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Improving knowledge and behaviors on diet and physical activity in children: results of a pilot randomized field trial

G. La Torre[1], A. Mannocci , R. Saulle[1], A. Sinopoli[1], V. D'Egidio[1], C. Sestili[1], R. Manfuso[1], D. Masala[2]

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Parole chiave: Conoscenze, comportamenti, dieta, attività fisica, bambini, trial di campo randomizzato

Abstract

Background. *The aim of this study was to increase the knowledge of healthy eating, to encourage change in nutritional behavior in accordance with the Mediterranean diet and to promote physical activity in children aged 7 to 9 years and their parents in a school setting through the use of cards and board games of the project Giochiamo (Let us play).*
Methods. *This experimental randomized field trial enrolled children in a school setting. The trial consisted of two phases. The first phase, including both intervention and control groups, encompassed a informative session about the food pyramid and physical activity (PA) by experts of public health and preventive medicine. The second phase, including only the experimental groups, involved games focusing on the main concepts of the food pyramid and PA. A questionnaire was administered before the intervention and after one month in order to assess changing in knowledge and behavior scores.*
Results. *Eighty-nine children were randomly allocated in the intervention (22 children of the fourth year, 22 children of the second year) and the control group (23 children of the fourth year, 22 children of the second year). The univariate analyses showed significant differences (p = 0,004) between intervention and control groups for behavior score after the intervention. In particular, in a stratified analysis classes of the second year showed significant differences for knowledge score (p = 0,005) and for behavior score (p = 0,002), resulting higher among the intervention group. No significant differences resulted in classes of the fourth year for both scores.*
Conclusions. *The results of the Giochiamo project clearly demonstrate that the lecture and the games were effective to improve knowledge and behavior habits on the Mediterranean diet and PA. Second year students showed significant differences for knowledge and behavior score in comparison to fourth year students suggesting that, the earlier the intervention occurs, the better are the results in terms of improvement of knowledge and eating habits and PA behaviors.*

[1] *Department of Public Health and Infectious diseases, Sapienza University of Rome, Italy*
[2] *Department of Human, Social and Health Sciences, University of Cassino and Southern Lazio, Italy*

Introduction

In Italy, a recent systematic review has shown that the excess weight concerns one child out of four and the high prevalence of overweight and obesity resulted statistically significant in the Southern compared to Central and Northern Italy (1). However a decline of overweight and obesity prevalence was recorded, even if the gap between Southern Italy and the other regions is still in place (2, 3).

The regular use of so-called junk food (junk foods) containing substantial amounts of saturated fats, hydrogenated fats, preservatives and carbohydrates with a high glycemic index, is responsible for the onset of obesity in both children and adults. It is therefore necessary to encourage the consumption of fruit and vegetables in order to educate them to the adoption of healthy eating habits and to contribute to the fight against obesity (4).

Educating to a healthy lifestyle is important for children. A recent study about nutritional education program, led by trained teachers in the context of the Italian School Fruit Scheme, found that it is possible to improve the frequency of the daily consumption of fruit and vegetables (5).

Some Authors, following a systematic review approach, underlined that the development of scientifically validated lifestyle interventions for children is still an unmet need (6). Other research demonstrated that it is difficult to get positive results in the school setting on both PA and nutrition, even involving children and their parents (7).

The use of the game theory is of certain concern in the field of health education. The game could be an appropriate mean to teach nutrition issues and to influence dietary behavior. A pilot study conducted in three middle schools in Naples showed a significant increase in nutrition knowledge and in weekly vegetable intake in the children playing a new board-game "Kaledo" (8). In the UK a randomised controlled trial with a card game "Top Grub" has facilitated the enjoyable delivery of nutrition education in a sample of primary school age children (9).

However a trial regarding both PA and nutrition has not been developed until now. So the goal of this study was to increase knowledge and behavior of children, aged 7-9 years, on diet and on PA, in particular on the introduction of the food pyramid, the consumption of different food groups and the importance of being physically active, through the use of the games (cards and table games) (10).

Methods

Study design and setting

The study design is of a pilot randomized field trial: the randomization was carried out at the class level (cluster), and not at the individual level. The study was carried out in 2016 at an elementary school in Rome.

The recruitment of the children was made using a presentation letter to the parents and obtaining an informed consent. The study protocol [10] was approved by the local Ethical Committee.

Intervention

The trial consisted of two phases. In the first one, both intervention and control classes received a brief meeting (2 hours) by experts of Public Health and Preventive Medicine about the food pyramid and PA.

In the second phase, only the experimental classes were involved in playing the planned activities. The intervention was based on the development of cards and board games with the help of teachers and children.

Each experimental class was involved in activities in two different days (2 hours per day) and within each class 4 small groups were created. All the games were drivers of the main concepts of the food pyramid,

with the most important cards represented by fruits and vegetables, cereals and legumes (typical of the Mediterranean Diet) and the least important represented by unhealthy foods (i.e., hot dog, soda drinks, sweats).

The following games were developed and administered:

Card games

1. "Pappa" (that remembers the rules of the game "Tappo", "Top" in English. The goal of the game is to build a complete meal, with cards of different colors involving always fruit and vegetables);
2. "Piramemory" (that resembles the game rules of "Memory", whose goal is to find and match similar cards);
3. "Zompa verdura" ("Jumping vegetables" that is similar to the game "Jumping the horse", which underlines the importance of fruit and vegetables in avoiding the loosing of the game);
4. "Frutta e mezza" ("Fruit and a half", that resembles the game rules of "Seven and a Half", again giving the highest points to fruit and vegetables).

Table games

1. "Mangiopoli" (that resembles the rules of "Monopoly". The aim of the game is to gain profit in terms of vitamins, lending, selling and buying the properties that are along the board game. The properties represent both PA and nutrition issues;
2. "Piramidiamo" (that is based on building a weekly diet through the use of the cards, following the food pyramid model).

Games with physical activities

1. The "Egyptian goose game" (that remembers the rules of the well known "Goose game". The virtuous cards, those representing fruit, vegetables, fish and legumes, let the player going on until the goal area);
2. The "Egiziamo" game (that resembles the rules of the game "Capture the Flag" in English. The game involves teamwork and running with two different teams. The referee calls for the cards and the winner is who first touches the flag and answers questions on PA and nutrition).

The pre-post questionnaires

Knowledge and behavior on physical activity and nutrition were measured with previously validated tools (11, 12).

The questionnaire was composed of four sections on:

a) socio-demographic issues;
b) knowledge on nutrition;
c) nutrition behavior;
d) physical activity.

The first questionnaire was administered in the presence of at least one teacher, before the intervention, and the second after one month.

Two scores were calculated from the answers concerning knowledge and behaviors, separately. For each questions, one point was assigned for the right answer. Moreover, adjusted scores were also calculated considering only questions on diet and nutrition.

Statistical analysis

Sample size calculations were made using the software Epicalc 2000. For this calculation, we used the knowledge score (min=0; max=13), hypotesizing:

Average pre-intervention score = 6 points

Average post-intervention score = 8 points (increasing of the score by 30%)

Standard Deviation =2

Significance Level=0,05

Power= 80%

Sample size calculations resulted in 15 units for both the intervention and the control groups. Taking into account the cluster design, an increase of 20% was applied. So for each group we had to recruit at least 18 pupils.

Differences between and among groups were tested using the Mann-Whitney and Wilcoxon tests.

Stepwise with backward elimination procedure of non-significant variable (probably to entry $p<0.05$) was subsequently used to generate a linear regression model, with the scores as dependent variables. The goodness of fit for the linear model was assessed with R2 (13).

Results

Two intervention and two control classes (comprising 44 and 45 children respectively) completed the field trial concerning the presentation, the first questionnaire and at least one intervention with final questionnaire administration (Figure 1).

For these classes, size was similar in the intervention group (22 fourth, 22 second) and the control group (23 fourth, 22 second). Male and female (46, 43) were distributed in similar proportions in intervention and control classes.

The main reason for missing data and no full fulfillment of questionnaire was lack of precision, anyway children were assisted during the administration of questionnaire.

Children were excluded from the analysis if they: a) missed the first presentation of the project; b) were absent in the intervention setting; c) were absent at the second

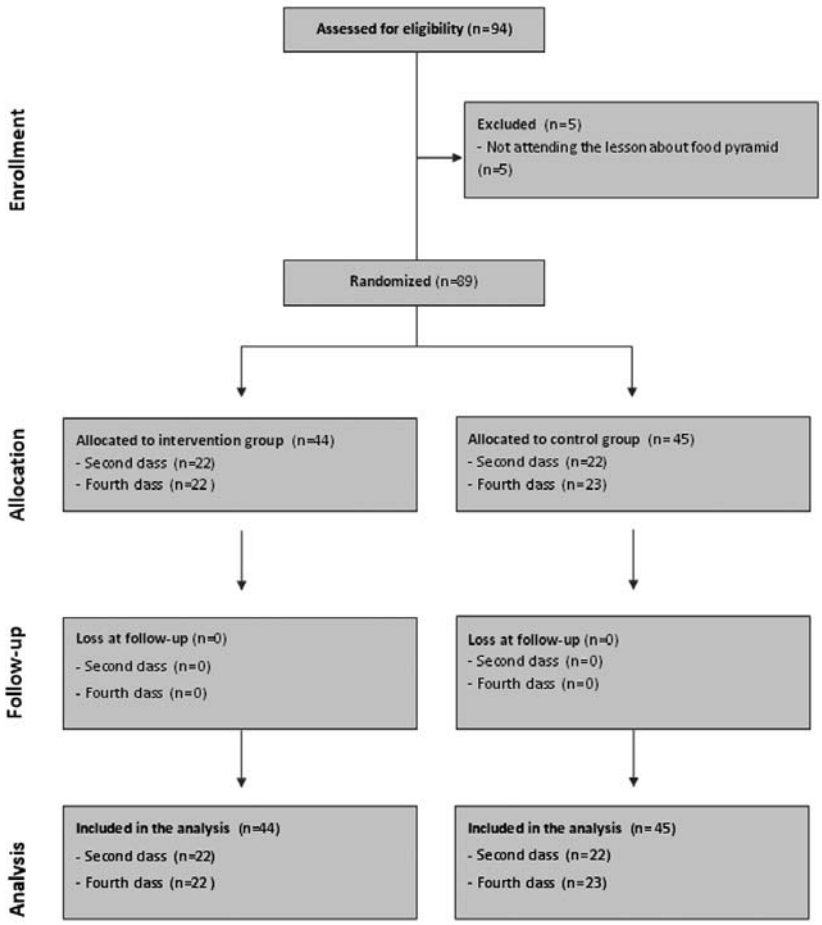

Figure 1. Flow chart of the randomized field trial

administration of the questionnaire. There were no data lost at follow up in both intervention and control groups.

Outcome of interest were: knowledge and behavior score (Table 1), knowledge and behavior score adjusted (meaning results only from Mediterranean diet, so excluding questions on PA) (Table 2) and delta score calculated as "post intervention-pre intervention" reported in Table 3.

Knowledge and behavior scores were smaller at baseline in the intervention group; only knowledge score resulted smaller at baseline in control group. Instead, behavior score in control group was slightly higher at the end.

The univariate analyses showed significant difference (p = 0.004) between intervention and control groups for behavior score after intervention. In particular in a stratified analysis second classes showed significant difference for knowledge score (p = 0.005) and for behavior score (p = 0.002), resulting higher in the intervention group. No significant difference resulted in the fourth classes for both scores. (Table 1) The analysis with adjusted score showed similar results (Table 2).

The univariate analysis of delta score showed significant difference between intervention and control groups for knowledge score (p =<0.001) and behavior score (p=0.001) after intervention.

The stratified analysis showed significant difference for both delta score only in second classes (delta knowledge p=0.014; delta behavior p=0.005). In second classes also delta score adjusted showed significant difference in knowledge (p=0.011) and behaviors (p=0.011). No significant difference resulted in fourth classes (Table 3).

The comparison of score within intervention group for all participants and stratified by classes resulted in significant differences (p=<0.001 or p=0.001) for all scores and also for the adjusted ones (Table 4). On the other hand, no significant differences for all scores resulted within the control group, except for behavior score in fourth class (Table 5).

Table 1 - Univariate analysis of knowledge and behavior score

Comparison score	Intervention		Control		p*
Variables	median	range	median	range	
All					
score knowledge T_0	7	0-13	8	0-11	0.053
score knowledge T_1	10	0-14	8	0-13	0.220
score behavior T_0	6	0-10	6	0-10	0.095
score behavior T_1	8	0-13	7	0-12	**0.004**
Second classes					
score knowledge T_0	7	0-10	6	0-11	0.670
score knowledge T_1	11	3-14	7	0-12	**0.002**
score behavior T_0	5,5	0-10	6	0-10	0.263
score behavior T_1	7,5	3-13	6	0-11	**0.005**
Fourth classes					
score knowledge T_0	7,5	0-13	8	3-11	0.347
score knowledge T_1	10,0	0-13	10	5-13	0.462
score behavior T_0	6	0-10	7	4-10	0.121
score behavior T_1	8	0-11	8	5-12	0.564

Table 2 - Univariate analysis of knowledge and behavior score adjusted

Comparison score adjusted	Intervention		Control		p*
Variables	median	range	median	range	
All					
score knowledge T_0 A	6	0-11	7	0-10	0.078
score knowledge T_1 A	9	0-12	8	0-11	0.23
score behavior T_0 A	5	0-9	6	0-10	0.094
score behavior T_1 A	7	0-12	6	0-10	**0.005**
Second classes					
score knowledge T_0 A	6	0-9	5	0-10	0.628
score knowledge T_1 A	9	03-12	6,5	0-10	**0.005**
score behavior T_0 A	5	0-8	5	0-10	0.262
score behavior T_1 A	6,5	2-12	5	0-10	**0.008**
Fourth classes					
score knowledge T_0 A	6	0-11	7	3-11	0.346
score knowledge T_1 A	8,5	0-12	8	4-11	0.38
score behavior T_0 A	5	0-9	6	3-8	0.185
score behavior T_1 A	7	0-10	7	4-10	0.694

A = adjusted

Table 3 - Univariate analysis of knowledge and behavior delta score

Comparison delta score	Intervention		Control		p*
Variables	mean	SD	mean	SD	
All classes					
delta score knowledge	3.045	3.064	0.711	2.455	**<0.001**
delta score behavior	2.568	2.679	0.688	1.831	**0.001**
delta score knowledge adjusted	0.371	0.794	0.167	0.543	0.115
delta score behavior adjusted	0.306	0.741	0.139	0.456	0.157
Second classes					
delta score knowledge	2.470	3.043	0.368	2.113	**0.014**
delta score behavior	2.000	2.345	-0.210	1.718	**0.005**
delta score knowledge adjusted	0.465	0.500	0.103	0.289	**0.011**
delta score behavior adjusted	0.384	0.465	-0.015	0.332	**0.011**
Fourth classes					
delta score knowledge	2.315	2.286	1.087	2.827	0.211
delta score behavior	1.894	2.208	1.521	1.675	0.627
delta score knowledge adjusted	0.30	0.96	0.22	0.68	0.97
delta score behavior adjusted	0.25	0.90	0.26	0.51	84

*p-value from Mann Whitney test

Table 4 -. Univariate analysis of knowledge and behavior in intervention group

Comparison pre/post intervention	min	max	mean	SD	p*
All					
score behavior T_0	0	10	4.30	2.46	**<0.001**
score behavior T_1	0	12	6.86	2.37	
score knowledge T_0	0	11	5.39	2.93	**<0.001**
score knowledge T_1	0	12	8.43	2.38	
Second classes					
score behavior T_0	0,00	10,00	4.64	2.85	**<0.001**
score behavior T_1	3.00	13.00	7.95	2.57	
score knowledge T_0	0.00	10.00	5.73	3.09	**<0,001**
score knowledge T_1	3.00	14.00	9.82	2.77	
Fourth classes					
score behavior T_0	0.00	10.00	5.27	2.93	**0.001**
score behavior T_1	0.00	11.00	7.64	2.61	
score knowledge T_0	0.00	13.00	6.73	3.74	**0.001**
score knowledge T_1	0.00	13.00	9.55	2.81	

* p-value from Wilcoxon test

Table 5 - Univariate analysis of knowledge and behavior in control group

Comparison pre/post control	min	max	mean	SD	p*
All					
score behavior T_0	0	10	6.088	2.353	**0.029**
score behavior T_1	0	12	6.8	2.92	
score knowledge T_0	0	11	7.177	2.782	0.087
score knowledge T_1	0	13	7.955	3.118	
Second classes					
score behavior T_0	0	10,00	5.500	2.755	0.711
score behavior T_1	0	11,00	5.272	2.994	
score knowledge T_0	0	11,00	6.363	3.230	0.321
score knowledge T_1	0	12,00	6.772	3.421	
Fourth classes					
score behavior T_0	4	10,00	6.652	1.773	**0.005**
score behavior T_1	5	12,00	8.260	1.982	
score knowledge T_0	0,	11,00	7.956	2.055	0.164
score knowledge T_0	5	13,00	9.087	2.353	

* p-value from Wilcoxon test

Table 6 - Multivariate analysis

delta knowledge				**delta behaviors**			
		B	p			B	p
class	second*/fourth	-0.220	0.822	class	second*/fourth	0.089	0.374
gender	M*/F	0.089	0.370	gender	M*/F	-0.005	0.961
Intervention	no*/yes	0.392	**<0.001**	Intervention	no*/yes	0.383	**<0.001**
R^2		0.154		R^2		0.147	
delta knowledge A				**delta behaviors A**			
		B	p			B	p
class	second*/fourth	0.115	0.300	class	second*/fourth	0.220	0.047
gender	M*/F	0.075	0.503	gender	M*/F	-0.013	0.908
Intervention	no*/yes	0.267	**0.018**	Intervention	no*/yes	0.267	**0.016**
R^2		0.071		R^2		0.117	

*reference

The following variables were included in the regression model: gender, class, intervention versus control group. For both delta scores, including those adjusted, the only determinant which shows a significant correlation ($p<0.05$) was the participation in the intervention group (Table 6).

Concerning the acceptability of the intervention, all of the 44 children who participated in the intervention with games of card and movement had positive or constructive comments about games, also expressing the highest preference for the card game "Pappa" (17/44, 38.6%) and the movement game "Egiziamo" (14/44, 31.8%).

Discussion

Childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years (14, 15). In 2012, more than one third of children and adolescents were overweight or obese (16, 17).

Children and adolescents who are obese are likely to be obese as adults and are therefore more at risk for adult health problems such as heart disease, type 2 diabetes, stroke, several types of cancer (including cancer of the breast, colon, endometrium, esophagus, kidney, pancreas, gall bladder, thyroid, ovary, cervix, and prostate, as well as multiple myeloma and Hodgkin's lymphoma and osteoarthritis) and they are at greater risk and social and psychological problems such as stigmatization and poor self-esteem (16-22).

Childhood and adolescence is a critical period for the establishment of bad or good dietary habits and lifestyles and for the early prevention of some overweight/obesity related diseases. In addition, eating habits, lifestyle and behavior patterns, once developed, may persist throughout adulthood so that the fundamental issues behind public health concerns for young people are the changes in food habits that have developed mainly as a result of the globalization of food. Over the past few decades significant changes have taken place in eating habits and environments. Overweight and obesity are the result of "caloric imbalance" - too few calories expended for the amount of calories consumed - and are affected by various genetic, behavioral, and environmental factors (16-17).

The dietary and physical activity behaviors of children and adolescents are influenced by many sectors of society,

including families, communities, child care settings, medical care providers, faith-based institutions, governmental agencies, the media, the food and beverage industries, the entertainment industries, and even the schools, where kids eat a snack and often consume the meal in the canteen and spend most of their time. Schools play a particularly critical role by establishing a safe and supportive environment with policies and practices that support healthy behaviors. Schools also provide opportunities for students to learn about and practice healthy eating and physical activity behaviors.

Schools can provide an important opportunity for prevention as they provide the most effective way of reaching large numbers of children (23-24).

The school environment can be improved by providing healthy meals, breakfast clubs, subscription schemes for fruit, vegetables and milk, healthy options in vending machines and snack bars and water.

But it's essential to improve children's nutritional behavior patterns and knowledge and the curriculum needs to cover several broad categories of nutrition, food and eating (25-27).

Healthy food and nutrition should be a high priority on every school agenda, because of the positive effect on child well-being. Good nutrition fosters mental, social and physical well-being, contributing to increased self-esteem and positive body image. Evidence suggests that healthy food and improved nutrition increases learning ability, leading to better academic performance.

So in the present study we wanted to convey information and nutritional knowledges, but also establish healthy attitudes, through the game which is the most useful and directed methods to easily learn about healthy dietary pattern and to promote healthy choices as the norm. Our intention was to test a way of communicating key health messages to children and the results are clearly in favor of our intervention based on food games mainly referring and calling to mind the good nutritional standards of the Italian food pyramid, that is the healthy Mediterranean dietary pattern.

The results of our study clearly confirm that the games, that we have created and proposed to the children, have been successful because they were welcome, enjoyable and funny, as much as they have been effective in terms of improving knowledge and eating habits. In fact, there was a significant difference between intervention and control groups for behavior score after intervention.

In particular, the results suggest that, the earlier the intervention occurs, the better are the results in terms of improvement of knowledge and eating habits. In fact, the second classes showed significant difference for knowledge and behavior score in comparison to the fourth classes.

Limitation in this study is mainly due to a small sample size because of the pilot study nature and because the time of intervention was narrow, but this aspect could be in favor of the intervention in the key that more frequent and protracted will be the intervention, better could be the results in relation to our outcomes of knowledge and behaviors. Moreover, the project measured change in knowledge and behaviors only on the short term, and a longer follow-up is needed to measure more stable results. The strength of this study lies in the fact that (1) it is a randomized controlled trial, (2) the games were created with the support of a specialist in food science and nutrition, and (3) because the sample was made up of children of a school sited in a neighborhood with an average socio-economic conditions.

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Riassunto

Incrementare la conoscenza e il comportamento sulla dieta e l'attività fisica nei bambini: i risultati di uno studio pilota randomizzato

Introduzione. Lo scopo dello studio è stato quello di incrementare la conoscenza sulla corretta nutrizione, di incoraggiare il cambiamento delle abitudini alimentari in conformità alla dieta mediterranea e di promuovere l'attività fisica nei bambini dai 7 ai 9 anni e dei loro genitori, attraverso l'uso delle carte e dei giochi da tavola del progetto Giochiamo svolto a scuola.

Metodi. Lo studio è un trial sperimentale, randomizzato su campo e ha coinvolto bambini in un contesto scolastico. L'intervento è stato strutturato in due fasi. La prima fase, per i gruppi di intervento e di controllo, ha compreso una lezione sulla piramide alimentare e sull'attività fisica (PA) tenuta da esperti di Salute Pubblica e di Medicina Preventiva. La seconda fase ha coinvolto solo il gruppo di intervento con giochi incentrati sui principali concetti della piramide alimentare e sull'attività fisica (PA). Il questionario è stato somministrato prima dell'intervento e dopo un mese per valutare il cambiamento nei punteggi di conoscenza e comportamento.

Risultati. 84 bambini sono stati distribuiti in maniera randomizzata tra il gruppo di intervento (22 bambini del quarto anno, 22 bambini del secondo anno) e il gruppo di controllo (23 bambini del quarto anno, 22 bambini del secondo anno). L'analisi univariata ha mostrato differenze significative ($p = 0,004$) tra gruppi di intervento e controllo per il punteggio sul comportamento dopo l'intervento. In particolare, in un'analisi stratificata le classi del secondo anno hanno rilevato differenze significative per il punteggio di conoscenza ($p = 0,005$) e per il punteggio di comportamento ($p = 0,002$), risultando più elevate nel gruppo di intervento. Nessuna differenza significativa è stata riportata per le classi del quarto anno per entrambi i punteggi.

Conclusioni. I risultati del progetto Giochiamo dimostrano chiaramente che la lezione e i giochi sono stati efficaci per aumentare le conoscenze e i comportamenti sulla dieta mediterranea e sull'attività fisica. Gli studenti partecipanti all'intervento del secondo anno hanno mostrato differenze significative per i punteggi di conoscenze e comportamento rispetto agli studenti del quarto anno, questo suggerisce che prima viene effettuato l'intervento, maggiore è il risultato in termini di miglioramento delle conoscenze e delle abitudini alimentari.

References

1. Turchetta F, Gatto G, Saulle R, Romano F, Boccia A, La Torre G. Systematic review and meta-analysis of the prevalence of overweight and obesity among school-age children in Italy. Epidemiol Prev 2012; **36**(3-4): 188-95.
2. Nardone P, Spinelli A, Lauria L, Buoncristiano M, Bucciarelli M, Galeone D; Gruppo OKkio alla SALUTE. Variabilità sociodemografica nelle prevalenze di sovrappeso e obesità dei bambini in italia nel 2014. Epidemiol Prev 2015; **39**(1): 64.
3. Spinelli A, Nardone P, Buoncristiano M, Lauria L, Bucciarelli M, Galeone D; Gruppo OKkio alla salute. Italia 2014: l'obesità nei bambini sta diminuendo. Epidemiol Prev 2015; **39**(1): 63.
4. Story M, Nanney MS, Schwartz MB. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. Milbank Q 2009; **87**(1): 71-100.
5. 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: 1-14.
6. Gorga E, Regazzoni V, Bansilal S, et al. School and family-based interventions for promoting a healthy lifestyle among children and adolescents in Italy: a systematic review. J Cardiovasc Med (Hagerstown) 2016; **17**(8): 547-55.
7. Sacchetti R, Dallolio L, Musti MA, et al. Effects of a school based intervention to promote healthy habits in children 8-11 years old, living in the lowland area of Bologna Local Health Unit. Ann Ig 2015; **27**(2): 432-46.
8. Amaro S. Viggiano A, Di Costanzo A, et al. Kalèdo, a new educational board-game, gives nutritional rudiments and encourages healthy eating in children: a pilot cluster randomized trial. Eur J Pediatr 2006; **165**: 630-5.
9. Lakshman R, Sharp S, Ong K, Forouhi N G. A novel school-based intervention to improve nutrition knowledge in children: cluster randomised controlled trial. BMC Public Health 2010; **10**: 123.
10. La Torre G, Mannocci A, Saulle R, et al. GiochiAMO! The protocol of a school based intervention for the promotion of physical activity and nutrition among children. Clin Ter 2016; **167**(5): 152-5.
11. La Torre G, Rossini G, Saulle R, et al. Randomized controlled trial on the promotion of healthy lifestyles among adolescents in the orthodontic

setting: study protocol. Clin Ter 2013; **164**(4): e301-4.
12. Saulle R, Del Prete G, Stelmach-Mardas M, De Giusti M, La Torre G. A breaking down of the Mediterranean diet in the land where it was discovered. A cross sectional survey among the young generation of adolescents in the heart of Cilento, Southern Italy. Ann Ig 2016; **28**(5): 349-59.
13. Hosmer DW, Lemeshow S. Applied logistic regression. New York: John Wiley & Sons, Inc, 2000, p. 373. DOI: 10.1002/0471722146.
14. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. JAMA 2014; **311**(8): 806-14.
15. National Center for Health Statistics. Health, United States, 2011: With Special Features on Socioeconomic Status and Health. Hyattsville, MD: U.S. Department of Health and Human Services, 2012.
16. Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. Circulation 2005; **111**:1999-2002.
17. Office of the Surgeon General. The Surgeon General's Vision for a Healthy and Fit Nation. [PDF - 840 KB]. Rockville, MD: U.S. Department of Health and Human Services, 2010.
18. Freedman DS, Khan LK, Dietz WH, Srinivasan SA, Berenson GS. Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. Pediatrics 2001; **108**: 712-8.
19. Guo SS, Chumlea WC. Tracking of body mass index in children in relation to overweight in adulthood. Am J Clin Nutr1999; **70**: S145-8.
20. Freedman DS, Kettel L, Serdula MK, Dietz WH, Srinivasan SR, Berenson GS. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. Pediatrics 2005; **115**: 22-7.
21. Freedman D, Wang J, Thornton JC, et al. Classification of body fatness by body mass index-for-age categories among children. Arch Pediatr Adolesc Med 2009; **163**: 801-11.
22. Kushi LH, Byers T, Doyle C, et al. American Cancer Society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. CA Cancer J Clin 2006; **56**: 254-81.
23. Carter R. The impact of public schools on childhood obesity. JAMA 2002; **288**(17): 2180.
24. World Health Organization (WHO). Healthy nutrition: an essential element of a health-promoting school. Geneva: World Health Organization, 1998 (WHO Information Series on School Health No. 4).
25. Dixey R, Jeindl I, Loureiro I, Pérez-Rodrigo C, Snel J, Warnking P. Healthy eating for young people in Europe; a school based nutrition education guide. Copenhagen: International Planning Committee of the European Network of Health Promoting Schools (IPC), 1999.
26. World Health Organization (WHO). Skills for health. Skills-based health education including life skills: an important component of a child-friendly/ health promoting school. Geneva: World Health Organization, 2003 (WHO Information Series on School Health No. 9).
27. St-Onge M, Keller K, Heymsfield S. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. Am J Clin Nutr 2003; **78**(6): 1068-73.

Corresponding author: Prof. Giuseppe La Torre. Dipartimento di Sanità Pubblica e Malattie Infettive, Sapienza Università di Roma, Piazzale Aldo Moro 5 - 00185 Roma
e-mail: giuseppe.latorre@uniroma1.it