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Trends in prevalence of childhood overweight and obesity in a community-based programme: The VIF Programme

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ABSTRACT

Background: Obesity in children is considered the main childhood health problem.

Objective: To assess the impact of 7-year community-based interventions on the trend prevalence of overweight and obesity in French preschool children and primary school children between 2008 and 2015.

Methods: Two cross-sectional studies were performed in last grade of every pre-school and primary schools of 6 cities in 2008 and 2015. In 2008 and 2015, 3387 children and 3415 children (aged 5 and 11 years old) participated in the 2 surveys. Interventions consisted to promote physical activity, healthy dietary, sleep habits and well-being. Prevalence of overweight and obesity were defined according to age- and sex-specific BMI cut-off points. Priority education area of the schools was also recorded.

Results: Prevalence of overweight and obesity decreased significantly between 2008 and 2015 in children from pre-schools (18.1% vs 13.0%) and primary schools (20.9% *vs* 16.9%) (P < 0.05). No effects of priority education area and sex were found related to the decrease of prevalence in overweight and obesity.

Conclusions: Our results show that over 7 years period, the community-based intervention have a positive impact on the overweight and obesity prevalence in childhood. These results are promising and encouraging in addressing obesity and related issues in French young boys and girls.

INTRODUCTION

Obesity in children is considered the main childhood health problem in European countries. Indeed, the prevalence of obesity has tripled in European countries in the last 30 years, especially in young people.[1] In a recent systematic review and meta-analysis, it was shown that the prevalence of overweight and obesity in children and adolescents was very high, although trends have stabilized in most European countries, especially in France.[2] Many studies have demonstrated that paediatric obesity has a number of health consequences for physical, social and psychological parameters in children and adolescents.[3] Equally alarming is that 40–70% of obese children will remain obese in adulthood. In addition, this persistence of paediatric obesity into adulthood can lead to developing important risk factors for type 2 diabetes, coronory heart diseases, some types of cancers and increased early mortality.[4] All these consequences lead to a considerable long-term health and economic burden.[5]

Studies have elucidated the role of dietary and lifestyle factors in obesity, especially sugar-sweetened beverages, poor diet quality, physical inactivity, prolonged screen time, short sleep duration or shift work and built environment characteristics.[3,6-11] Many intervention studies taking into account these variables for the treatment of overweight and obesity in children and adolescents have been performed, although with limited success.[12]

Because the prevalence of childhood overweight and obesity remains high, and intervention effectiveness has shown low success in the short and long term, prevention is now widely pinpointed as crucially important in the treatment of obesity. For some years, an original strategy has been emerging, based on multilevel, community-based approaches to addressing childhood obesity prevention[13-17], which is considered to be more effective.[18] However, data about this type of intervention are still scarce.[19] Moreover, available data in France are old; for example, Romon et al reported a substantial and significant decrease in the prevalence of overweight in children between 1992 and 2000 in two towns in northern France.[16]

With children spending an increasing time in sedentary activities in the last two decades, and a prevalence of obesity that is stable but high, there is a real need to pursue the development of prevention programmes throughout France and to assess the current effectiveness of these interventions. Therefore, the aim of this study was to assess the changes in prevalence of overweight and obesity in French preschool children and primary school children between 2008 and 2015.

METHODS

Study design and participants

This study used data from the VIF (Vivons en Forme, "live healthy") Programme. The VIF organization is a continuation of the obesity prevention scheme previously called EPODE (Ensemble Prévenons l'Obésité des Enfants), a community-based prevention programme aimed at promoting healthier lifestyles among children and their families, involving municipal services in charge of child education and care.[20] Actions included in the VIF intervention scheme aim at improving eating and physical activity habits among children. In addition, the VIF Programme includes also an approach based on a social marketing framework to improve our targeted behavioural intervention programmes.[21-22] The community-based intervention based on VIF methodology leads to the mobilization of four complementary levels of implementation: central and local organizations, the local setting and the child lifestyle level. The VIF Programme has been described in detail elsewhere.[20,23-24] Mobilizing these local stakeholders within a co-creation process, the intervention is organized around pluri-annual themes of focus, such as considering the food portion size[22], indulging product management or enhancing water consumption, or how to be more physically active via extra-curricular activities and at home. Each theme is built up according to a full social marketing methodology.[25] Hence, the approach is designed to empower in a sustainable manner the local

relays thanks to comprehensive training programmes carried out by the VIF teams. The final objective is to train the instructors to host practical workshops involving children and families, thereby benefiting from the dedicated tool-kits based on the identified constraints and motivation levers linked to each behaviour change. For this methodology, a personal from the VIF association formed local project managers designed in each community by the mayor. The role of the local project manager is to mobilize a wide diversity of local stakeholders, especially in schools, pre-schools, extracurricular organizations and any social network of associations, which are key settings to implement activities with children and families. Topics addressed during this health prevention program were dietary intake and physical activity in order to promote the health lifestyle. Severals thematics were discussed with children: (i) breakfast, (ii) morning snack, (iii) snacking, (iv) importance of hydration, (v) food groups, (vi) fruits, (vii) daily physical activity. In addition, workshops have been set up on several occasions with children, but also with parents.

All cities in France were invited to participate to the program, with each mayor deciding whether to participate or not. If the invitation was accepted, the VIF methodology was implemented in the town, as previously described. For the present analysis, two cross-sectional surveys in French preschool children and primary school children were conducted in 2008 and 2015 in six towns (Beauvais, Meyzieu, Royan, Douchy-les-Mines, Saint-Quentin and Vitré). Five of these same towns (except Vitré) were included in the last grade of preschool, and all six towns for the last grades in primary school. All schools were enrolled in the VIF Programme. For this present analysis, all school children aged 5–6 years (i.e., the last grade of preschool) and 10–11 years (i.e., the last grade of primary school) who were living in the towns that participated in 2008 and 2015 were included. A total of 7264 children took part in the two surveys, among whom there were 6802 children with complete data for height, body weight, age and sex and were thus included in the present analysis. In 2008 and 2015,

3387 children (1756 boys, 1631 girls) and 3415 children (1750 boys, 1665 girls) participated, respectively. Sample characteristics are shown in Table 1.

All data obtained from this program were anonymized, and declared and approved by the Commission Nationale de l'Informatique et des Libertes (National Commission on Informatics and Liberty). The program were explained to both children and their parents living in the participating town, after which the children or their parents could accept or decline record anonymously their information technology data. Data were recorded by the responsible of the town and to communicate to the VIF association by an electronic data system. An audit of the complete dataset was performed, and aberrant data were excluded.

Measurements

Physical measurements including weight, height and body mass index (BMI) were performed by school physicians and/or school nurses. Body weight was measured to the nearest 0.1 kg using an electronic scale with the participant wearing light clothes and without shoes. Height was measured without shoes to the nearest 0.1 cm using a standard physician's scale. BMI was calculated as weight/height squared (kg/m^2). Obesity and overweight prevalence were calculated according to International Obesity Task Force (IOTF) cut-offs.[26]

Statistical analysis

Results are expressed as means, standard deviations for continuous variables, and frequencies and percentages for categorical variables. Children's main characteristics were described according to the survey year (2008 vs. 2015). The magnitude of the between-survey differences was assessed by calculating the absolute standardized differences; an absolute standardized difference >20% was interpreted as meaningful. Comparisons in combined and

individual prevalences of overweight and obesity between the two surveys (2008 vs. 2015) were carried out using a mixed logistic regression model by including towns as random effect to account for the clustering effect. Odds ratios (ORs) were derived from models as effect size. Analyses were performed in preschool and primary school grades separately and key subgroup analyses on priority education area (*i.e* socio-economic environment: low or high) and sex were conducted. Heterogeneity in between-period difference across subgroups was tested by including the corresponding interaction term into the mixed logistic regression model. All statistical tests were two-sided and performed at the 0.05 level. Data were analysed with SAS version 9.4 (SAS Institute, Cary, NC, USA).

RESULTS

Table 1 shows the characteristics of the population studied in 2008 and 2015 for both school grades (preschool and primary school). Excepted for age and body mass in last grade preschool group (ASD > 20%), there is no meaningful differences in main study population characteristics. In last grade of preschool, the study population in 2008 have a higher age (~0.1 years on average) and body mass (~0.7 kg) compared to 2015. Comparisons of the prevalence in overweight and obesity between 2008 and 2015 for both school grades are presented in Table 2. By applying recommended international standards, it can be seen that the combined prevalence of overweight and obesity decreased significantly between 2008 and 2015 in preschool children (18.1% vs. 13.0%; OR, 0.67; 95% CI, 0.57 to 0.79). This decrease was observed in children in priority education areas (OR, 0.64; 95% CI, 0.50 to 0.82) as well as in children not in priority education areas (OR, 0.69; 95% CI, 0.55 to 0.86; p for heterogeneity = 0.70). Similarly, there is no evidence of a difference in decrease from 2008 to 2015 according to sex (Table 2; p for heterogeneity = 0.87). When overweight and obesity were differentiated, a decrease in prevalence was observed for both overweight (12.6% vs.

9.2%, OR, 0.70; 95% CI, 0.58 to 0.84) and obesity (5.5% to 3.8%; OR, 0.67; 95% CI, 0.50 to 0.89).

Similar results were found for primary school children (Table 2) with a combined prevalence of overweight and obesity of 20.9% in 2008 and 16.9% in 2015 (OR, 0.78; 95% CI, 0.63 to 0.96). The specific prevalence of overweight was 16.6% in 2008 compared with 13.0% in 2015 (OR, 0.77; 95% CI, 0.61 to 0.97) and the specific prevalence of obesity was 4.3% in 2008 vs. 3.8% in 2015 (OR, 0.88; 95% CI, 0.58 to 1.33).

DISCUSSION

The study assessed the effects of a 7-year community-based intervention on the trend in prevalence of overweight and obesity in French children. Findings from our study are important because studies have shown that childhood overweight and obesity are associated with a number of social, psychological and physical health problems.[27]

Short- and long-term health outcomes associated with overweight and obesity in children and adolescents are important issues influencing public health policy. There is now a growing body of data on the intervention and prevention of childhood obesity in many countries worldwide. Indeed, in recent decades, the number of studies aiming to reduce the prevalence of obesity and overweight in youth that target their intervention towards daily physical activity and sedentary and dietary behaviours has increased significantly.[12] That said, most of these studies have shown limited effectiveness of interventions, which may be explained by the large variation in study design, intervention duration and study quality (methodological bias).[12] A potential major bias concerns follow-up times, which vary considerably from one study to another. Indeed, in most cases, the length of time for which interventions were conducted was too short to obtain a positive result on obesity or weight status, and without

follow-up in subsequent years. Some studies have shown encouraging results but with a specific approach towards the prevention of childhood obesity and overweight.[13-17] It has been noted by some health professionals and researchers that successfully addressing childhood-onset obesity requires multilevel (individual, community and governmental) and multi-agency collaboration.[18] As central institutions for the socialization of children and as a hub of community-wide activities, schools are ideal locales for organizing obesity-prevention programmes. The VIASANO community-based programme aimed to reduce the prevalence of overweight in two pilot towns in Belgium among children aged 3–4 and 5–6 years.[15] The preliminary results of the 3-year follow-up (2007–2010) showed a decrease in the prevalence of overweight (–2.1%) and obesity including overweight (–2.4%).[15] An earlier study in France, with a 12-year follow-up (1992–2004) included two towns with an intervention following a community-based approach and two other towns with no intervention.[16] After 12 years, it was shown that the prevalence of overweight was significantly lower (8.8%) in the two towns receiving the intervention compared with those with no intervention (17.8%). Thus, the results from the present study concord with previous findings.[13-17] In our study, with its multilevel, community-based approach to childhood obesity prevention over 7 years, the combined prevalence of overweight and obesity in youth decreased significantly between 2008 and 2015 in preschool children (18.1% vs. 13.0%) and primary school children (20.9% vs. 16.9%). Our results also indicated a decrease in prevalence rates separately of overweight and obesity for each age range (i.e., preschool and primary school). Compared with national data on the prevalence of childhood overweight and obesity during the same period, the towns included in the prevention programme had prevalence rates that were lower than in other towns without such programmes.[28]

Thus, our study updates findings and information from previous work.[15-16] Indeed, our results show homogeneity in the effectiveness of the prevention programme in the two age groups,

with a decrease in both boys and girls, as well as in children in priority education areas and not in priority education areas. These results are encouraging and suggest that the VIF Programme may be a good strategy for reducing the rates of prevalence of childhood overweight and obesity over an extended period of time.

However, findings from this study need further assessment including on longer-term impacts on health. Indeed, a major limitation of the intervention and prevention programmes to treat overweight and obesity concerns the follow-up assessment over a period of time. In addition, in our study, the final point of measurement was when children were 10 years old, that is, before puberty and adolescence. This issue is important because adolescence is a crucial period in life that includes multiple physiological and psychological changes that have a considerable effect on physical activity and dietary habits, and consequently on weight status.[29-30] Low habitual physical activity in adolescents and children—characteristic of modern sedentary living—may be the dominant factor in increasing obesity.[31] Therefore, it would be valuable to continue the programme in participating towns into adolescence and adulthood to gain a complete picture of the impact of these school and community-based interventions. It has been suggested that long-term results may be achieved through ongoing support from society as a whole, including parents, schools and government agencies, but this notion needs to be examined.[32]

Finally, by applying recommended international standards, it can bee seen that the prevalence of combined childhood overweight and obesity was higher in girls compared with boys (in preschool and/or primary school) (21.5% vs. 17.7% for girls and boys, respectively). Our data thus reflect previous investigations carried out in France and other countries that reported prevalence rates of overweight and obesity that were significantly higher in girls compared with boys.[2,28,33-34]

The current study has both strengths and limitations. The main strength is the model and implementation scheme of the intervention programme. Our study was developed as a cross-cutting community-based prevention programme involving municipal services in charge of child education and care (i.e., schools, preschools, local sports and parents' associations, catering structures, health professionals, elected representatives, and local stakeholders from the public and private sectors). Another strength involves the study's large, diverse sample of children from across France with sex-specific information, and the harmonization and standardization of assessment of anthropometric measurements. However, although the present data derive from a large country-wide sample, this study did not use a stratified sample design. Therefore, it is not possible to assume that the studied cohort is fully representative of the populations of French children and adolescents. We did not also excluded the confusion bias between the two study periods regarding the study population characteristics. Another limitation concerns the absence of a control group. Because there was no randomized control group (school or town control), our results should be interpreted with caution. Indeed, we cannot attribute all of the reductions to obesity to the intervention against background trends of reductions in obesity in routine surveys. We must consider that the findings are preliminary, although encouraging.

In summary, the results of a 7-year community-based intervention are promising for addressing obesity and related issues in French youngsters, regardless of sex or socio-economic environment. Thus, the VIF Programme may potentially play a role in the prevention of childhood overweight and obesity.

Competing of interests statement

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Table 1. Characteristics of the population studied (3296 girls and 3506 boys)

	2008 (n=2253)	2015 (n=2242)	ASD, %
Last grade of pre-school			
Boys, n (%)	1149 (51.0)	1144 (51.0)	0.05
Age (*yr*)	5.7 ± 0.5	5.6 ± 0.4	22.3
Height (*cm*)	115 ± 6	114 ± 6	13.5
Body mass (*kg*)	21.1 ± 3.6	20.4 ± 3.3	20.7
BMI ($kg \cdot m^{-2}$)	15. 97 ± 1.93	15.65 ± 1.73	17.7
Priority education area, n (%)	943 (41.9)	960 (42.8)	1.9
Last grade of primary school			
Boys, n (%)	607 (53.5)	606 (51.7)	3.7
Age (*yr*)	10.8 ± 0.2	10.8 ± 0.3	5.5
Height (*cm*)	143 ± 8	144 ± 7	10.3
Body mass (*kg*)	37.9 ± 8.0	37.4 ± 8.5	6.7
BMI ($kg \cdot m^{-2}$)	18.30 ± 3.03	17.80 ± 2.99	17.4
Priority education area, n (%)	399 (35.2)	396 (33.8)	3.0

Values are mean ± standard deviation unless otherwise as indicated. ASD indicates absolute standard difference.

Table 2. Comparisons in prevalence of overweight and obesity between 2008 and 2015 in last grade of pre- and primary-school, overall and according to key-subgroups

	2008 (n=2253)	2015 (n=2242)	OR (95%CI)	*P*	*P Het**
Last-grade Pre-school					
Overall	407/2253 (18.1)	291/2242 (13.0)	0.67 (0.57 to 0.79)	0.0001	
Priority education area					
No	222/1310 (17.0)	161/1282 (12.6)	0.69 (0.55 to 0.86)	0.0009	0.70
Yes	185/943 (19.6)	130/960 (13.5)	0.64 (0.50 to 0.82)	0.0005	
Gender					
Girls	219/1104 (19.8)	155/1098 (14.1)	0.66 (0.53 to 0.83)	0.0003	0.87
Boys	188/1149 (16.4)	136/1144 (11.9)	0.68 (0.53 to 0.86)	0.0014	
Last-grade Primary-school					
Overall	237/1134(20.9)	198/1137(16.9)	0.78 (0.63 to 0.96)	0.021	
Priority education area					
No	143/735 (19.5)	120/777 (15.4)	0.78 (0.59 to 1.02)	0.07	0.99
Yes	94/399 (23.6)	78/396 (19.7)	0.78 (0.55 to 1.10)	0.15	
Gender					
Girls	122/527 (23.1)	104/567 (18.3)	0.77 (0.57 to 1.03)	0.08	0.89
Boys	115/607 (19.0)	94/606 (15.5)	0.79 (0.58 to 1.07)	0.13	

Values are no./total no. (%). OR indicates odds ratio of overweight/obesity associated with 2015 using 2008 as reference, calculated using a mixed logistic regression model including city as random effect to account the clustering effect.
*P Het : p-value for Heterogeneity.