

Evaluation of the effectiveness of a nutrition education intervention performed by primary school teachers

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Abstract

Background: Long-term interventions based on the active involvement of students, carried out by properly prepared staff using didactic support material (brochures, games etc.) including the participation/involvement of mothers or associates in community interventions; seem to be the most effective ones. This study evaluates the effectiveness of nutrition education interventions carried out by teachers with active didactic methodologies.

Methods: The research was carried out by administering a frequency of food intake questionnaire, before and after the intervention. To compare the answers given before and after the educational intervention the Wilcoxon-test was applied to dependent data discriminating the group with “sufficient implementation” of the project versus “insufficient implementation”.

Results: Our data demonstrates that a substantial percentage of children do not report an adequate nutritional intake, making education interventions not only opportune but necessary.

In both groups there was an increase in the number of subjects having breakfast, particularly in terms of bread and biscuits intake. In the group with “sufficient implementation” there was an increase in the intake of all kinds of food with respect to the previous day's intake and a decrease in the intake of meat, fish and legumes consumed during the previous week; in the group with “insufficient implementation” only fish intake increased significantly while vegetable intake decreased in a non-significant way.

So this educational intervention appears to have been particularly effective in modifying breakfast habits and reducing snack.

Key words: evaluation study, health education, primary school

Introduction

Poor nutrition habits are considered to be an important risk factor for severe pathologies (cardiovascular diseases, tumours, diabetes etc.) [1]. Therefore, it is recommended that nutritionally balanced diet should commence from infancy, one that is low in saturated fats and rich in vegetables, fruit and pulses [2, 3].

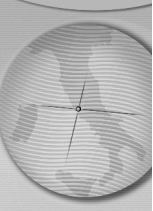
Thus there are numerous nutritional education interventions, above all in the realm of schools, as they are easy to implement and support the idea of nutritional habits being acquired early in life. Furthermore an effective prevention must begin in adolescence or childhood [4].

Long-term interventions based on the active involvement of students, carried out by staff who

have been properly prepared using didactic support material (brochures, games etc.) including the participation/involvement of mothers or associates in community interventions, seem to be the most effective [5-7].

Unfortunately, most of the conducted interventions were not evaluated for their success and as far the casting of the teachers in the central role is concerned, reports of their effectiveness by the teachers themselves is also lacking [8-10].

Our work aims to evaluate the effectiveness of nutritional education interventions using a metropolitan scale based on active didactic methodologies carried out by teachers (properly instructed and supported) in relation to the effective realisation of the project on the part of the teachers [11].



Methods

All 89 primary schools in Naples were invited to participate in the project. Schools acceding to the project sent in written consent forms signed by the director of the institute as well as the teachers who would be obliged to participate in the training course.

The training course (12 hours) provides lessons on the following topics: "Why do health education"; "Aims and principles of health education"; "Nutrients and food requirements; "Nutrition and health", "Nutrition habits"; "Methodology, strategies and techniques of health education", as well as, "Health education didactics".

The participants of the course will be provided with a copy of the text "Teacher's guide", which contains basic notes on nutrition, an educational schedule with a detailed didactic itinerary and didactic material for students. The text of which was written by a work-group of teachers, paediatricians and physicians who specialized in health education [12].

During the performance of the educational project the teachers were provided with copies of an information brochure and a poster "Advice for correct nutrition" for the parents of each student involved in the project. Furthermore, to reinforce and integrate the messages of the teacher, a session with a doctor or a dietician, who were adequately trained in nutritional education and effective communication, took place in every class.

The educational programme assigns the students with an active role resulting in practical educational experiences.

This is arranged in two parts: a cognitive part and an affective-symbolic part. The first which is established in the following 4 sub-units: 1) "Our body is a machine, what we eat is our fuel", 2) "More pulse, vegetables, fruit and fish", 3) "Less saturated fat and salt", 4) "Coffee and wine? No, thank you". Each didactic sub-unit provides specific didactic material and is arranged in line with the following scheme, which relies on cognitive theories [13]. The didactic itinerary includes discussions, games, literature, experiments, interviews, research, drawings etc. In the "affective-symbolic" part one tries to present food which is less welcomed by children (vegetables, pulse etc.) in a positive light by the use of tales, games, nursery rhymes.

The sample: 27 schools belonging to 9 of the 10 health districts of Naples participated in the project, i.e. a total of 135 fourth and fifth year classes.

The research was conducted on the basis of a sample of 30 classes who were randomly assigned with a total of 570 students participating. The students in these classes do not have lunch at school.

The questionnaire (Figure 1): The research was carried out by administering a frequency of food intake questionnaire [14], before (in December) and after the intervention (in May) The questionnaire was handed out to the students by 5 physicians who were not involved in the educational intervention according to a standardized procedure (self presentation, explaining the objective of the questionnaire and how to fill it in, handing out the questionnaires, controlling that the students would not talk to each other and collecting the questionnaires).

Due to 62 students being absent 508 entrance questionnaires were administered.

The monitoring form: At the end of the school year the teachers filled in a monitoring form investigating aspects concerning the running of the project (which sections were implemented, which didactic materials were used, working hours etc.). The teachers could fill in the form when it was given to them or subsequently; it was collected by an operator or sent in by fax. Only 20 of the total of 30 forms were sent back.

Criteria for the evaluation of the educational project implementation as sufficient/insufficient execution: It was considered as being a "sufficient implementation" if at least 2 of the sub-units 1, 2 and 3 were implemented. The sub-units were considered in direct response to this specific question but the squares referring to the use of at least 2 of the 3 didactic materials of sub-unit 1 and of 2 of the 2 didactic materials of sub-unit 2 and 3 were marked with a cross. This choice was made because we realised that teachers often use their own didactic material or that of the school. On the other hand several teachers did not respond to the question "Yes, the didactic sub-unit x was implemented", but declare to have made use of the respective didactic material, perhaps because they did not believe they had used it completely or, more simply, because they did not recall the denomination of the didactic sub-unit.

Evaluation: The final analysis was carried out by those students who responded to the first and to the second questionnaire and by the students of classes where the teachers had sent back the filled in monitoring form. For this reason, data was collected from only 306 students from 20 classes. The data entered in the database were processed by PC/SPSS version 9.0. To compare the answers given before and after the educational

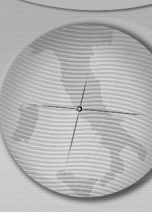


Figure 1. Questionnaire to value nutrition habit (from INRAN 2003)

(Please respond honestly to all questions of the questionnaire writing clearly. For the questions 1, 2, 3, 4 and 5 you have to blacken the square of the answer you want to give; you have to blacken a square for each line)

School..... Class..... Section.....
 Surname..... Name..... Date of birth...../...../.....
 Profession of your father..... Profession of your mother

Question 1 – What kind of school education has your father?
 – primary – middle school certificate – A-level – degree

Question 2 – What kind of school education has your mother?
 – primary – middle school certificate – A-level – degree

Question 3 – Did you have breakfast today?

If you had breakfast please indicate what and how much you ate:

- milk and yoghurt (indicate the number of beakers)
 0 0 1 1 2 more than 2 2
- bread, rusk, cereals (number of slices, pieces, bowls)
 0 0 1 1 2 2 more than 2 3
- biscuits (indicate the number)
 0 0 1-2 2 3-4 3 5-6 4 7-8 5 more than 8 6
- snack (indicate the number)
 0 0 1 1 2 2 more than 2 3
- fruit juices (indicate the number of glasses)
 0 0 1 1 2 2 more than 2 3
- coffee (indicate the number of small cups)
 0 0 1 1 more than 1 2
- eggs (indicate the number)
 0 0 1 1 2 2 more than 2 3
- sweets (indicate the number of pastry, pieces of cake, chocolate bars)
 0 0 1 1 2 2 more than 2 3
- other (indicate what and how much of it)

If you did not have breakfast indicate the reasons
 I did not feel well I am not in the habit of having breakfast
 I had no time I was not hungry Other

Question 4 – Which portions of the food mentioned did you eat yesterday?

- meat zero 0 half 1 one 2 two or more 3
- fish zero 0 half 1 one 2 two or more 3
- pulse zero 0 half 1 one 2 two or more 3
- vegetables zero 0 half 1 one 2 two or more 3
- cold meats and salami zero 0 half 1 one 2 two or more 3
- snack zero 0 half 1 one 2 two or more 3

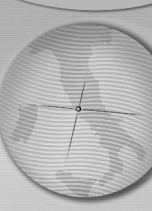
Question 5 – How many portions of the food mentioned did you eat in the last 7 days?

- fish 0 0 1 1 2 2 3 3 4 or more 4
- pulse 0 0 1 1 2 2 3 3 4 or more 4
- vegetables 0 0 1 1 2-3 2 4-5 3 6-7 4 8-9 5 more than 9 6

intervention the Wilcoxon-test was applied to dependent data. Since 28 students were absent when the exit questionnaires were supposed to be filled in, the test was carried out only on a sample of 278 students.

Results

278 students participated in all parts of the project. The average age was 9 years and the educational level of the families was middle-low. In fact the school education of almost 60% of the parents was primary or middle; the major part of the fathers were employees (58.2%) while 69.9%



of the mothers were housewives (Table 1).

Several elements relating to the nutritional habits of fourth- and fifth-graders examined by us can be derived:

- 1) A substantial minority (16.7%) does not have breakfast in the morning (main reasons for this seem to be lack of habit and time. However, after the intervention this percentage was reduced and that of not being hungry increased instead;
- 2) 8.2% have coffee (almost always with milk) for breakfast (Table 2);
- 3) A substantial percentage of the population's vegetable assumption was deficient: only 42.1% had eaten it the previous day, 59.1% during the last 7 days of which only 3.6% had consumed more than 4 portions (however, we have doubts concerning the weekly data, see data provided later in this section) (Table 2);
- 4) Notable is the snack consumption, such as cakes and sweets consumption (tab. 2): a discreet percentage (31,7%) had them for breakfast (8.5% 2 and 1.3% more than 2); 57.3 % declared to have eaten one at least the previous day (however, the real percentage is considered to be higher as 10.7 % did not responding to the question) and 8.2% had consumed three or more the previous day;
- 5) Notable is also the intake of fresh and conserved meat: 59.5% declared to have eaten meat the previous day (5.9% more than 1 portion) and 40.5% to have consumed cold meats and salami (8.5% more than 1 portion) (Table 2);
- 6) It should be noted that while 100% of the students answered the questions relating to breakfast the percentage of "no answers" regarding food intake of the previous day and the last 7 days varies between 5.0 and 13.0% (Table 2 and 3).

As far as the participation in the project is concerned in about half of the classes the project was carried out by teachers in a sufficient way, in 14.9% "insufficiently" and in 33.3% there are no indications as to why the forms were not sent back. Among other hypothetical reasons regarding the latter are that they forgot to send them back because of being too busy at the end of the school year but also that they were reluctant to confess not to have carried out the project or having done so insufficiently. Consequently the quota of students participating in the project in an insufficient way would be higher than 14.9%.

Our nutrition education project seems to provide contradictory results (Table 4):

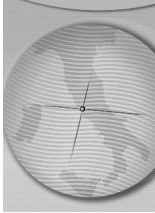
- 1) An increase of number of subjects having breakfast (only 8.2 % in the exit survey declared

Table 1. Family condition of the students (306) in percent

	%
Fourth-graders	65,4
Fifth-graders	34,6
School education of the mother	
Primary	26,8
Middle	34,0
A-level	18,0
Degree	7,2
No answer	14,1
Profession of the mother	
Entrepreneur – freelance professional	
Self-employed person	4,2
Manager - office-worker (also armed forces)	7,2
Employee	13,7
Unemployed	1,6
Housewife	69,9
Retired	0
No answer	3,3
School education of the father	
Primary	21,9
Middle	37,6
A-level	17,3
Degree	8,5
No answer	14,7
Profession of the father	
Entrepreneur – freelance professional	6,5
Self-employed person	12,4
Manager - office-worker (also armed forces)	11,1
Employee	58,2
Unemployed	4,6
Housewife	2,6
Retired	0
No answer	4,6

not having had breakfast). This improvement was verified as well for the group having carried out the didactic itinerary in a sufficient way ($p < 0,000$) as for the group having executed it insufficiently (with a reduced "p" but still of a 0.025 significance);

- 2) An increase in bread and biscuit intake for breakfast, however, only in the group having implemented the project sufficiently. In this group there was also a reduction (but not significant) of snack intake which was not verified in the group with "insufficient execution";
- 3) The number of students consuming snacks the previous day decreased in both groups.
- 4) In the group with "sufficient execution" the intake of all kinds of food during the last 7 days increased; in the group with "insufficient execution" only the intake of fish increased significantly while vegetable intake decreased in a non-significant way.



Discussion

Our research confirmed that a substantial percentage of children do not demonstrate correct nutritional intake and therefore nutrition education interventions are more opportune and necessary than ever [2, 3].

A nutritional education intervention based on active didactic methodologies and conducted by

increase is in line with the objectives of the intervention in terms of fish, vegetables and pulses then it contradicts those regarding meat and salami. This development depends more than likely on the increase of the percentage of non-responding subjects (between 17.0 and 29.0%): probably a lot of students did not mark a - response to indicate that they did not eat it thus

Table 2. Food consumed during breakfast (306) and the previous day in percent

Breakfast							
Portion	0	1	2	More than 2	Yes	No answer	Total
	%	%	%	%	%	%	%
Food							
Milk	37,9	57,5	2,6	2,0	62,1	0	100
Bread	71,9	15,7	7,2	5,2	28,1	0	100
Snack	68,3	21,9	8,5	1,3	31,7	0	100
Juice	88,9	8,5	2,3	0,3	11,1	0	100
Eggs	92,8	3,3	3,9	0	7,2	0	100
Sweets	89,8	5,6	2,3	2,3	10,2	0	100
Other	99,0	0,3	0,7	-	1,0	0	100
	0	1	More than 1	-	Yes		
Coffee	91,8	7,5	0,7	-	8,2	0	100
	0	1-4	5-6	More than 6	Yes		
Biscuits	66,7	21,2	5,2	6,8	33,3	0	100
Previous day							
Portion	0	1	More than 1	Yes	No answer	Total	
	%	%	%	%	%	%	%
Food							
Meat	34,6	17,0	36,6	5,9	59,5	5,9	100
Fish	68,6	5,6	9,5	3,6	18,7	12,7	100
Pulse	61,4	6,9	17,0	2,9	26,8	11,8	100
Vegetables	46,7	18,3	16,3	7,5	42,1	11,2	100
Cold meats and salami	48,0	14,7	17,3	8,5	40,5	11,5	100
Portions	0	1-2	3	More than 3	Yes	No answer	Total
Snack	32,0	49,1	4,9	3,3	57,3	10,7	100

Table 3. Food intake and amount of portions consumed during the previous week (306) in percent

Portion	0	1	2	3	4	More than 4	Yes	No answer	Total
	%	%	%	%	%	%	%	%	%
Food									
Fish	43,5	33,3	10,5	3,3	4,2	-	51,3	5,2	100
Pulse	32,7	25,8	17,3	10,8	7,8	-	61,7	5,6	100
Vegetables	34,6	27,1	19,9	6,9	1,6	3,6	59,1	6,2	100

teachers (properly trained and supported by a text containing information about nutrition, a detailed didactic programme, specific didactic material and a single meeting with a physician or dietician in class) is efficient with regards to the modification of some nutrition habits in the short term, in particular to having breakfast in the morning and in eating less snacks. Other results were not convincing, for example, the increase in the intake of all kinds of food regarding the

previous day in a significant way as reported in the group with "sufficient execution", if this

causing a general increase of the percentage in relation to those responding with "Yes". The phenomenon could have been caused by the greater hurriedness in which the exit questionnaire was filled in (a hurriedness noticed also by the doctors handing it out). There are doubts concerning the real correspondence between what was responded to the question "How many portions of these food have you eaten during the last 7 days?" and reality. Doubts that have been confirmed by matching the answers given to this question and those regarding the

Table 4. Modification of nutrition habits regarding the food consumption of breakfast, the previous day and the previous week in relation to the evaluation (278)

Breakfast									Total				
	Sufficient				Insufficient								
Food	=	□	□	p	=	□	□	p	=	□	□	nv	p
Breakfast	176	35	5	0,000	42	5	15	0,025	218	40	20	0	0,010
Milk	106	63	47	ns	30	11	21	ns	136	74	68	0	ns
Bread	123	55	38	0,04	29	14	19	ns	152	69	57	0	ns
Biscuits	90	77	49	0,02	31	16	15	ns	121	93	64	0	0,044
Snack	104	49	63	ns	34	14	14	ns	138	63	77	0	ns
Juice	163	31	22	ns	47	10	5	ns	210	41	27	0	ns
Coffee	172	25	18	ns	47	10	5	ns	219	35	23	1	ns
Eggs	185	15	16	ns	50	6	6	ns	235	21	22	0	ns
Sweets	159	31	26	ns	51	6	5	ns	210	37	31	0	ns
Other	205	3	3	ns	61	1	0	ns	266	9	3	0	ns
Previous day									Total				
	Sufficient				Insufficient								
Food	=	□	□	p	=	□	□	p	=	□	□	nv	p
Meat	60	83	42	0,003	15	19	17	ns	75	102	59	42	ns
Fish	86	43	27	0,02	22	6	4	ns	108	49	31	90	0,041
Pulse	64	59	31	0,003	18	14	8	ns	82	73	39	84	0,011
Vegetables	52	78	35	0,000	15	13	10	ns	67	91	45	75	0,005
Cold meats and salami	54	72	37	0,001	12	15	13	ns	66	87	50	75	0,019
Snack	63	52	86	0,003	16	7	28	0,002	79	59	114	26	0,003
Previous week									Total				
	Sufficient				Insufficient								
Food	=	□	□	p	=	□	□	p	=	□	□	nv	p
Fish	48	101	34	0,000	14	24	11	0,030	62	125	45	46	0,000
Pulse	39	109	48	0,000	13	20	16	ns	52	129	56	41	0,000
Vegetables	38	113	39	0,000	4	19	24	ns	42	132	53	51	0,000

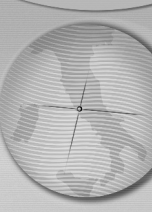
Legend: ns: not significant; nv: not valuable; p: significance ($\leq 0,05$)

food intake of the previous day. The 5.6% of students for fish, 4.1% for pulse and 8.7 for vegetables declared to have consumed these foods the previous day, but not to have consumed them the previous week. The data related to the previous day are considered to be more reliable because it is likely that a person (particularly a child) does not remember what he or she ate 5, 6 or 7 days ago while it is more unlikely not to remember what you ate the previous day.

A thorough review of the research on the effectiveness of health education interventions concludes that the effectiveness of nutrition education interventions has been demonstrated in terms of the successful increase in fruit and vegetable intake and the reduction of fat (thus also of snacks) whereas a reduction of salt and protein intake has not been demonstrated. This review does not take the habit of having breakfast into consideration (maybe because this habit is more established in the Anglo-Saxon countries than in Italy). Our results are in line with these conclusions.

The evaluation of effective nutrition behaviour in the healthy population and particularly in the healthy population of children shows notable objections. The execution by means of questionnaires filled in by children themselves show possible distortion caused by those administering the questionnaire (teachers or operators of the educational intervention can also influence the answers unwillingly), by the setting (the collective administering in the classroom bears the risk of uniform answers if the person handing out the questionnaire is not particularly alert), by the possible tiredness of the children if the questionnaire is too long, by the risk that the student does not recall what he ate or does not tell the truth (in order to please the teacher or the person administering or the thrill of being disobedient).

We tried to control these factors as far as possible (administering by external subjects being conscious of the necessity of a severe evaluation and specifically trained, the questionnaire containing only a few questions all being closed



ones, instructions how to fill it in correctly etc.) but maybe we would have to emphasize more that in the case of food not being eaten the respective square is to be marked by a cross to indicate this and provide a further training meeting for the staff responsible for the administering of the questionnaire in May to remind them of a rigorous administering regarding the exit questionnaire as well.

Our research shows that not all teachers involved in the project of health education carried it out in a sufficient way even if they had signed the obligation form (in this case signed by the director of the school), participated in a training course and had been provided with all of the didactic material and necessary information regarding its use.

This quota is not negligible and therefore it is necessary not to restrict oneself to a summary evaluation of the success of the project but to distinguish between the students who really participated in the educational itinerary and those who did not or who did in an insufficient way in order to examine the grade of project execution (that is an index of the possibility of its execution) and if the educational intervention as designed (i.e. in its entirety) was effective or not. Many researches on the effectiveness of health education interventions that were executed in a school environment and where the teacher was provided with a key role did not make such discriminations thus undervaluing the real effectiveness of the planned project.

References

- 1) WHO (2003): Diet and physical activity: a public health priority. Available from www.who.int/hpr/nutrition/ExpertConsultationGE.htm. [Accessed December 12, 2007].
- 2) Guide Lines National Plain: health education to promote a safety nutrition: Recommendation. Available from <http://www.pnlg.it/tskfr/cap56.php>. [Accessed December 12, 2007].
- 3) National Institute of Food and Nutrition Research (2003), Guide Line for a safety nutrition. Available from http://www.inran.it/servizi_cittadino/stare_bene/guida_corretta_alimentazione [Accessed December 12, 2007].
- 4) Perez-Rodrigo C, Aranceta J. Nutrition education in schools: experiences and challenges. *Eur J Clin Nutr* 2003; 57:582-5.
- 5) Walter HJ, Hofman A, Vaughan RD, Wynder EL. Modification of risk factors for coronary heart disease. Five-year results of a school-based intervention trial. *N Engl J Med* 1988; 318: 1093-100.
- 6) Kelder SH, Perry CL, Lytle LA, Klepp KI. Community-wide youth nutrition education: long-term outcomes of the Minnesota Heart Health Program. *Health Educ Res* 1995;10:119-31.
- 7) Resnikow K, Davis M, Smith M, Lazarus-Yaroch A, Baranowski J, Doyle C, Wang DT. How best measure implementation of school health curricula: a comparison of three measures. *Health Educ Res* 1998;13:239-50.
- 8) Ritchie A. Nutrition education and promotion in primary schools. *Aust J Holist Nurs* 2001;8:39-44.
- 9) Contento IR, Balch G, Bronner YL, Lytle LA, Maolney SK, Olson CM. The effectiveness of nutrition education and implications for nutrition education policy, programs and research: a review of research. *JNEB* 1995; 27:277-422.
- 10) Contento IR, Randell JS, Basch CE. Review and analysis of evaluation measures used in nutrition education intervention research. *JNEB* 2002;34:2-25.
- 11) Lister-Sharp D, Chapman S, Stewart-Brown S, Sowden A. Health promoting schools and health promotion in schools: two systematic review. *Health Technol Assessment* 1999;3:22-4.
- 12) Working group on health education: "Four-leaved Project-Guide to the teachers" Naples: Municipality of Naples Education Assessorship, 1998.
- 13) Giordan A. Una didattica per le scienze sperimentali. [A Didactic for experimental science]. Roma: Armando, 1981.
- 14) National Institute of food and nutrition research (INRAN). Handbook of nutritional surveillance. Roma: Zesi s.r.l., 2003.