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ORIGINAL ARTICLE

Obesity and overweight. An assessment of the effectiveness of a public health intervention☆

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Received 18 June 2013; accepted 26 August 2013

KEYWORDS
Child;
Adolescent;
Obesity;
Overweight
Body mass index

Abstract
Introduction: The prevalence of excess weight (obesity and overweight) is increasing in developed countries, with preventive measures not shown to be sufficiently effective. The aim of this study was to investigate the effectiveness of the sustained prevention and treatment by Primary Care Paediatrics of overweight from early childhood.
Material and methods: The BMI of 1669 patients from two Paediatric Teams were compared using four different age intervals between 4 and 14 years during 2007-2009. One of the teams had spent 15 years carrying out a systematic strategy aimed at the prevention and monitoring of overweight.
Results: The BMI means in this study were higher than those shown in the 1988 Orbegozo tables, particularly in older ages and in males. The prevalence of overweight was lower in the population with the systematic intervention team, and this was significant at the end of the paediatric age, 14 years (P = .043).
Conclusions: The overweight problem is so great that the measures aimed at its prevention are clearly beyond the scope of health professionals. However, interventions by health professionals can be effective in maintaining a healthy weight, if they are carried out on an ongoing basis.

☆ Please cite this article as: Txakartegi Etxebarria X, López Mateo M, Aurrekoetxea J.J. Obesidad y sobrepeso. Aproximación a la efectividad de una intervención sanitaria. An Pediatr (Barc). 2014;80:379-386.

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2341-2879/
http://dx.doi.org/10.1016/j.anpede.2013.08.002

PALABRAS CLAVE
Niño;
Adolescente;
Obesidad;
Sobrepeso;
Índice de masa corporal

Obesidad y sobrepeso. Aproximación a la efectividad de una intervención sanitaria

Resumen
Introducción: La prevalencia del exceso de peso (obesidad y sobrepeso) se incrementa en los países desarrollados sin que las medidas preventivas se muestren lo suficientemente efectivas. El objetivo de este estudio era investigar la efectividad de la prevención y el tratamiento del exceso de peso desde la primera infancia de forma sostenida desde atención primaria de Pediatría.
Material y métodos: Se compararon los IMC de 1669 pacientes de dos equipos de Pediatría, mediante cortes transversales a 4 intervalos de edad entre los 4 y 14 años, durante el trienio 2007-2009, de la localidad de Gernika-Lumo, donde uno de los cuales lleva 15 años realizando una estrategia sistemática encaminada a la prevención y seguimiento del exceso de peso.
Resultados: Las medias de IMC en este estudio fueron superiores a las de las tablas de Orbegozo de 1988, sobre todo en las edades superiores y en varones. La prevalencia del exceso de peso fue menor en la población del equipo con intervención sistemática, siendo esta significativa al final de la edad de atención pediátrica; 14 años ($p = 0,043$).
Conclusiones: El problema del exceso de peso es de tal magnitud que las medidas encaminadas a su prevención exceden claramente el ámbito de los profesionales de la salud. Sin embargo, las intervenciones de los profesionales de la salud pueden ser efectivas para mantener un peso saludable siempre que sean realizadas de forma continuada.

Introduction

Obesity, described by the World Health Organization (WHO) as the epidemic of the twenty-first century, is the most common nutritional disorder among children and adolescents in developed countries.[1]

In Spain, the Paidos study (1984) showed an obesity prevalence of 4.9% in children of both sexes between the ages of 6 and 15.[2] The enKid study (1988-2000) showed a 13.4% prevalence of obesity and 12.4% of overweight,[3] with lower figures for both in our autonomous community (the Basque Country).[4] In the ALADINO study (2010-2011; preliminary results), prevalence between the ages of 6 and 9.9, using the WHO tables, was 18.3% and 26.2% for obesity and overweight respectively, giving a prevalence for excess weight (EW), defined as the sum of both, of 44.5%.[5]

Nowadays the strong link between childhood and adolescent obesity, its persistence in adult life, and an increase in risk factors for cardiovascular, metabolic, gynaecological, psychiatric and other diseases is well known and is confirmed by the leading clinical practice guidelines.[6-13]

Preventive interventions against EW (overweight plus obesity) proposed in the Spanish Ministry of Health and Social Policy's Clinical Practice Guidelines (CPG) for 2010 involve promoting actions at school, in the health service, community and family, aimed at avoiding unhealthy dietary habits and encouraging physical activity inside and outside school.[14] The results of the studies cited in this CPG present low-to-moderate levels of evidence, limited in many cases to the period of the intervention, and strengths of recommendation rated B and C. Only breastfeeding has a grade A recommendation strength. However, the Clinical Guidelines of the UK's National Institute for Health and Clinical Excellence conclude that ongoing interventions by primary health care professionals focusing on diet and/or physical exercise are effective for maintaining a healthy weight, and even though some of them do not lead to improvements in weight, they do achieve positive changes in diet and physical exercise.[15]

Interventions for the treatment of EW proposed in the Spanish CPG also have grade B and C recommendation strengths.[14] The most effective are combined measures in which changes are recommended in diet, exercise and behaviour, with family involvement, to achieve weight loss in boys and girls aged from 6 to 16 with EW (recommendation strength B).[7,14-16]

Objectives

The aim of this study was firstly to assess the scale of the problem of EW in patients of paediatric age under the care of two paediatric teams in a municipal area, and secondly to evaluate an initiative carried out by one of the teams compared with the other in EW prevention and monitoring.

Material and methods

Population and sample

The municipality of Gernika-Lumo has a single health centre (HC), run by the Basque Health Service Osakidetza. It includes a primary care unit which mainly serves the population of that town, with two paediatric teams comprising a paediatrician and a nurse, with some 1,200 children randomly assigned to each team. The population is predominantly urban, in a town with strong industrial and service sectors and a primary sector which, despite

Table 1 Measures implemented by Team 1 in 1996 to prevent excess weight, 1988.

General measures	Recommend all schools to discontinue celebrating birthdays at school with food Recommend school head teachers to offer mid-morning fruit instead of cereals (biscuits) at least two days per week
Individual measures (systematically adopted in Team 1)	*1.* Set family mealtimes and recommend adherence
	2. Recommend 5 meals per day
	3. Underline the importance of breakfast and advise offering a dairy product, cereal and a piece of fruit
	4. Recommend not to use any food as a reward for the child
	5. Discontinue all intake outside the recommended 5 meals
	6. Recommend offering water to drink and discontinue fizzy drinks and packaged fruit juices.
	7. Recommend sport
	8. Recommend walking instead of using motor vehicles: "Life on Foot"
	9. Limit time spent watching television to less than 2 hrs on schooldays and less than 4 hrs at weekends and during holidays
	10. Reinforce measures previously adopted: promote breastfeeding, postpone the introduction of solids to 6 months ….

Table 2 Measures implemented by Team 1 in 1996 to monitor excess weight.

1. Appointments with nurse at varying intervals according to degree of OW/OB, age at onset and evolution, to emphasise the points mentioned and monitor anthropometric data
2. Appointments with paediatrician at varying intervals according to the same parameters, generally one appointment for every two with the paediatric nurse
3. Annual blood pressure check
4. Blood test with lipid profile (just once if results are normal) in cases of serious obesity, family history of lipid abnormalities, hypertension or unfavourable evolution.
5. Referral to Paediatric Endocrinologist in the event of serious obesity with unfavourable evolution.
6. Referral to Child Psychiatric Unit in the event of suspected or evident concomitant psychiatric disorder

favourable local conditions, has become a minority activity since the 1960s.

One of the teams (T1) has remained very stable and has developed preventive initiatives since 1995, at a community and individual level at the health centre, monitoring EW in children (Tables 1 and 2). The other team (T2) has undergone many changes, in terms of the assigned doctor (10 different professionals) and nurse (4), and has not followed any particular protocol for individual prevention or monitoring of EW.

Table 3 shows the number and percentage of children who attended the Child Health Plan[17] check-ups at ages 4, 6, 10 and 14 compared with the total population for these ages assigned to each team during the three-year period 2007-2009.

Study design

The study aimed to assess the effectiveness of a systematic intervention for the prevention and monitoring of EW in one of the paediatric primary care clinics by comparing the results with those from another clinic in the same municipality with no intervention protocol. The information was obtained by taking cross-sectional anthropometric weight and height data from the above-mentioned check-ups during the three-year period 2007-2009. The design of this study is therefore cross-sectional.

Study variables

The anthropometric data referred to above were requested from the computer services department of the Basque Health Service-Osakidetza, as well as data on the paediatric team to which the patient was assigned, sex, birth age, and the date on which the measurements were recorded during the three-year period 2007-2009. No data were available for 14-year-old patients, and these were therefore obtained manually. The stability of the sample was checked to confirm that patients were not transferred between the teams in the period under study.

To perform the measurements, two identical Añó-Sayol scales/stadiometers were used, calibrated weekly by clinic staff and annually by health service maintenance staff. The anthropometric measurements were taken with the patient barefoot, in underwear, standing, with the sagittal axis aligned with the centre line of the stadiometer.

Table 3 Population for each set of paediatric patients, by check-up age group and study sample or paediatric population seen between 2007 and 2009.

Age	Team 1			Team 2			p[a]
	Population	Sample	%	Population	Sample	%	
Age 4	293	262	89.4%	281	211	75.1%	0.161
Age 6	283	259	91.5%	281	226	80.4%	0.297
Age 10	251	224	89.2%	236	176	74.6%	0.185
Age 14	230	176	76.5%	213	134	62.9%	0.188
Total	1057	921	87.1%	1011	747	73.9%	0.012

[a]Chi-squared test.

Study data were obtained from the Child Health Plan[17] check-ups at ages 4, 6, 10 and 14. Since the dates did not coincide, age inclusion criteria were implemented in many cases:

1. Age 4 check-up, age inclusion criterion between 3.5 and 4.5 years.
2. Age 6 check-up, between 5.0 and 6.9 years.
3. Age 10 check-up, between 9.0 and 10.9 years.
4. Age 14 check-up, between 13.0 and 14.9 years.

We excluded children with chronic illnesses that were congenital or acquired in the perinatal period or subsequently, which might have affected weight and/or height development.

The data obtained were compared using the tables published by the Fundación Orbegozo in 1988.[18] In view of the limited size of the sub-samples, we decided just to analyse EW as defined in the preliminary results of the ALADINO study,[5] as the sum of overweight and obesity, which in our case meant a body mass index (BMI) in the 90th percentile or above in these tables, as suggested in the CPG for prevention and treatment of obesity in children and adolescents.[14]

This study was carried out using secondary data previously obtained in clinical practice. The data were anonymised prior to the statistical analysis. The study did not use any personally identifiable data.

Statistical analysis

Means ± standard deviations were used to describe the BMI distribution in the various subgroups. The BMI of the two sets of paediatric patients was compared with the reference population[18] and expressed as the number of standard deviations from the adjusted normal distribution (z-score). We compared differences between the overweight means of the two sets of patients using the Student t test. The odds ratios (OR) of EW prevalence and 95% confidence intervals (95% CI) for probability were calculated, stratified by sex and age. We used the statistical program SPSS version 15.0.1.

Results

The study sample comprised 1,669 children, 921 from T1 (438 girls and 483 boys) and 748 from T2 (354 girls and 394 boys); 8 children met the exclusion criteria described above and were not included. The sample represented 77.6% of the total population registered in the health system at the four data-collection ages. Table 3 compares the sample and target population, stratified by age. A higher rate of adherence to follow-up was observed in T1. The overall mean ages of the four strata studied were 4.1, 6.0, 10.1 and 14.1 years.

Table 4 shows that the mean BMI in the Gernika-Lumo sample was higher than in the population of the Orbegozo study in all age and sex subgroups. No statistically significant differences were observed between the two sets of patients, for each age group, among boys, girls or overall. Figures 1 and 2 show the results of the study sample compared with the reference population, with data more widely dispersed in the former than in the latter.

The prevalence of EW in the total sample studied was 17.9% (95% CI, 16.2-19.8), with 16.6% EW in the population assigned to T1 and 19.5% in that assigned to T2. Table 5 shows the different prevalences by age group, sex and paediatric team. Combining the two teams, we observed a greater prevalence of EW in boys than in girls in all the age subgroups, although the differences were only significant for the age 10 group ($p = 0.005$) (other groups: $p > 0.050$).

Stratifying by age and taking the age 4 group as the reference group for each team, we observed a higher OR for EW prevalence with increasing age. In boys in the age 10 group for both teams and in the age 14 group for T2, the OR was significantly higher than in the age 4 group. In girls, a significantly higher OR was only observed in the age 6 group for T2.

Comparing prevalences at age 4, both in boys and in girls, we observed similar values in both paediatric teams, and also in boys at age 6, and lower prevalences in the higher age groups for T1. The OR for all boys and girls at 14 was significantly lower in T1; OR = 0.55 (95% CI, 0.31-0.99) ($p = 0.043$).

Discussion

A worldwide EW problem exists and it has consequences at physical, psychological, social, employment and public spending levels. The trend towards increasing prevalence[1,19-22] has led many countries to propose belated

Table 4 Mean BMI of the various sub-populations, SD and mean deviation from reference mean (Orbegozo 88), expressed as the number of standard deviations (z-score).

Age	Orbegozo 88		Team 1*						Team 2*					
	Girls	Boys	Girls			Boys			Girls			Boys		
	Mean	Mean	Mean	SD	z	Mean	SD	z	Mean	SD	z	Mean	SD	z
4	16.3	16.2	16.5	1.5	0.2	16.5	1.4	0.2	16.5	1.7	0.1	16.4	1.7	0.2
6	16.5	16.3	16.8	2.0	0.2	16.7	1.9	0.3	17.1	2.5	0.3	17.0	1.9	0.4
10	17.6	17.1	18.2	2.6	0.2	18.5	2.9	0.6	18.3	2.9	0.3	18.9	3.2	0.8
14	20.4	19.4	21.1	3.0	0.3	20.7	2.9	0.5	21.1	3.5	0.3	21.4	3.8	0.7

*p > 0.05 between team 1 and team 2 in each age group, neither in boys nor in girls nor in the both sexes overall (Student t test).
SD: standard deviation; BMI: body mass index.

actions aimed at preventing and treating EW.[6,7,14-16] However, the level of evidence for these actions is modest at best and the benefit is largely limited to the period when studies are being carried out or immediately thereafter.[14] All this seems to indicate that the solution has to come from a higher authority, with effective planning of each and every level on which the problem is treated and, more importantly, prevented at a family, educational, social, audiovisual, advertising and health service level.[7,14-16]

If the systematic application of a childhood EW prevention and treatment programme brought benefits, and the programme were implemented on an ongoing basis, this would be noted in medium-to-long term results, even if they were just moderate.[14,15]

In this study we were comparing two populations. In the first, community and individual preventive actions were taken at health service and family level from the time EW prevalence was observed in children under 10 in 1996. In the same group, treatment/follow-up actions were taken in cases of children with EW or those showing a tendency towards EW. These measures were started when the 14-year-old population in the current study was aged between 1 and 4.[23] For the structural reasons mentioned above, no systematic action, apart from global community actions, was carried out on the other half of the child population (included in T2) in terms of EW prevention or treatment, beyond the non-specific measures for a balanced diet and physical exercise as proposed in the Programme of Preventive Activities and Health Promotion. Furthermore, EW prevalence in that population was unknown, since no kind of survey had ever been conducted.

It is important to discover how effective activities are in HCs so that they can be carried out more or less often and even discontinued if they do not benefit the child

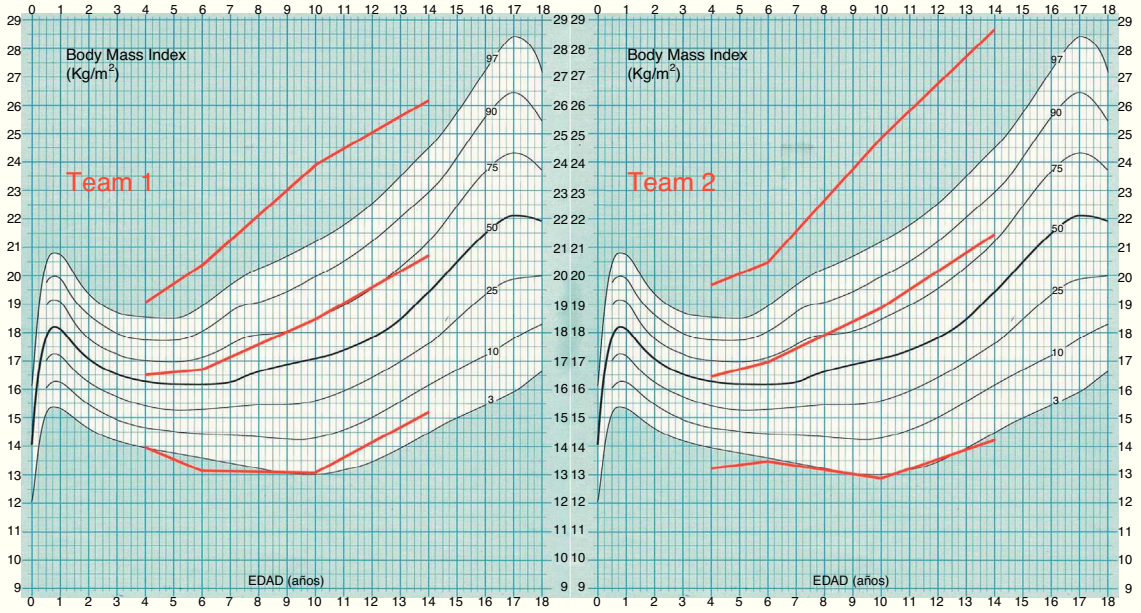

Figure 1 Graph showing the mean ± 1.88 standard deviations for the boys' sample, plotted on the Fundación Orbegozo tables published in 1988.

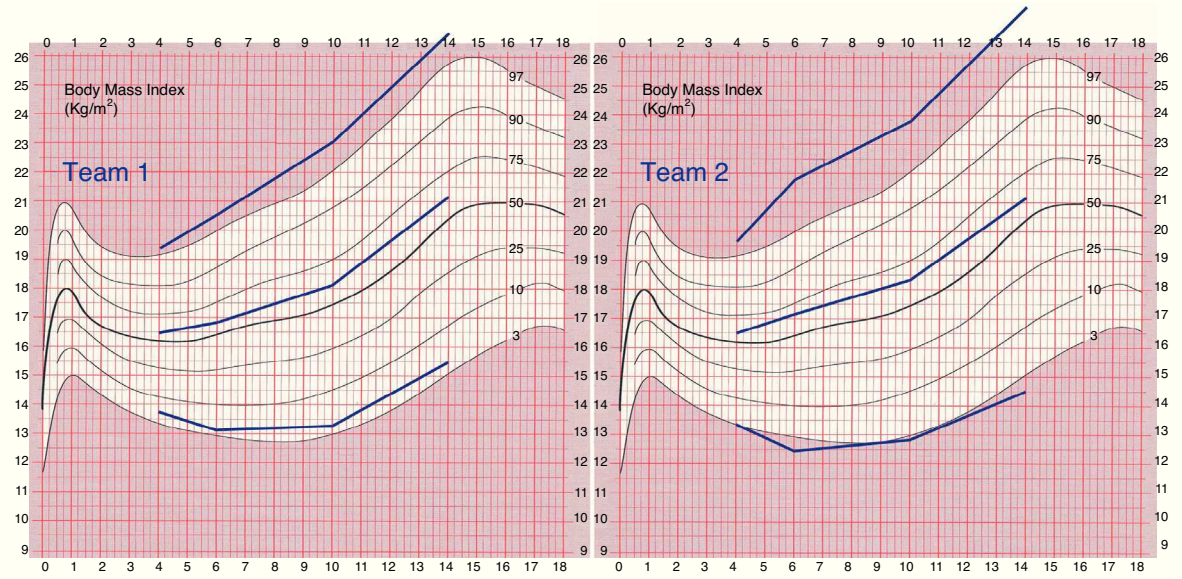

Figure 2 Graph showing the mean ± 1.88 standard deviations for the girls' sample, plotted on the Fundación Orbegozo tables published in 1988.

population, since every medical intervention entails some probability of adverse effects such as stigmatisation and iatrogenesis. The new situation of the HC in Gernika-Lumo led us to investigate whether it is worthwhile for paediatricians in general to adopt measures to minimise the impact of EW on the child population or whether, on the contrary, they are not worth the effort.

The sample size was limited; nevertheless, the number of children studied was large enough to obtain statistically significant results. There was a low rate of attrition in the child health check-ups, around one-fifth in all age groups and a third in the age 14 check-up, the latter being due, as already noted, to data collection issues. There were differences between the rates of attrition for the two

Table 5 Evolution of EW according to age by groups for boys, girls and overall. Comparison of the two sets of paediatric patients, taking the age 4 group for each team as the point of reference.

	Team 1			Team 2			OR (95% CI)[b]
	N	EW, %	OR (95% CI)[a]	N	EW, %	OR (95% CI)[a]	
Boys							
Age 4	125	13.6%	1	117	12.8%	1	1.07 (0.51-2.25)
Age 6	125	22.4%	1.83 (0.95-3.56)	125	21.6%	1.87 (0.94-3.73)	1.05 (0.58-1.91)
Age 10	134	25.4%	2.16 (1.14-4.11)	87	28.7%	2.74 (1.34-5.60)	0.84 (0.46-1.55)
Age 14	99	14.1%	1.05 (0.49-2.24)	65	26.2%	2.41 (1.11-5.22)	0.47 (0.21-1.02)
Girls							
Age 4	137	11.7%	1	95	11.6%	1	1.01 (0.45-2.28)
Age 6	134	14.9%	1.33 (0.66-2.69)	101	22.8%	2.25 (1.03-4.92)	0.60 (0.30-1.16)
Age 10	90	14.4%	1.28 (0.58-2.80)	89	15.7%	1.43 (0.61-3.33)	0.90 (0.40-2.05)
Age 14	77	14.3%	1.26 (0.55-2.87)	69	20.3%	1.94 (0.82-4.59)	0.65 (0.28-1.56)
Overall							
Age 4	262	12.6%	1	212	12.3%	1	1.03 (0.60-1.79)
Age 6	259	18.5%	1.58 (0.98-2.55)	226	22.1%	2.03 (1.21-3.41)	0.80 (0.51-1.25)
Age 10	224	21.0%	1.84 (1.13-3.00)	176	22.2%	2.04 (1.18-3.51)	0.93 (0.58-1.51)
Age 14	176	14.2%	1.15 (0.66-2.01)	134	23.1%	2.15 (1.21-3.82)	0.55 (0.31-0.99)

EW: excess weight; CI: confidence interval; OR: odds ratio.
[a]OR and 95% CI with respect to the lower age group.
[b]OR and 95% CI team 1 vs team 2.

teams, with higher attrition in T2, but both teams showed a parallel evolution.

Following the recommendations of the Ministry of Health and Social Policy's CPG, we chose BMI as the measure for assessing nutritional status because it is the simplest measure to obtain, is efficient, has well-defined statistical properties and has been adopted internationally as a reasonable indicator of subcutaneous fat accumulation.[14] We also compared the BMI results with those of the Fundación Orbegozo tables from 1988, in order to avoid the effect of the general increases in mean BMI and standard deviations that have taken place since then in the new curves and tables and that make some cases of EW appear normal.[14,18]

The prevalence of EW in the total sample studied at the four age levels is high, but lower than in other studies from Spain.[3,4,24,25] It is higher in males, as found in most studies, which report increased EW in males until adolescence, when it is the same in both sexes, and then over the age of 50 it is higher in females.[7,25,26]

We observed a lower prevalence of EW in the population corresponding to the group that implemented preventive EW activities and follow-up and monitoring when the problem was identified. This difference became greater as the age of the population increased, and it reached statistical significance in the age 14 group.

Even though most meta-analyses conclude that initiatives for obesity prevention and treatment alike have very limited results that are confined to the duration of the activity or immediately afterwards, the data obtained in our study support the opinion of some authors who argue that ongoing activity on EW can achieve the proposed aims.[14,15] Based on our observation in the different ages studied that BMI levels are similar at early ages and statistically different at age 14 in the prevalence of EW, we may be able to conclude that close monitoring of EW in terms of prevention and treatment can be effective.

Our cross-sectional study analysed the anthropometric measurements obtained in the child health check-ups carried out during the three years preceding the start of the study (2010). The study was intended as a community-based trial (a pseudo-randomised interventional study, a quasi-experimental trial). A community trial would have involved following up the cohort. A retrospective cohort raised difficulties with regard to obtaining the information. A prospective study would be ethically questionable, as it would involve non-performance of some of the actions aimed at prevention and treatment of EW in one of the groups over a prolonged period, especially when there is a reasonable likelihood, as is indicated in this study, that such interventions would be effective. Given the study design, we cannot establish a cause-effect relationship between the preventive activity and the reduction in prevalence, although the progressive nature of the latter appears to indicate that such a relationship exists, and it would therefore be interesting to carry out a longitudinal study of the anthropometric data for both groups of children over 25 years, and even include other groups of children with and without interventions to provide appropriate control for bias.

In conclusion to this study, it seems reasonable to believe that future benefits will be gained, at least in the medium term, from on-going actions that seek a solution to the chronic problem of obesity, which largely results from harmful lifestyle habits. It should be noted that our results were obtained in a period when health institutions were either unaware of the magnitude of the problem or had yet to implement plans to tackle it. Furthermore, the media actively encouraged eating and buying nutritionally unhealthy foodstuffs and consumer goods, specifically leading to obesity. The coordinated anti-obesity plan will have a much greater impact than the work done in our primary care clinics and in the community but this work will still be very important, if not indispensable, for achieving the desired results.

Conflicts of interest

The authors have no conflicts of interest to declare.

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