

SHORT COMMUNICATION

Health and nutrition education in primary schools of Crete: follow-up changes in body mass index and overweight status

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The current study examines the long-term effects of a school-based 'Health and Nutrition Education programme' on body mass index (BMI) changes and the prevalence of overweight. The intervention group consisted of all pupils registered in the first grade of two counties of the island of Crete in 1992, while all pupils registered in a third county formed the control group. For evaluation purposes, a representative sample was examined at baseline (1992) following the 6-y intervention (1998) and 4 y after the programme's cessation (2002). The data presented here are based on pupils with full anthropometrical data in all three examination periods (284 intervention group pupils and 257 control group pupils). Former intervention group pupils had lower average BMI (by 0.7 kg/m², s.e. 0.28, $P=0.019$) at the 10-y follow-up compared to the control group subjects, while no differences were detected in the prevalence of obesity between the two groups. The findings of the current study indicate that the beneficial effects of the programme on pupils' BMI continue, to an extent, 4 years after its cessation. However, the lack of significant differences in the prevalence of overweight between the two groups indicates that the effects of the intervention may not be equally distributed in the population, with greater effects in certain subgroups and less or none in others. *European Journal of Clinical Nutrition* advance online publication, 6 July 2005; doi:10.1038/sj.ejcn.1602216

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Introduction

Obesity constitutes the most frequent nutrition-related condition affecting children and adolescents (Lobstein *et al*, 2004) while available data indicate that increased body weight during childhood predisposes a person to adult obesity (Eriksson *et al*, 2003). Consequently, development of a healthy lifestyle early in life seems to be a promising way to counteract adult obesity (Lobstein *et al*, 2004). In order to

treat or prevent childhood obesity, various intervention schemes, focusing either on obesity alone or on several cardiovascular disease risk factors, have been tested so far. The results are mixed (Puska *et al*, 1982; Tell, 1987; Walter *et al*, 1988; Resnicow *et al*, 1992; Luepker *et al*, 1996; Story, 1999; Campbell *et al*, 2001; Muller *et al*, 2001; Manios *et al*, 2002a; Neumark-Sztainer *et al*, 2003). Although most of these studies are not directly comparable due to differences in study design, the most effective programmes seem to be those implemented in the school setting, which include a home component and parental involvement (Walter *et al*, 1988; Resnicow *et al*, 1992; Muller *et al*, 2001; Manios *et al*, 2002a). Although the short-term benefits of these programmes are encouraging, it should not be neglected that the success of such interventions are best judged on the basis of the long-term tracking of the benefits achieved over the intervention period into adolescence or adulthood.

A follow-up was undertaken to investigate the long-term outcomes of the intervention 4 y after completion of a 6-y

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duration 'Cretan Health and Nutrition Education Programme' (Manios *et al*, 2002a). The current paper presents the preliminary data of the follow-up examination focusing on body mass index (BMI) changes and the prevalence of overweight in the intervention and control group.

Subjects and methods

Programme's implementation and evaluation

The 'Cretan Health and Nutrition Education programme' was initiated in September 1992 with the approval of the Greek Ministry of Education and had a total duration of 6y following the same children from the first grade to the sixth grade. The population of the intervention group was comprised by the total number of children registered in the first grade in two counties of the island of Crete while those registered in a third county served as the control group. More details on the programme structure and implementation can be found elsewhere (Manios *et al*, 1998, 1999).

For evaluation purposes, a random sample of 24 schools (602 pupils and their parents) in the intervention counties and 16 schools (444 pupils and their parents) in the control county were selected for comparative purposes. Both intervention and control pupils and their parents were examined at base line (academic year 1992–1993) and at the end of the 6y intervention period (academic year 1997–1998). The final re-examination of both groups took place 4y after programme's cessation (academic year 2001–2002) and when pupils were at the tenth grade. The data presented in the current paper are based on those pupils having full data in all three examination periods (284 pupils from the intervention schools and 257 from the control schools). The parental information was obtained at baseline while pupils' anthropometrical indices were obtained in all three examination periods following the same protocol procedure (Manios *et al*, 1998, 1999). The classification of children as overweight and obese is based on IOTF cut off points (Cole *et al*, 2000). For the needs of the current paper, overweight and obese children have been grouped together.

Statistical analysis

Multiple linear regression was performed to assess long-term effects of intervention on BMI, adjusting for possible

differences in parental education, baseline BMI and school. Proportions overweight in intervention and control groups were compared at each examination using the normal approximation to the binomial distribution. SPSS 12.0 (SPSS Inc., TX, USA) software was used.

Results

Mean BMI values in intervention and control group children are presented by year of examination in Table 1. Former intervention group pupils had lower average BMI at the 4y follow-up after the end of the intervention programme; intervention group children had on average 0.7 kg/m² (s.e. 0.28) lower BMI than control group children ($P=0.019$), after controlling for gender ($P=0.024$), baseline BMI values ($P<0.001$) and parental education status ($P=0.60$). The proportions of boys and girls classed as overweight, however, did not differ significantly between intervention and control groups at any examination (Table 2). Also, intervention status was not found to significantly influence the odds of being overweight 4y after follow-up using multivariable analysis with odds ratio 0.84 for intervention group children vs controls (95% CI 0.52–1.35). Intra class variation within school was calculated and no significant differences were found in baseline BMI levels ($P=0.4$) and BMI changes throughout follow-up examination ($P=0.10$).

Table 2 Percentages of boys and girls overweight in 1992, 1998 and 2002 by intervention status^a

| | Boys (n = 263) | | Girls (n = 278) | |
|--|------------------------|-------------------|------------------------|-------------------|
| | Intervention (n = 151) | Control (n = 112) | Intervention (n = 133) | Control (n = 145) |
| Baseline examination (1992) | 18.5% | 18.8% | 23.3% | 26.9% |
| End of intervention examination (1998) | 32.5% | 36.6% | 27.8% | 37.2% |
| Follow-up examination (2002) | 33.1% | 42.0% | 24.1% | 25.5% |

^aOnly children with BMI measurements taken at each examination were included ($n=541$). Proportions overweight were compared with within each gender and year of examination but no differences between intervention and control groups were found to be significant at the 5% level.

Table 1 Unadjusted average BMI scores for male and female subjects by intervention status at baseline, at the end of the intervention period and at follow-up^a

| | Boys (n = 263) | | Girls (n = 278) | |
|--|------------------------|-------------------|------------------------|-------------------|
| | Intervention (n = 151) | Control (n = 112) | Intervention (n = 133) | Control (n = 145) |
| Baseline examination (1992) (age in years = 6.3 ± 0.3 y) | 16.3 (0.17) | 16.3 (0.23) | 16.1 (0.18) | 16.2 (0.18) |
| End of intervention examination (1998) (age in years = 11.4 ± 0.3 y) | 19.8 (0.29) | 20.6 (0.41) | 19.5 (0.32) | 20.2 (0.32) |
| Follow up examination (2002) age in years = 15.3 ± 0.4 y) | 22.6 (0.34) | 23.7 (0.45) | 21.7 (0.32) | 22.6 (0.34) |

^aOnly children present at each examination were included ($n=541$). The data presented are unadjusted means and standard errors.

Discussion

To our knowledge, no follow-up data are available from the large (Walter *et al*, 1988; Luepker *et al*, 1996) and smaller studies in the literature (Walter *et al*, 1988; Resnicow *et al*, 1992; Story, 1999; Campbell *et al*, 2001; Muller *et al*, 2001; Neumark-Sztainer *et al*, 2003) where approaches similar to the current intervention have been used. The CATCH study might be the only exception, where a 5 y follow-up was undertaken primarily looking at effects of the intervention on school food services (Osganian *et al*, 2003) and the Physical Education classes (McKenzie *et al*, 2003) offered by the former intervention schools.

The preliminary findings of the current study indicate that the beneficial effects of the 'Health and Nutrition Education Programme' on pupils' BMI continue, to an extent, 4 y after its cessation. Children in the intervention group were found to have lower BMI on average, than control group children ($P=0.019$, Table 1). When looking at the programme's outcomes, from the perspective of overweight prevalence, although the rates are lower for the intervention group particularly for boys, no significant differences were detected between the two groups (Table 2). A possible explanation for the significant differences in average BMI but none in the proportions overweight may lie in the extremes of the BMI distribution.

The current findings should not be judged independently of the high prevalence rates of overweight among adolescents in Greece as observed in this Cretan population and also in a population in Central Greece of similar age, where the prevalence rates were found to be similar to or higher than the control group of the current study (42.3% for boys and 32.4% for girls) (Manios *et al*, 2002b). The fact that the prevalence of overweight adolescents in Greece seems to be among the highest in the world (Lobstein & Frelut, 2003) underlines both the need of such intervention programmes but also partially explains the observed effects of the intervention on average BMI values since the current situation leaves significant space for improvement (Lytle *et al*, 2002; Manios *et al*, 2002a). The current findings indicate that the effects of the intervention may not be equally distributed in the population with greater effects in certain subgroups, such as females, and less or none in others. Further analysis of the data will try to focus and provide some insights on the observed outcomes of the intervention programme.

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