, Petrelli F, Pirillo I, di Luca NM, Grappasonni I. Fighting obesity in children from European World Health Organization member states. Epidemiological data, medical-social aspects, and prevention programs. Clin Ter. 2019 May-Jun;**170**(3):e223-e230. doi: 10.7417/CT.2019.2137.
19. Gregori D, Hochdorn A, Azzolina D, Berchialla P, Lorenzoni G; OBEY-AD Study Consortium. Does Love Really Make Mothers Blind? A Large Transcontinental Study on Mothers' Awareness About Their Children's Weight. Obesity (Silver Spring). 2018 Jul;**26**(7):1211-1224. doi: 10.1002/oby.22214.
20. Jeffery AN, Metcalf BS, Hosking J, Mostazir MB, Voss LD, Wilkin TJ. Awareness of body weight by mothers and their children: repeated measures in a single cohort (EarlyBird 64). Child Care Health Dev. 2015 May;**41**(3):434-42. doi: 10.1111/cch.12167. Epub 2014 Jun 10. Erratum in: Child Care Health Dev. 2015 Nov;41(6):1251.
21. World Health Organization (WHO). Executive summary. In: Guideline: Sugars Intake for Adults and Children. Available from: https://www.ncbi.nlm.nih.gov/books/NBK285538/

[Last accessed: 2023 Dec 12].
22. Jakobsen DD, Brader L, Bruun JM. Association between Food, Beverages and Overweight/Obesity in Children and Adolescents-A Systematic Review and Meta-Analysis of Observational Studies. Nutrients. 2023 Feb 2;**15**(3):764. doi: 10.3390/nu15030764.
23. Centers for Disease Control and Prevention (CDC). Diabetes Risk Factors. Available from: https://www.cdc.gov/diabetes/basics/risk-factors.html [Last accessed: 2023 Dec 12].
24. Valaiyapathi B, Gower B, Ashraf AP. Pathophysiology of Type 2 Diabetes in Children and Adolescents. Curr Diabetes Rev. 2020;16(3):220-229. doi: 10.2174/1573399814666180608074510.
25. Parker ED, Lin J, Mahoney T, Ume N, Yang G, Gabbay RA, et al. Economic Costs of Diabetes in the U.S. in 2022. Diabetes Care. 2023 Nov 1:dci230085. doi: 10.2337/dci23-0085. Epub ahead of print.
26. Cangelosi G, Grappasonni I, Pantanetti P, Scuri S, Garda G, Nguyen CTT, et al. Nurse Case Manager Lifestyle Medicine (NCMLM) in the Type Two Diabetes patient concerning post COVID-19 Pandemic management: Integrated-Scoping literature review. Ann Ig. 2022 Nov-Dec;**34**(6):585-602. doi: 10.7416/ai.2022.2500. Epub 2022 Feb 8.
27. Cangelosi G, Grappasonni I, Nguyen CTT, Acito M, Pantanetti P, Benni A, et al. Mediterranean Diet (MedDiet) and Lifestyle Medicine (LM) for support and care of patients with type II diabetes in the COVID-19 era: a cross-observational study. Acta Biomed. 2023 Aug 30;**94**(S3):e2023189. doi: 10.23750/abm.v94iS3.14406.
28. Petrelli F, Cangelosi G, Nittari G, Pantanetti P, Debernardi G, Scuri S, et al. Chronic Care Model in Italy: a narrative review of the literature. Prim Health Care Res Dev. 2021 Jan;22:e32. doi:10.1017/S1463423621000268.
29. D'Alleva A, Leigheb F, Rinaldi C, Di Stanislao F, Vanhaecht K, De Ridder D, et al. Achieving quadruple aim goals through clinical networks: A systematic review. J Healthc Qual Res. 2019 Jan-Feb;**34**(1):29-39. doi: 10.1016/j.jhqr.2018.10.010. Epub 2019 Feb 1.
30. Petrelli F, Cangelosi G, Scuri S, Nguyen CTT, Debernardi G, Benni A, et al. Conoscenze alimentari in pazienti afferenti ad un centro di diabetologia [Food knowledge of patients at the first access to a Diabetology center]. Acta Biomed. 2020 Apr 10;**91**(3-S):160-164. doi: 10.23750/abm.v91i3-S.9418.
31. Petrelli F, Cangelosi G, Scuri S, Pantanetti P, Lavorgna F, Faldetta F, et al. Diabetes and technology: A pilot study on the management of patients with insulin pumps during the COVID-19 pandemic. Diabetes Res Clin Pract. 2020 Nov;169:108481. doi: 10.1016/j.diabres.2020.108481. Epub 2020 Sep 28.
32. Acito M, Bartolini D, Ceccarini MR, Russo C, Vannini S, Dominici L, et al. Imbalance in the antioxidant defence system and pro-genotoxic status induced by high glucose concentrations: In vitro testing in human liver cells. Toxicol In Vitro. 2020 Dec;69:105001. doi: 10.1016/j.tiv.2020.105001.
33. Yan S, Zhao J, Kemp M, Sobol RW. Editorial: Mechanistic studies of genome integrity, environmental health, and cancer etiology. Front Cell Dev Biol. 2022 Sep 28;**10**:1026326. doi: 10.3389/fcell.2022.1026326.
34. Skinner JD, Carruth BR, Wendy B, Ziegler PJ. Children's food preferences: a longitudinal analysis. J Am Diet Assoc. 2002 Nov;**102**(11):1638-47. doi: 10.1016/s0002-8223-(02)90349-4.
35. Benton D. Role of parents in the determination of the food preferences of children and the development of obesity. Int J Obes Relat Metab Disord. 2004 Jul;**28**(7):858-69. doi: 10.1038/sj.ijo.0802532.
36. UNESCO. Decision of the Intergovernmental Committee 8.COM 8.10 for inscription of Mediterranean Diet on the Representative List of the Intangible Cultural Heritage of Humanity, Baku, 2013. Available from: https://ich.unesco.org/en/decisions/8.COM/8.10 [Last accessed: 2024 Jan 08].
37. Acito M, Fatigoni C, Villarini M, Moretti M. Effect of Cooking and Domestic Storage on the Antioxidant Activity of Lenticchia di Castelluccio di Norcia, an Italian PGI Lentil Landrace. Int J Environ Res Public Health. 2023 Jan 31;**20**(3):2585. doi: 10.3390/ijerph20032585.
38. Acito M, Palomba M, Fatigoni C, Villarini M, Sancineto L, Santi C, et al. Fagiolina del Trasimeno, an Italian cowpea landrace: effect of different cooking techniques and domestic storage on chemical and biological features. Int J Food Sci Technol. 2022;**57**(10):6557–71. doi.org/10.1111/ijfs.15998.
39. Sagratini G, Santini C, Caprioli G, Vittori S, Maggi F, Nzekoue AFK, et al. Chapter 8 - Typical plant-based food from a nutraceutical perspective: The case of the Marche region. In: Santini C, Supino S, Bailetti L, eds. Case Studies on the Business of Nutraceuticals, Functional and Super Foods. Elsevier; 2022: p. 145–60. doi.org/10.1016/B978-0-12-821408-4.00008-0.
40. Villarini M, Acito M, di Vito R, Vannini S, Dominici L, Fatigoni C, et al. Pro-Apoptotic Activity of Artichoke Leaf Extracts in Human HT-29 and RKO Colon Cancer Cells. Int J Environ Res Public Health. 2021 Apr 15;**18**(8):4166. doi: 10.3390/ijerph18084166.
41. Marconi S, Vezzoli M, Locatelli M, Bertolotti P, Zanini B, Valerio A. The role of primary school teachers' nutrition training in healthy eating promotion. Health Educ J. 2022 Aug 1;**81**(5):554–72. doi.org/10.1177/0017896922109371.
42. Roccaldo R, Censi L, D'Addezio L, Berni Canani S, Gennaro L. A teachers' training program accompanying the "School Fruit Scheme" fruit distribution improves children's adherence to the Mediterranean diet: an Italian trial. Int J Food Sci Nutr. 2017 Nov;**68**(7):887-900. doi: 10.1080/09637486.2017.1303826. Epub 2017 Mar 23.
43. World Health Organization (WHO). Promoting physical activity through schools: a toolkit. Available from: https://apps.who.int/iris/handle/10665/350836 [Last accessed: 2023 Dec 12].
44. D'Alessandro A, De Pergola G. Mediterranean diet pyramid: a proposal for Italian people. Nutrients. 2014 Oct 16;**6**(10):4302-16. doi: 10.3390/nu6104302.
45. Serra-Majem L, Tomaino L, Dernini S, Berry EM, Lairon D, Ngo de la Cruz J, et al. Updating the Mediterranean Diet

Pyramid towards Sustainability: Focus on Environmental Concerns. Int J Environ Res Public Health. 2020 Nov 25;**17**(23):8758. doi: 10.3390/ijerph17238758.
46. Moro E, Galletti R. Sharing Food and Conviviality in the Mediterranean Diet. Some Ethnographic Examples. In: Nobayashi A, editor. Making Food in Local and Global Contexts. Singapore: Springer Nature; 2022. p. 71–87. doi. org/10.1007/978-981-19-1048-7_5.
47. Sahu M, Gandhi S, Sharma MK. Mobile Phone Addiction Among Children and Adolescents: A Systematic Review. J Addict Nurs. 2019 Oct/Dec;**30**(4):261-268. doi: 10.1097/JAN.0000000000000309.
48. Perilli E, Necozione S, Bianchini V, Perazzini M, Grassi M, Americo A, et al. Mobile Phone Addiction and Mobile Phone Use in Dangerous Circumstances: Prevalence and Correlates in a Sample of Italian University Students. Mediterr J Clin Psychol. 2021 Aug; **9**(2). doi.org/10.13129/2282-1619/mjcp-3014.
49. Camilleri MA, Camilleri AC. Digital Learning Resources and Ubiquitous Technologies in Education. Technol Knowl Learn. 2017 Apr 1;**22**(1):65–82. doi.org/10.1007/s10758-016-9287-7.
50. Falloon G. Mobile Devices and Apps as Scaffolds to Science Learning in the Primary Classroom. J Sci Educ Technol. 2017 Dec 1;**26**(6):613–28. doi.org/10.1007/s10956-017-9702-4.
51. Zydney JM, Warner Z. Mobile apps for science learning: Review of research. Comput Educ. 2016 Mar 1;94:1–17. doi.org/10.1016/j.compedu.2015.11.001.
52. Jull J, Giles A, Graham ID. Community-based participatory research and integrated knowledge translation: advancing the co-creation of knowledge. Implement Sci. 2017 Dec 19;**12**(1):150. doi: 10.1186/s13012-017-0696-3.
53. Brush BL, Mentz G, Jensen M, Jacobs B, Saylor KM, Rowe Z, et al. Success in Long-Standing Community-Based Participatory Research (CBPR) Partnerships: A Scoping Literature Review. Health Educ Behav. 2020 Aug;**47**(4):556-568. doi: 10.1177/1090198119882989. Epub 2019 Oct 16.
54. Vaughn LM, Jacquez F, Lindquist-Grantz R, Parsons A, Melink K. Immigrants as Research Partners: A Review of Immigrants in Community-Based Participatory Research (CBPR). J Immigr Minor Health. 2017 Dec;**19**(6):1457-1468. doi: 10.1007/s10903-016-0474-3.
55. Vaughn LM, Wagner E, Jacquez F. A review of community-based participatory research in child health. MCN Am J Matern Child Nurs. 2013 Jan-Feb;**38**(1):48-53. doi: 10.1097/NMC.0b013e31826591a3.
56. Keller JG, Miller C, LasDulce C, Wohrle RG. Using a Community-Based Participatory Research Model to Encourage Parental Involvement in Their Children's Schools. Child Sch. 2021 Jul 1;**43**(3):149–58. doi.org/10.1093/cs/cdab015.
57. Acito M, Rondini T, Gargano G, Moretti M, Villarini M, Villarini A. How the COVID-19 pandemic has affected eating habits and physical activity in breast cancer survivors: the DianaWeb study. J Cancer Surviv. 2023 Aug;**17**(4):974-985. doi: 10.1007/s11764-022-01294-w. Epub 2022 Dec 13.
58. Natalucci V, Villarini M, Emili R, Acito M, Vallorani L, Barbieri E, et al. Special Attention to Physical Activity in Breast Cancer Patients during the First Wave of COVID-19 Pandemic in Italy: The DianaWeb Cohort. J Pers Med. 2021 May 6;**11**(5):381. doi: 10.3390/jpm11050381.
59. Gianfredi V, Nucci D, Balzarini M, Acito M, Moretti M, Villarini A, et al. E-Coaching: the DianaWeb study to prevent breast cancer recurrences. Clin Ter. 2020 Jan-Feb;**170**(1):e59-e65. doi: 10.7417/CT.2020.2190.
60. Acito M, Natalucci V, Rondini T, Gargano G, Emili R, Moretti M, et al. The DianaWeb cohort during the first COVID-19 lockdown: changes in eating behaviour in women with breast cancer. Acta Biomed. 2023 Aug 30;**94**(S3):e2023135. doi: 10.23750/abm.v94iS3.14285.
61. Villarini M, Acito M, Gianfredi V, Berrino F, Gargano G, Somaini M, et al. Validation of Self-Reported Anthropometric Measures and Body Mass Index in a Subcohort of the DianaWeb Population Study. Clin Breast Cancer. 2019 Aug;**19**(4):e511-e518. doi: 10.1016/j.clbc.2019.04.008. Epub 2019 Apr 18.
62. Acito M, Fatigoni C, Villarini M, Moretti M. Cytogenetic Effects in Children Exposed to Air Pollutants: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health. 2022 May 31;**19**(11):6736. doi: 10.3390/ijerph19116736.
63. Panico A, Grassi T, Bagordo F, Idolo A, Serio F, Tumolo MR, et al. Micronucleus Frequency in Exfoliated Buccal Cells of Children Living in an Industrialized Area of Apulia (Italy). Int J Environ Res Public Health. 2020 Feb 13;**17**(4):1208. doi: 10.3390/ijerph17041208.
64. Carducci A, Casini B, Donzelli G, Verani M, Bruni B, Ceretti E, et al. Improving awareness of health hazards associated with air pollution in primary school children: Design and test of didactic tools. Appl Environ Educ Commun. 2016 Jul 2;**15**(3):247–60. doi.org/10.1080/1533015X.2016.1181017.
65. Russo C, Acito M, Fatigoni C, Villarini M, Moretti M. B-Comet Assay (Comet Assay on Buccal Cells) for the Evaluation of Primary DNA Damage in Human Biomonitoring Studies. Int J Environ Res Public Health. 2020 Dec 10;**17**(24):9234. doi: 10.3390/ijerph17249234.
66. Girán J, Girán KA, Ormándlaky D, Pozsgai É, Kiss I, Kollányi Z. Determinants of pupils' energy drink consumption - Findings from a Hungarian primary school. Heliyon. 2023 May 3;**9**(5):e15954. doi: 10.1016/j.heliyon.2023.e15954.
67. Khouja C, Kneale D, Brunton G, Raine G, Stansfield C, Sowden A, et al. Consumption and effects of caffeinated energy drinks in young people: an overview of systematic reviews and secondary analysis of UK data to inform policy. BMJ Open. 2022 Feb 7;12(2):e047746. doi: 10.1136/bmjopen-2020-047746.
68. Mansour B, Amarah W, Nasralla E, Elias N. Energy drinks in children and adolescents: demographic data and immediate effects. Eur J Pediatr. 2019 May;**178**(5):649-656. doi: 10.1007/s00431-019-03342-7. Epub 2019 Feb 15.
69. Petrelli F, Grappasonni I, Evangelista D, Pompei P, Broglia G, Cioffi P, et al. Mental and physical effects of energy drinks consumption in an Italian young people group: a pilot study. J Prev Med Hyg. 2018 Mar 30;**59**(1):E80-E87. doi: 10.15167/2421-4248/jpmh2018.59.1.900.

Supplementary material

Supplementary Table S1. The questionnaire submitted to the primary school pupils involved in this study.

QUESTIONNAIRE
Sex □ Male □ Female **Please, indicate your weight: ……..** **Please, indicate your height: ……..** **Which Class do you attend?** □ First Class □ Second Class □ Third Class □ Fourth Class □ Fifth Class **Do you usually have breakfast before school?** □ Yes □ No **What do you usually have for breakfast?** □ Milk and cereal □ Fruit juice and biscuits □ Yoghurt and fruit □ Rusks and jam □ Bread and chocolate cream □ Other □ I don't have breakfast **What do you usually have during recess?** □ Sandwich □ Sweet snack □ Fruit □ Yoghurt □ Fruit juice □ Biscuits □ Carbonated sugar-sweetened beverages □ Water □ Other **Do you usually eat sweet snacks?** □ Yes □ No

Do you usually eat fruit and vegetables?

□ Yes

□ No

How many times a week do you eat fruit and vegetables?

□ Never

□ Once a week

□ Twice-three times a week

□ Four-six times a week

Which drink do you usually have more frequently?

□ Coke

□ Fruit juice

□ Orange Soda

□ Water

Have you ever been to a fast-food restaurant?

□ Yes

□ No

How often do you go to a fast-food restaurant?

□ Never

□ Less than once or once a week

□ More than once a week

How do you go to school?

□ By car or school bus

□ By bike

□ Walking

Do you practise any sports?

□ Yes

□ No

Which sport do you practise?

□ I don't practice any sports

□ Football/Soccer

□ Volleyball

□ Swimming

□ Gymnastics

□ Other sport(s)

How many times a week do you practise sports?

□ I don't practise any sports

□ Once a week

□ Twice-three times a week

□ More than three times a week

Do you attend physical education courses at school?

□ Yes

□ No

How many hours a week do you practise physical activity at school?

□ I don't do physical activity at school

□ One hour

□ Two hours

How many hours a day do you usually watch TV?

□ One-two hours

□ More than two hours

Do you usually watch TV in your bedroom?

□ Yes

□ No

Do you usually play videogames?

□ Yes

□ No

How many hours a day do you usually play videogames?

□ I don't play videogames

□ One-two hours

□ More than two hours

Do you use or play with a smartphone?

□ Yes

□ No

While eating, do you usually watch TV or play with a tablet/smartphone?

□ Never

□ Sometimes

□ Always

Supplementary Table S2. The pre-set scheme used for the teachers' written survey.

INTERVIEW
Do you know if there are any active National health-related programs/projects for primary schools, based on nutritional education to prevent paediatric overweight/obesity? Please, can you describe one of them? .... **In your school specifically, are there any active health-related programs/projects for primary schools, based on nutritional education to prevent paediatric overweight/obesity? Please, can you describe one of them?** .... **What does the school do to fight paediatric overweight/obesity?** .... **Is there a school canteen in this school?** □ Yes □ No **Is the menu of the school canteen planned by a health specialist (nutritionist, dietician, physician, etc.)?** □ Yes □ No **How are the physical education courses structured?** .... **How many hours of physical activity a week are included in the school curriculum?** .....

Is there a gym in this school?

□ Yes

□ No

Does the school usually organize meetings with health professionals to increase pupils' knowledge and awareness about healthy eating habits?

□ Yes

Please, describe it/them

.....

.....

.....

.....

□ No

Does the school usually organise meetings with health professionals to increase parents' knowledge and awareness about paediatric overweight/obesity topic?

□ Yes

Please, describe it/them

.....

.....

.....

.....

□ No

Supplementary Table S3. Frequency (%) of the children's weekly intake of fruit and vegetables, grouped according to the attended class.

	Never	Once a week	Twice-three times a week	Four-six times a week
First Class	10.5	10.5	36.8	42.1
Second Class	13.3	13.3	33.3	40.0
Third Class	4.5	9.1	54.5	31.8
Fourth Class	8.7	4.3	52.2	34.8
Fifth Class	8.3	4.2	50.0	37.5

Supplementary Table S4. Frequency (%) of the children who habitually eat sweet snacks, grouped according to the attended class.

	Yes	No
First Class	36.8	63.2
Second Class	53.3	46.7
Third Class	40.9	59.1
Fourth Class	43.5	56.5
Fifth Class	45.8	54.2

Supplementary Table S5. Frequency (%) of the children who have already been to a fast-food restaurant at least once in their life, grouped according to the attended class.

	Yes	No
First Class	78.9	21.1
Second Class	86.7	13.3
Third Class	90.9	9.1
Fourth Class	82.6	17.4
Fifth Class	79.2	20.8

Supplementary Table S6. Frequency (%) of the children who practise sports during the week, grouped according to the attended class.

	Yes	No
First Class	68.4	31.6
Second Class	93.3	6.7
Third Class *	100.0	0.0
Fourth Class *	95.7	4.3
Fifth Class *	95.8	4.2

* Fisher's exact test, $p < .05$ (reference = First Class)

Supplementary Table S7. Frequency (%) of the children's weekly sports activity, grouped according to the attended class.

	I don't do any sport	Once a week	Twice-three times a week	More than three times a week
First Class	31.6	0.0	63.2	5.3
Second Class	6.7	13.3	60.0	20.0
Third Class *	0.0	13.6	77.3	9.1
Fourth Class *	4.3	13.0	73.9	8.7
Fifth Class	4.2	4.2	83.3	8.3

* Fisher's exact test, $p < .05$ (reference = First Class)

Supplementary Table S8. Frequency (%) of the children's daily exposure to TV, grouped according to the attended class.

	One-two hours	More than two hours
First Class	84.2	15.8
Second Class	66.7	33.3
Third Class	86.4	13.6
Fourth Class	82.6	17.4
Fifth Class	70.8	29.2

Supplementary Table S9. Frequency (%) of the children's daily exposure to videogames, grouped according to the attended class.

	I don't play videogames	One-two hours	More than two hours
First Class	57.9	31.6	10.5
Second Class	33.3	53.3	13.3
Third Class	40.9	50.0	9.1
Fourth Class	39.1	47.8	13.0
Fifth Class *	12.5	62.5	25.0

* Fisher's exact test, $p < .05$ (reference = First Class)

Corresponding author: Prof. Iolanda Grappasonni, School of Medicinal and Health Products Sciences, University of Camerino, Via Madonna delle Carceri 9, 62032 Camerino, Italy.
e-mail: iolanda.grappasonni@unicam.it_