

# The prevention of obesity starting from the kindergarten by means of peer educator mothers and *WhatsApp* messages

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## Abstract

**Background.** Early-life diet plays a crucial role in the development of body weight issues. We therefore investigated the effectiveness of a peer-education intervention, aiming at encouraging the intake of fruits and vegetables and of a healthy mid-morning snack, targeting the mothers of 3-8 years old children attending kindergarten and primary school.

**Study design.** Experimental approach.

**Methods.** The study involved 924 children (intervention group) and 450 children (control group). The intervention was carried out by organizing three meetings at school with the participation of healthcare professionals, mothers and teachers in a maieutic way. The meetings focused on i) discussing the issues that mothers face with their children's nutrition; ii) possible solutions; iii) identification of "leading mothers" playing as peer-educators. As control a similar intervention targeting only the teachers, without involving the mothers, was also carried out. The effectiveness of such interventions was evaluated by external evaluators, before, the interventions and 3 and 9 months after the interventions.

**Results.** The check, carried out 3 months after the intervention, showed a significant improvement with respect to the mid-morning snack, and the consumption of the main dishes as well as fruits; the check carried out 9 months after the intervention, showed that such improvements were maintained in the case of the mid-morning snack and the fruit intake. No improvement was observed in relation to the control group.

**Conclusions.** This is the first example of an intervention promoting a healthy diet involving mothers of children attending kindergarten and primary school as peer educators and it actually improved the dietary habits.

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## Introduction

In Italy 9,4% of children are obese and 20,4% are overweight; 55,2% have too caloric mid-morning snacks (MMS), and 24.3% eat fruits and vegetables less than once a day (1).

To prevent these conditions, we have to act when children are as young as possible, because 1) it is during childhood that food preferences and eating habits are acquired (2, 3) and 2) because the earlier the “adiposity rebound”, the higher the risk of obesity in the following years (4, 5). An excessive consumption of high caloric and protein-based food, along with a low intake of fruits and vegetables are key risk factors for obesity (5-7). These wrong dietary habits will therefore need to be addressed.

Mothers play a crucial role in the nutrition of their children, being the ones who attend their care, go grocery shopping and prepare meals (within both parents-employed couples the asymmetry index in preparing meals is 82%) (8). Therefore, it is necessary to increase mothers’ awareness when it comes to the adoption of a proper nutrition for their children, especially the younger ones. In particular, mothers should be guided in order to be able to provide their children with low-calories snacks, and to encourage the consumption of fruit and vegetables. Effectiveness, sustainable and easily reproducible strategies are necessary in order to impact a very large target population.

Peer education is not widely used for education on healthy nutrition, although until now it gave encouraging results in groups of peer teenagers and adults (9-13). In particular, the literature reports only one peer education based intervention aiming at promoting proper eating behaviours and involving the mothers of 3- to 8-years-old children (14), despite the strong hypothesis that peer mothers, if properly trained, could be very helpful in transferring their health knowledge and behaviour to other mothers and to their children (15).

This study aims at evaluating the effectiveness of an easily reproducible peer education intervention, targeting a low and medium-low socioeconomic population of mothers of 3- to 8-years-old kindergarten and primary school children. The intervention aims at promoting healthy dietary habits among children, by stimulating the habit of having healthy MMS, preferring fruits, vegetables, yogurt or, otherwise, choosing low-energy snacks with a low saturated fat and protein content, and increasing the consumption of fruits and vegetables.

## Methods

### *Study design*

The study was designed after a pilot intervention was set up to explore the feasibility and the potential efficacy and to define the main parameters of the study.

The pilot project was carried out in a school located in a suburban neighbourhood of the city of Naples, involving 148 children, and showed a significant improvement in the intake of healthy MMS. No significant improvement was assessed on the intake of main meals, nor on fruits.

This pilot study found that 33% of pupils took healthy MMS before the intervention and only 30% of the children involved were present at all 3 surveys (dropout rate of 70%).

For our new study, we have set the goal of increasing the percentage of children taking healthy MMS to at least 50%. By setting a test significance level of 0.05 and a power of 0.90, we calculated the sample size, which resulted of 200 children.

Using, as an estimate of the dropout rate, the percentage of the pilot study (70%), it emerged the need to involve at least 670 children at the start of the study to obtain a final sample of 200 children upon which making comparison by paired samples (30% of 670 is 201).

Practical reasons (the headmasters of the identified schools demanded that all classes were involved; greater ease in convincing schools to participate in the intervention study rather than in the control group; limited human resources) led to an oversizing of the intervention group (924 children in 8 schools and 54 classes) and under-scaling of the control group (450 children in one school and 23 classes).

### *Intervention Group*

The intervention was carried out as follows:

1. Set up of a preliminary meeting, involving the school headmaster and some teachers, aiming at collecting opinions about school meals, as well as at describing the intervention and checking its feasibility, sharing its goals and methodology.

2. Set up of a first meeting, involving mothers and teachers. After a brief presentation, supported by slides, on the increase of childhood obesity and on the need to eat more fruits and vegetables and make a nutritionally adequate MMS, all participants were asked to write down on a piece of paper the difficulties they face in preparing everyday's meals and in ensuring that their children adhere to healthy dietary habits. The anonymous contributions they wrote were read aloud, and grouped on a poster according to the following criteria:

- sheets with the same problems were put together;
- similar problems were placed close to each other;
- different problems were placed distant;
- problems that were the consequence or the cause of another problem were placed respectively above or below the problem they were related with.

In this way, a "tree of problems" was created, illustrated, discussed and amended according to the issues raised during the discussion. In particular, it was shown that

the "tree of problems" is useful to reach a common view of the current situation, and to identify proper shared solutions for building a "tree of solutions", where all participants can contribute to the definition of the intervention. This methodology is referred to the Project Cycle Management and to the maieutic education.

During this first meeting, the Local Health Agency (LHA) staff provided informative material and the URL of the "Snackmeter" (a database with the nutritional composition of 356 snacks on the market) (16).

3. Set up of a second meeting, scheduled 7-10 days after the first one, to define the "tree of solutions", to decide which ones to implement and to create commitments for their realization.

Making the MMS nutritionally more adequate was always among the commitments. In particular, when the mothers did not propose the establishment of a snack weekly schedule (e.g. on Monday yogurt, on Tuesday fruit, etc.), the LHA staff did it. At the same time, the possibility to use social media, such as a WhatsApp group involving the children's mothers attending the same class was presented, in order to arrange and follow a "snack schedule".

Following the two meetings, and taking into account the teachers' suggestions, some mothers were identified as more suitable at playing a "leader" role. The "peer educator" mother usually stands up for her interest in healthy nutrition, fights to improve school services, and shows a good leadership talent.

At the end of the meeting, the LHA staff informally kept talking to these mothers, to ensure that commitments were respected and to encourage them to stimulate and coordinate the other mothers to do the same, also by using a classroom WhatsApp group. The LHA staff and the "leader" mothers exchanged personal mobile numbers and e-mail addresses, so they could easily get in touch each other, if necessary.

All the meetings took place at the schools, each one lasted about 2 hours and involved the presence of 2/3 health professionals. An average of 4 mothers/class (about 20% of all mothers) and 1 teacher/class attended each meeting.

### *Control group*

The control group was identified in a school with characteristics similar to those of the school of the intervention group, and the following intervention was carried out:

1. Set up of a meeting involving the headmaster and some teachers.
2. Set up of a meeting involving teachers, consisting of two presentations supported by slides and subsequent debate. The meeting, which lasted about 2 hours, focused on the following topics: the increase of childhood obesity, advice on proper nutrition and, in particular, for a nutritionally adequate MMS. During this meeting, the same communication material provided to the intervention group was illustrated and delivered (the “Snackmeter” was handed also in paper format).
3. Delivery of a number of copies of the communication material to the school, equal to the number of children attending the school, so that each teacher could hand the material to the parents of the children attending their class, either directly or through the children themselves.
4. The meeting was attended by 1 teacher per class.

### *Evaluation of the intervention*

Trained healthcare professionals, not involved in the project’s team, carried out the evaluation of the intervention. It included:

- an assessment of the MMS both in the intervention group and in the control group (in Italy the MMS is not provided by the school, but by the parents; the City provides the school lunch-service upon request of the parents and upon payment of a fee);

- the consumption (in quantitative terms) of the main course, side dish and fruits by children at school (only in the intervention group).

The operators reported on a card the MMS of each child, writing down the amount (one piece, one jar, one slice, one fruit), trade and brand name for the industrial snacks or, in the case of a homemade snack, its description (e.g. “Apricot pie”). On the same card was also recorded whether the main course, side dish and fruit portions were eaten completely, partly or not eaten at all.

The evaluation was performed before the first meeting with mothers and teachers (t0), 3 months after the intervention (t1), and 9 months after the intervention (t2).

The assessment was carried out in the days where the menu of the school lunch was similar, and included vegetables as a side dish and possibly in the main course too (see Supplementary Material: Table S1).

In the control group it was not possible to carry out the t2 assessment. The teachers of the control group were given a questionnaire in order to check whether they received the informative material, and whether it was provided directly to the mothers or through the children.

All collected data were entered in the project database.

Each MMS was assigned a score by using the criteria reported in Table 1, in order to classify snacks according to their nutritional adequacy.

The total score identifies 3 different snack categories:

- “Appropriate snacks”: with a total score rating between 3 and 4;
- “Partly appropriate”: with a total score rating between 5 and 6;
- “Inappropriate snacks”: with a total score rating between 7 and 11.

The nutritional composition was calculated for non-prepackaged (e.g. “banana”) and home-made snacks by using the Food Composition Tables by National Research

Table 1 – Parameters and related scores used to assign the total score defining the adequacy of the snack

Energy intake (e.i.)	Kcal per piece	Score
	e.i. ≤ 120	1
	120 < e.i. ≤ 150	2
	e.i. > 150	3
Amount of energy (a.e.)	Kcal/100 g of product	
	a.e. ≤ 400	1
	400 < a.e. ≤ 450	2
	a.e. > 450	3
Amount of saturated fats (s.f.)	g of saturated fats/100 g of product	
	s.f. ≤ 6	1
	6 < s.f. ≤ 10	2
	s.f. > 10	3
Presence of hydrogenated fats	yes	2
	no	0

Institute for Food and Nutrition (17) and subsequently the score was assigned with the above described criteria.

### Data analysis

We removed data referring to children who were not present at school and to those who did not eat at school, in order to process them for paired samples. The chi-square test was used to compare data before and three months after the intervention, while the Wilcoxon test was employed for analysis of data collected 9 months after the intervention, because in this case the number of children was lower than in the other assessments. At the time of the second assessment, the percentage of children not present at school was 6% higher than during the first assessment.

The evaluation concerned:

- MMS: 601 children at t0-t1 (503 from kindergarten and 98 from primary school, that is 65% of the recruited children), and 138 kindergarten children that were present at t0-t1-t2 assessment (15% of the total);

- main course and side dish: 452 children were considered at t0-t1 (422 of kindergarten, 30 of primary school, that is 49% of the total), and 113 kindergarten children that

were present at t0-t1-t2 assessment (12% of the total);

- fruit intake, 167 children were considered at t0-t1 (137 of kindergarten, and 30 of primary school, that is 18% of the total), and 22 kindergarten children, that were present at t0-t1-t2 assessment (2.4% of the total).

The control group for the evaluation of the MMS involved 303 children, that is 67% of the total.

The frequency distribution of the score assigned to the snacks consumed by the children (according to the criteria described).

The same analysis was applied to the data of the school lunch.

## Results

Three months after the intervention, we found an increase of the number of children having an appropriate MMS (from 33.6% to 53%), of those eating all the main course with vegetables (from 53% to 58%), the side dish (from 53% to 56%) and the fruit (from 35 to 68%) (Tables 2 and 3). The improvement found is large and significant ( $p < 0.0001$  for MMS and 0.05 for main course, side dish and fruit). Nine months

Table 2 - Percentage of pupils with mid-morning snack (MMS) “Appropriate”, “Partly appropriate” and “Inappropriate” before, 3 and 9 months after the intervention

Mid-morning snack (MMS)	Before the intervention (t0) 601 pupils	3 months after the intervention (t1) 601 pupils	9 months after the intervention (t2) 136 pupils
Appropriate	33.6%	53.1%	63.3%
Partly appropriate	16.0%	11.8%	5.0%
Inappropriate	50.1%	35.1%	31.7%

Comparison t0/t1:  $\chi^2$   $p < 0.0001$  Comparison t0/t2: Wilcoxon:  $p < 0.001$

after the intervention, 63% of the children had an appropriate MMS and 81% ate fruit (a significant increase compared to the initial situation,  $p < 0.001$  and  $0.05$ , respectively). As for the main course and the side dish, there were no significant differences at the 9 months assessment (Tables 2 and 3).

Comparison with data obtained for the control group (see Supplementary Material: Table S2), where no improvement was detected, further highlights the effectiveness of the intervention.

## Discussion

The results of our research show an improvement in all the indicators examined 3 months after the start of the intervention. Such an improvement is stable for the MMS and the fruit intake, as well as 9 months after the intervention.

During the focus group with some mothers, teachers and school officials, we found that peer educator mothers played an important role in persuading other mothers to

Table 3 - Percentage of pupils who ate completely, partially or not at all the first course, the side dish and the fruit portion of the school canteen before, 3 and 9 months after the intervention

	Before the intervention (t0)	3 months after the intervention (t1)	9 months after the intervention (t2)
First course*	452 pupils	452 pupils	113 pupils
Completely	65.5%	74.3%	58.4%
Partly	25.9%	18.6%	29.2%
Not	8.6%	7.1%	12.4%
Side dish**	452 pupils	452 pupils	113 pupils
Completely	25.2%	29.4%	23.9%
Partly	14.4%	18.8%	18.6%
Not	60.4%	51.8%	57.5%
Fruit***	167 pupils	167 pupils	22 pupils
Completely	55.1%	68.2%	81.8%
Partly	1.8%	1.2%	4.5%
Not	43.1%	30.5%	13.6%

\* Comparison t0/t1:  $\chi^2$   $p < 0.05$  Comparison t0/t2: Wilcoxon non significant

\*\* Comparison t0/t1:  $\chi^2$   $p < 0.05$  Comparison t0/t2: Wilcoxon: non significant

\*\*\* Comparison t0/t1:  $\chi^2$   $p < 0.05$  Comparison t0/t2: Wilcoxon: non significant

follow a MMS weekly schedule, often with the teachers' help.

The peer educator mothers succeeded in reaching most parents of the school, and in positively influencing the dietary habits of many children. In our opinion, this was due to several factors:

The mothers who took part in at least one of the meetings on healthy eating are those who are more interested in this topic and more motivated to implement changes in their children's eating habits.

The peer educator mothers felt responsible in having an educational and promotional role concerning healthy dietary habits, that was acknowledged and supported by the LHA and the school.

The educational methodology (maieutic method, teamwork) and the techniques that were used (building the "tree of problems" and the "tree of solutions") strongly stimulated the engagement of the mothers.

The widespread use of social media such as WhatsApp by mothers of children attending the same class was pivotal to support the peer educator mothers in playing their role.

This kind of social media is increasingly used, also in health education interventions, with good results (18-20).

Changing a dietary habit and overcoming the rejection of vegetables, very common among children, is more difficult than replacing a snack with another which is nutritionally more adequate or with a fruit. This might explain the less brilliant results of our intervention about increasing the consumption of the main course (which almost always included some vegetables) and the vegetable side dish and the non-significant results obtained in the check carried out 9 months after the intervention.

The effectiveness of school education interventions has not been clearly established.

The results showing which intervention strategies are most effective are conflicting

(21-28). This is partly due to the inherent research issues still pending in this field (difficulty in obtaining reliable measures of the behavioral changes, excessive data loss during the follow-up, problems in the standardization of the intervention, control of the many variables that compose the educational activity, strong meta-analysis, etc.).

The results of our research challenge the concept according to which the key person for the implementation of kindergarten-based behavioral interventions (4-6 years) is the kindergarten-teacher (29), and highlight the role of the mothers, as also suggested by some recent studies (30, 31).

The number of studies focusing on the kindergartens (children 3-5 years old) (29-34) is not high and this is surprising, given the importance of targeting this age group for the prevention of obesity and the acquisition of healthy dietary habits.

In January 2021, a search was carried out on PubMed by using "peer education" OR "peer educator" AND "mother" as keywords and resulted in 40 articles: only 11 of them concerned the nutrition of children and only one targeted children over 3 years of age (14). No article was found questioning "kindergarten" AND "peer education". Our work is the first one to implement the methodology of peer education targeting mothers of children from kindergarten and primary school and – in our opinion - it provided satisfying results.

## Conclusions

Nutrition in early life plays a crucial role in the development of weight gaining, dietary habits and related diseases during the entire life. It is hence important to address the food education topics as early as kindergarten, by taking advantage of the moment of school lunch as an educational tool. This study shows that an intervention actively involving mothers through the peer education

methodology, as well as the support of teachers, can improve the dietary habits of 3- to 8-year-old children. If our results will be confirmed by longer-term studies and with less data loss during the various verifications carried out, we would gain an inexpensive instrument, easy to implement, even in contexts of low parental education and social status, and an effective intervention model to be implemented in kindergarten and in the first years of primary school, a crucial age group for the prevention of obesity.

### Conflict of Interest

Funding: none. Competing interests: none. Ethical approval: not required.

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### Riassunto

*Prevenire l'obesità a partire dalla scuola dell'infanzia attraverso mamme peer educator e messaggi WhatsApp*

**Background.** L'alimentazione dei primi anni di vita è di grande importanza nella genesi dell'eccesso ponderale. Per tali motivi abbiamo valutato l'efficacia di un intervento di educazione tra pari rivolto alle madri di bambini di 3-8 anni, che frequentano la scuola materna o elementare, e che mirava a favorire l'assunzione di frutta e verdura e l'abitudine a fare uno spuntino salutare a metà mattina.

**Disegno.** Studio sperimentale.

**Metodi.** Lo studio ha coinvolto 924 bambini (gruppo di intervento) e 450 bambini (gruppo di controllo). L'intervento è consistito in tre incontri condotti con metodo maieutico nelle scuole tra operatori sanitari, madri e insegnanti e incentrati su i) discussione dei problemi che le madri incontrano nell'alimentazione dei propri figli; ii) possibili soluzioni; iii) assunzione di impegni; iv) identificazione di "madri leader" che potevano svolgere il ruolo di peer-educator. Come controllo è stato effettuato un intervento analogo rivolto alle insegnanti, senza coinvolgere le madri. L'efficacia dell'intervento è stata valutata da valutatori esterni, prima, 3 e 9 mesi dopo l'intervento.

**Risultati.** A 3 mesi dall'intervento, abbiamo riscontrato un sensibile miglioramento nella merenda di metà mattina, nel consumo di primo e secondo piatto e frutta;

### Supplementary Material

Table S1 - Comparison between the menus of school canteen before intervention (t0) and three months after (t1) (only in 4 schools the menu was different at t0 and t1)

School	Classes	Menu t0	Menu t1
School 1	2	Artichokes Risotto, salad	Rice with pumpkin, salad
School 2	3	Pasta with peas, sour cream	Pasta with potato, sour cream
School 3	7	Rice with potato, zucchinis	Pizza with tomato sauce, zucchinis
School 4	10	Pasta with cabbage, salad	Rice with tomato sauce, salad

Table S2 - Percentage of pupils with mid-morning snack (MMS) "Appropriate", "Partially appropriate" and "Inappropriate" before and 3 months after the intervention in the control group

	Before intervention (t0) 303 pupils	3 months after the intervention (t1) 303 pupils
Appropriate	19.2%	19.4%
Partly appropriate	14.8%	13.5%
Inappropriate	66.0%	67.1%



nove mesi dopo, il miglioramento è stato mantenuto per lo spuntino di metà mattina e l'assunzione di frutta. Nel gruppo di controllo non è stato osservato alcun miglioramento.

**Conclusioni.** Questo è il primo esempio di intervento che promuove un'alimentazione sana coinvolgendo come peer educator le madri dei bambini che frequentano la scuola dell'infanzia e primaria e ha migliorato significativamente le abitudini alimentari.

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