Health and Nutrition Education in Elementary Schools: Changes in health knowledge, nutrient intakes and physical activity over a six year period

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Abstract

Objective: To examine the effects of a health and nutrition intervention, implemented in primary schools of Crete, on health knowledge, nutrient intakes and physical activity of the intervention population.
Methods: The intervention group consisted of 24 schools while the control group consisted of 16 schools. The overall duration of the intervention was six years, while the topics of the intervention primarily focused on children' dietary habits, physical activity and fitness.
Results: After the completion of the intervention period, the changes observed in health knowledge, nutrient intakes and physical activity were in favour of the intervention group pupils.
Conclusion: The encouraging findings of the study indicate the potential of the programme in health promotion and disease prevention without involving substantial new school resources and time.

Keywords
Children
Health education
Nutrients
Physical activity

Background

Greece has one of the most rapidly rising death rates due to cardiovascular diseases (CVD), which now constitutes the primary cause of morbidity and mortality[1]. This trend has been attributed mainly to dietary and smoking habits, sedentary lifestyle and limited health awareness of contemporary Greeks[1,2]. However, both the physiological precursors of CVD[3] as well as the behavioural patterns[3] related to the development of the disease have their roots in childhood. The accumulative evidence on the preventive potential of school-based health and nutrition education programmes[4] has lead the Preventive Medicine and Nutrition Clinic of the University of Crete to design and implement such a programme in Greek primary schools.

Methods

Subjects

The population of the intervention group comprised of all 4171 children registered in the first grade of primary schools throughout two counties of Crete in September 1992 while all of 1510 children registered in a third county served as the control group. A random sample of 24 schools (602 pupils) in the intervention counties of Iraklio and Rethymno were selected in order to assess the effectiveness of the programme. Similarly, 16 schools (444 pupils) in the county of Hania, having no health and nutrition intervention, were selected for comparative evaluation purposes.

School-based health education implementation

The health profile component of the "Know Your Body" school health promotion programme of the American Health Foundation[5] was adapted, modified and supplemented to suit our population. Both the "Know Your Body" study and the current study have been based on the Social Learning Theory model. This model proposes that human behaviour is the result of the interaction and cumulative impact of personal, environmental and behavioral characteristics. Multicomponent workbooks covering mainly dietary issues, physical activity and fitness, but also dental health hygiene, smoking, drinking and accident prevention were produced for Grades 1–6 with each pupil being supplied a workbook per year.

The health and nutrition components of the programme were conducted by the class teacher and incorporated 13–17 h of classroom material annually. The physical fitness and activity component of the programme, had a practical and a theoretical part (4–6 h of classroom material per year), and both were delivered by physical education instructors during the two 45 min physical education sessions per week

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scheduled in the curriculum. Details regarding the theoretical framework on which the design and implementation of the intervention was based on are presented else where[6].

Data collection

Data collection took place during the periods September to November 1992 and May to June 1998. The data obtained from parents, with the use of a questionnaire, was related to their personal characteristics (age, occupation, years of education etc.) and their health habits and health knowledge[7], while some of the data obtained from children is presented in more details below.

Pupils' health knowledge assessment

A multiple-choice questionnaire with colour illustrations was used to assess students' knowledge at the beginning and at the end of the six-year intervention period. The questionnaire focused on diet, food products and advertising, physical activity, smoking hazards and accident prevention[7].

Dietary and physical activity assessment

Parents completed a food frequency questionnaire regarding their children's weekly consumption of various foods. A three day weight food record[10] was obtained in a random sample ($n = 176$) of children and the data are presented here.

Children's physical activity during leisure time was assessed using a questionnaire based structured activity interview[8].

Statistical analysis

The effects of the programme were analysed by mixed model analyses estimating the changes in the measured variables in the two groups over the six year period, taking account of possible inter-school variation by including the random school effect in the model. Adjustments were made for baseline values, sex, parental education levels and initial BMI (having checked the lack of interaction assumption). The assumption of equality of the error variances in the main-effects model was tested in each case by applying Levene's test.

Results

The number of subjects presented in the tables was restricted to those subjects with repeated measurements and available covariates.

Regarding health knowledge scores, intervention group pupils improved significantly compared to the control group ($P < 0.0005$), while no differences were observed between parents in the two groups (Table 1). The daily energy intake as well as the intake of monounsaturated, polyunsaturated and saturated fatty acid and protein, were increased significantly more in the control group pupils compared to the intervention group (Table 2).

Regarding physical activity, intervention group pupils increased their leisure time physical activity from 1 h per week, at the age of six, to about 5.5 h per week at the age of 12. The pupils in the control group, although slightly more active at baseline, reported leisure time physical activity at re-examination which was about 4 h per week (Table 3).

Discussion

The positive outcomes of the six years of intervention, regarding the indices presented in the current article, could be attributed to two main factors: (a) the high parental participation in the intervention programme and (b) the reorganization and expansion of the health and physical education curriculum of the schools participating in the intervention group allowing more hours of intervention.

Parental involvement was an integral design feature of the program and a unique element of this study may have been the way the study itself engaged the parents in the intervention. In addition to the worksheets that the children completed at home with parental collaboration and the health promotion leaflets handed to parents, specific seminars for parents were an important means used to encourage participation. A motivational factor that contributed to this high turn-out was the fact that the medical and biochemical findings pertinent to the children were not mailed to parents but were handed to them during these seminars. The seminars also provided the opportunity

Table 1 Health knowledge scores at baseline and re-examination 6 years later

Total scores (% correct responses)	Group*	Baseline Mean (SD)	Follow-up Mean (SD)	Change + Mean (SE)	*P* value
Pupils	I	67.0 (10.2)	77.2 (8.8)	9.5 (0.5)	< 0.0005
	C	70.4 (9.9)	73.3 (8.2)	3.7 (0.5)	
Parents	I	62.3 (15.0)	70.4 (14.2)	6.6 (0.8)	n.s.
	C	63.2 (13.9)	70.1 (11.6)	6.8 (0.9)	

*I indicates intervention (357 pupils and 255 parents) and C control (272 pupils and 252 parents).
The *P* value compares I to C.

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Table 2 Pupils' daily nutrient intakes at baseline and re-examination 6 years later

	Group*	Baseline Mean (SD)	Follow-up Mean (SD)	Change + Mean (SE)	*P* value
Energy (kcal)	I	1843 (434)	1991 (530)	179 (66)	< 0.05
	C	1845 (438)	2190 (520)	367 (58)	
Total fat (g)	I	87.0 (23.9)	92.0 (30.5)	5.9 (4.0)	< 0.01
	C	86.8 (25.0)	103.9 (31.7)	18.8 (3.5)	
Monounsaturated Fatty acids (g)	I	36.2 (11.6)	39.1 (15.3)	2.7 (2.0)	< 0.05
	C	36.9 (12.6)	44.2 (16.1)	8.7 (1.7)	
Polyunsaturated Fatty acids (g)	I	9.7 (3.3)	10.8 (4.2)	1.0 (0.5)	< 0.005
	C	9.4 (3.0)	11.3 (4.3)	2.0 (0.5)	
Saturated Fatty acids (g)	I	31.2 (9.1)	31.3 (10.3)	0.8 (1.3)	< 0.01
	C	30.6 (9.1)	35.6 (10.9)	5.1 (1.2)	
Trans Fatty acids (g)	I	1.5 (0.8)	2.1 (1.4)	0.8 (0.1)	n.s.
	C	1.6 (0.9)	2.1 (1.2)	0.7 (0.1)	
Protein (g)	I	62.9 (17.8)	70.7 (21.4)	11.2 (2.7)	< 0.05
	C	63.4 (17.8)	79.7 (21.7)	16.9 (2.4)	
Carbohydrate (g)	I	203.9 (57.6)	224.9 (66.0)	23.4 (7.8)	n.s.
	C	202.0 (52.0)	239.5 (59.2)	37.7 (6.8)	

*I indicates intervention (90 pupils) and C control (86 pupils).
The *P* value compares I to C.

for parents to ask questions regarding these results and the programme in general.

Re-organization and expansion of the health and physical education curriculum of the schools in the intervention group was central to the programme. The combination of health and nutrition education with physical education classes was designed to optimize the effects of both the physical activity and fitness and the classroom components of the programme. Overall, during all the years of intervention, the programme provided at least 45–50 h of intervention activities annually, mainly on nutrition, physical activity and fitness.

The results of the study in terms of the effects of the programme on children's health knowledge gains can be attributed primarily to the classroom based health education curriculum. These findings are in agreement with the findings of other health and nutritional education studies with parental involvement[9] or without parental involvement[10] as well as with studies that combined nutrition education with promotion of physical activity and fitness[5,11].

Though gains in health knowledge are the most common target, behavioural change is perhaps the ultimate objective of health education programmes and arguably the most difficult to achieve[12]. The observed changes in children's nutrient intakes point to some positive dietary behavioural changes. This should be attributed mainly to the parental involvement in the program, but also, at least in part, to the provision of 'heart healthy' alternatives in the intervention school tuck shops.

Similarly, the observed significant increase in leisure time physical activity in the intervention group should be partially attributed to parents, insofar as parents in the intervention group were encouraged to allow their children to participate in outdoor activities in the neighbourhood or in organized activity related classes out of school.

The magnitude of changes observed in the current study are greater compared to other studies categorized under the broad term "general nutrition education" programmes[10] and "fitness enhancing" programmes[13,14] where behavioural changes were very small or questionable. The marginal behavioural changes observed in the latest programs could be attributed to the purely cognitive approach of these programmes as compared to the social learning theory

Table 3 Pupils' leisure time physical activity at baseline and re-examination 6 years later

	Group*	Baseline Mean (SD)	Follow-up Mean (SD)	Change + Mean (SE)	*P* value
Leisure time MVPA (mins/week)	I	55 (116)	338 (362)	281 (22)	< 0.05
	C	75 (134)	244 (301)	175 (26)	

*I indicates intervention (287 pupils) and C control (206 pupils).
The P value compares I with C.

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model used in the present study and elsewhere[15,16]. Studies falling in this category, with expanded duration[17] and parental involvement[18], such as the present study, seems to have an extra advantage, since it is known that parents play a primary role and serve to reinforce the development of specific eating and exercising habits in young children.

As many life-long habits have their roots in early childhood, it would seems that intervention measures aiming at establishing appropriate dietary habits and increasing levels of physical activity should be initiated early in life. Interventions, like the present one, provide a useful model for school-based health promotion programs for primary prevention of CVD, without involving substantial new school resources and time[11].

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