

Prevalence of Childhood Overweight and Obesity in Primary Care Observations on Birth Cohorts 2002-2011

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Received: 02 March 2021; Accepted: 13 April 2021

Citation: Piffer S, Rizzello R Lauriola AL, et al. Prevalence of Childhood Overweight and Obesity in Primary Care Observations on Birth Cohorts 2002-2011. *Nur Primary Care*. 2021; 5(2): 1-6.

ABSTRACT

Objectives: *The study evaluates the trend over time of overweight and obesity in children of the province of Trento subjected to the health check of the sixth year of age.*

Study Design: *It is a retrospective observational study of all children subjected to the health check of the sixth year of age in Trento province, North East Italy. Ten birth cohorts have been considered 2009-2018. The data was collected through paper forms filled in by family pediatricians. The collective national agreement for family pediatrics allows carrying out the health check of six years with a tolerance of ± 90 days from the 6th birthday. Weight status was analyzed and categorized using the Body Mass Index (BMI) threshold values established by Cole et al., as recommended by the International Obesity Task Force (IOTF). The percentages of overweight and obesity, with 95% confidence intervals, were computed at 6 years for each birth cohort, considering sex and the time of the assessment: before the 6th birthday, exactly at the 6th birthday and after the 6th birthday. We also compute, based on the data of the birth cohorts 2009-2011, the percentages of overweight and obesity, according the territorial area of residence of the children, the individual pediatrician and the citizenship (child with mother with foreign nationality vs. child with Italian mother).*

Results: *A total of 27,039 (51,6 % males) children were analysed. In males, the average proportions of overweight or obese subjects in all the cohorts under study are respectively 10.4% (CI 95% 10.1- 10.7) and 4.9% (CI 95% 4.7- 5.1). In Females, the corresponding values are 13.5% (CI 95% 13.1-13.9) and 5.7%, (CI 95% 5.2-6.1). The proportions of overweight or obese subjects, calculated in relation to the chronological moment in which the health check of the 6th was carried out show no statistically significant differences, as well as in relation to territorial area of residence of children. There is a wide variability in the prevalence of overweight and obesity in individual family pediatricians. In part, the different proportion of foreign children registered with individual pediatrician can explain this wide variability. Data relating to the birth cohorts 2009-2011 confirm a higher prevalence of overweight and obesity in foreign children. Socio-cultural factors can explain this fact, especially in reference to second-generation immigrants.*

Conclusions: *The surveillance system based on family pediatricians can integrate with the national surveillance system “OKkio alla SALUTE” with the second oriented towards the general population and the first oriented towards individual “case” children, providing a possible tool for identifying and taking charge of children with overweight/obesity.*

Keywords

Overweight, Obesity, Childhood, Surveillance, Prevention.

Introduction

Childhood obesity is one of the greatest health emergencies in developed countries while not sparing the children living in low and middle-income countries [1]. Italian figures are among the highest among the European countries participating in the Childhood Obesity Surveillance Initiative (COSI) promoted by the World Health Organization European Region [2]. The Italian national surveillance system, called *OKkio alla salute*, indicates in its fifth survey carried out in 2016 a proportion of overweight and obese children, aged 8-9 years, equal to 21.3% and 9.3 respectively with greater prevalence in the South and the Centre of Italy [3]. The corresponding values for the province of Trento are 18.1 and 4.7%. *OKkio alla salute* surveillance system is coordinated by the National Centre for Epidemiology, Surveillance and Health Promotion at the Italian National Institute of Health and conducted in collaboration with all the regions and the Ministry of Education. It is an essential part of the National Prevention Plan [4]. In the Province of Trento (540,000 inhabitants on 12.31.2019, north – east of Italy), there is an additional childhood health monitoring system which also provides information on the weight status. That has been in place for more twenty years and makes use of information from forms completed by family pediatricians on the occasion of health checks performed at the ages of 12 months, 6 years and 13 years. In the data collection, form used at 6 and 13 years it is possible calculate the proportion of overweight and obese subjects. This study reports on the prevalence of overweight and obesity in children assessed at the age of 6 years by family pediatricians, for different birth cohorts: from 2002 to 2011. Further information's are provided for the 2009-2011 birth cohorts on the prevalence of overweight and obesity according to territorial area of residence of the children and citizenship.

Materials and Methods

In the preventive care framework, the collective national agreement for family pediatricians provides for performing health evaluations at the following specific ages: 1, 3, 6, 12 and 24 months, and 3, 6, 9 and 13 years. During these evaluations, the family pediatrician records age-specific data in the child's pediatric health booklet, which is given to all babies born in the Province of Trento. Since the 1990s the provincial contract for family pediatrics, which supplements the national agreement, has also required family pediatricians to complete paper forms (attached to the health booklet) as part of the 12-month, 6-year and 13-year health evaluations and send these data to the provincial health care system. Individual pediatricians send the completed forms to the appropriate health district, which records the information in the health care data base. The data are exported and processed annually by the Clinical and Evaluative Epidemiology Service. Our Service has agreed over time with the family pediatricians, the criteria to be followed to evaluate the children and fill in the forms. We calculated the weight status at the sixth and thirteenth year, based on data collected by family pediatricians. The procedure for obtaining the anthropometric

data for individual children, in the clinics of the pediatricians, is that recommended by the WHO [5], with most of the children wearing just undergarments. The use of standardized scales and stadiometers is unfeasible in the general pediatrician clinics, also considering the number of pediatricians operating in our province, about 70. The collective national agreement for family pediatrics allows carrying out the health check of six years with a tolerance of ± 90 days from the 6th birthday, to make easier for families the access to pediatrician's clinic. We considered the birth cohorts from 2002 to 2011. Weight status was analyzed and categorized using the Body Mass Index (BMI) threshold values established by Cole *et al.*, as recommended by the International Obesity Task Force (IOTF) [6,7]. The percentages of overweight and obesity, with 95% confidence intervals, were computed at 6 years for each birth cohort, considering sex and the time of the assessment: before the 6th birthday, exactly at the 6th birthday and after the 6th birthday. The chi-squared test was used to analyse the significance of the differences. The temporal trend was analyzed according to the Cochran-Armitage criterion. The proportion of overweight and obese, for both sexes has been also calculated according the territorial area of residence (urban vs. rural), on the basis of the data of the birth cohorts 2009-2011, which presented a greater proportion of valid data and a greater coverage related to the live births. The urban area corresponds to the municipality of the city of Trento, which is the capital of the province, the rural area to the rest of the municipalities of the province. The proportion of overweight and obese, for both sexes has been also calculated by each primary care pediatrician, considering only those pediatricians with a number of registered subjects, for both males and females, equal to at least 30. To explain the variability of overweight and obesity prevalence by individual family pediatrician, we calculated the proportion of children with foreign mother registered with individual family pediatricians. We then calculated the proportion of overweight and obesity by citizenship (Italians vs. foreigners) and assessed whether this prevalence increased as the prevalence of foreign children increased among individual pediatrician.

Results

The total number of children assessed at the 6-year health check, from the birth cohort of 2002 to the birth cohort of 2011 is 27,039 (51,6 % males, 48,4% females). The distribution of cases according to the birth cohort and the relative coverage with respect to the live births of each cohort is shown in figure 1. 26,653 cases (98.6%) were recorded with complete anthropometric data. In males, the average proportions of overweight or obese subjects in all the cohorts under study are respectively 10.4% (CI 95% 10.1- 10.7) and 4.9% (CI 95% 4.7- 5.1). In Females, the corresponding values are 13.5% (CI 95% 13.1-13.9) and 5.7%, (CI 95% 5.2-6.1). Overall, a statistically significant excess emerges, for both overweight and obesity, in females compared to males. The values in females, as regards overweight and obesity are higher, almost every year, than those of males. The time trend is however decreasing, especially as regards overweight in males. The values relating to obesity, although slightly decreasing, appear to be fairly stable (Figure 2). 50% of the subjects with valid anthropometric data were evaluated

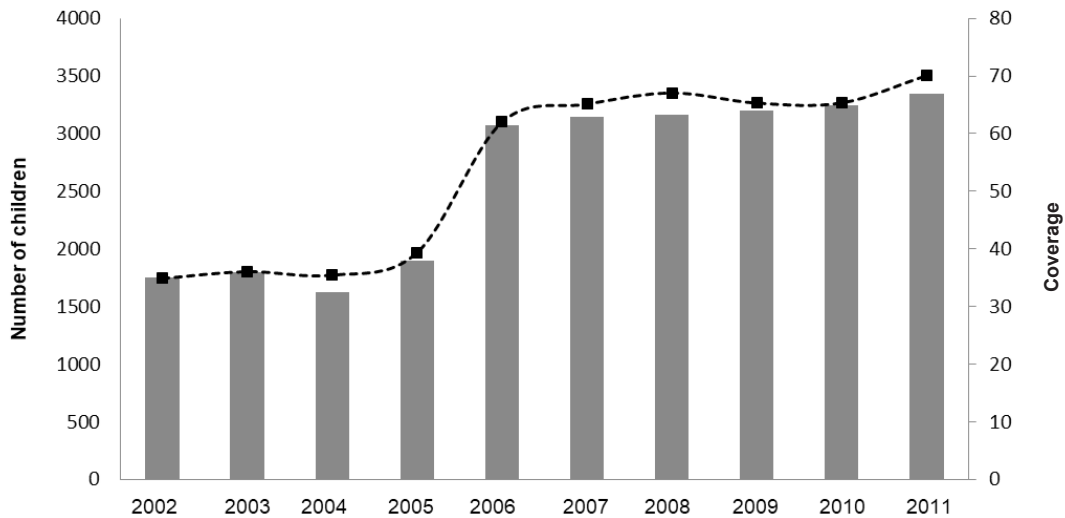


Figure 1: Trento Province. Number of children assessed at 6th year health check by birth cohort and relative coverage with respect to the live births of each cohort.

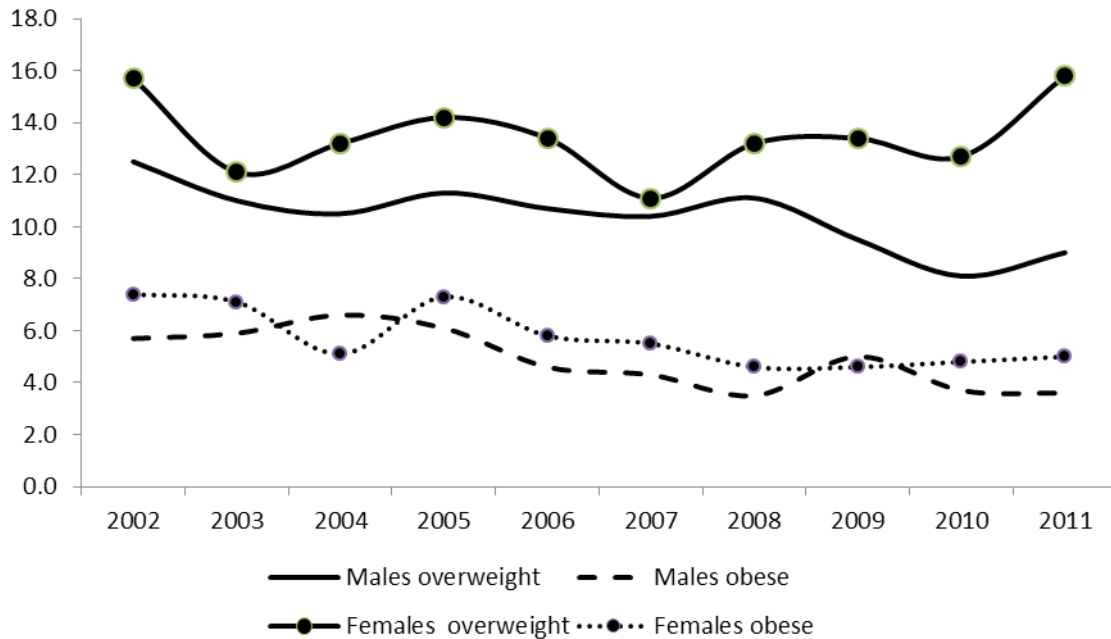


Figure 2: Trento Province. Proportion of overweight and obese in males and females at the 6th year health check by birth cohort.

exactly on the birthday of the sixth year, 35% were evaluated before and 15% after. The proportions are the same in both sexes. The proportions of overweight or obese subjects, calculated in relation to the chronological moment in which the health check of the 6th was carried out are presented in table 1. No statistically significant differences emerge regarding overweight in both sexes, while there is an excess of obese and a defect of obese respectively in males and females evaluated after the birthday of the 6th year. The proportion of overweight or obese subjects, calculated in relation to the territorial area of residence, for the cohorts 2009-2011 (9,907 subjects, 51% Males) show no differences compared to the average provincial values for those cohorts (Table 2). Males present, at the provincial level and for the two territorial

areas considered, a statistically significant lower proportion of overweight than females; males have also for obesity lower values than females even if the differences are not statistically significant. The proportion of overweight and obese has been assessed for 70 family pediatricians, for both sexes. In males the proportion of overweight is between 1.7 and 18.9%; 37 family pediatricians are below the provincial mean value and 33 above; the proportion of obese is between 0.0 and 16.3%; 34 family pediatricians are below the provincial mean value and 36 above. In females the proportion of overweight is between 4.0 and 31.0%; 38 family pediatricians are below the provincial mean value and 34 above; the proportion of obese is between 0.0 and 14.04%; 36 family pediatricians are below the provincial mean value and 34 above. The proportion

of overweight or obese subjects is higher in foreigners than in Italians, as shown in table 3. The proportion of children with a mother of foreign nationality is very heterogeneous in individual family pediatricians and ranges from 2 to 45% for both sexes. The proportion of overweight or obese subject's increases with the increase in the proportion of foreign children registered with the individual family pediatricians, as reported in table 4.

Table 1: Province of Trento. Proportion of overweight or obese subjects in males and females (CI 95%) according to the chronological moment of the health check of the 6th year. All birth cohorts.

Sexes	Before the sixth year birthday	Exactly on the sixth year birthday	After the sixth year birthday
Males			
% overweight	10.3 (9.97-11.16)	10.2 (9.83-10.57)	10.5 (10.0-10.8)
% obese	4.2 (3.9-4.6)	4.9 (4.6-5.2)	5.2 (4.7-5.7)
Females			
% overweight	13.5 (12.9-14.1)	13,3 (12.85-13.75)	13.4 (12.2-14.2)
% obese	5,8 (5.4-6.1)	5.6 (5.1-6.0)	4.5 (4.0-5.0)

Table 2: Province of Trento. Proportion of overweight or obese subjects in males and females (CI 95%), according to the territorial area of residence of the children. Birth cohorts 2009-2011.

Territorial area of residence	Males		Females	
	Overweight	obese	Overweight	obese
Urban Area	8.45 (6.97-9.93)	4.07 (3.02-5.12)	14.60 (12.70-16.50)	4.55 (3.42-5.68)
Rural Area	8.91 (8.01-9.81)	4.56 (3.90-5.22)	13.90 (12.77-15.03)	5.02 (4.65-5.39)
Province	8.79 (8.40-9.20)	4.43 (4.10-4.70)	14.0 (13.51-14.50)	4.90 (4.59-5.21)

Table 3: Province of Trento. Proportion of overweight or obese subjects in males and females (CI 95%), according to the citizenship. Birth cohorts 2009-2011.

Citizenship	Males		Females	
	Overweight	obese	Overweight	obese
Italians	8.5 (7.6-9.3)	4.0 (3.4-4.5)	13.4 (12.4-14.4)	4.2 (3.6-4.8)
Foreigners	9.2 (8.7-9.7)	6.3 (4.7-7.9)	16.8 (14.8-18.8)	6.7 (6.1-7.2)
Province	8.79 (8.40-9.20)	4.43 (4.10-4.70)	14.0 (13.51-14.50)	4.90 (4.59-5.21)

Table 4: Province of Trento. Proportion of overweight or obese subjects in males and females (CI 95%), according to the proportion of foreign children registered with primary care pediatricians. Birth cohorts 2009-2011.

Sex	% foreigners <10%	% foreigners 10-20%	% foreigners >20%
Males			
% overweight	8.7 (5.7-11.7)	9.0 (6.0-12.0)	9.2 (6.2-12.2)
% obesity	4.0 (1.0-7.0)	4.7 (2.4-7.0)	4.9 (2.6-7.2)
Females			
% overweight	12.6 (9.8-15.4)	14.7 (12.7-16.7)	15.1 (13.2-16.8)
% obesity	4.6 (2.1-7.1)	4.8 (2.3-7.2)	5.5 (3.5-7.5)

Discussion

Childhood obesity is an issue of such importance that it needs to be monitored over time. The family pediatricians represent in Italy the referring doctors for children up to the age of 14, for care, prevention and surveillance of their health status. The surveillance activity is carried out through the implementation of periodic health assessments defined by national law and integrated by the regulations of the province of Trento. The data collected at the

6th year health check can be used to represent, at the population level, the burden of overweight and obesity. This kind of survey is carried out in Italy, as well as in the province of Trento, also in the Emilia Romagna region. With respect to the latter, in the province of Trento it is possible to have historical data series.

These local surveillances consider the whole population and not a sample as in the case of the national surveillance. Our study reports a higher prevalence of overweight and obesity in girls than in boys, with a decreasing temporal trend for overweight and obesity in males and decreasing for obesity in females. The prevalence of overweight and obesity in our study substantially coincide with those reported in the Region Emilia-Romagna surveillance for the same age [8] and with a study of 2012 by Brambilla *et al.* [9] obtained in an area of Milan. In this latest study, the pediatric forms for health check at 6th year of life were used for the recovery of anthropometric parameters of interest. A higher prevalence of overweight in girls than boys has already been reported in some other Italian regional studies [10,11] and it is also confirmed, although with no statistically significant difference, by the Report ISTAT-Unicef of 2013 [12]. Prevalence data recorded in our study tend to be lower than those reported in other Italian regions [10,11,13,14]. Our prevalence values are also lower, for both gender, than those observed in the three European countries (Belgium, Slovenia and Spain) that, as part of the WHO European Childhood Obesity Surveillance Initiative, have also provided data for age 6 years [2]. However, it must be noted that the prevalence of overweight and obesity in children presents in the province of Trento, one of the lowest values ever. It may be also difficult to compare the data from the Province of Trento with other Italian studies because they differ in the age range, setting, type of population and procedures used [9-11,13,14].

The decrease over time in the values of overweight and obesity has been reported, both for the province of Trento and for Italy, by the National surveillance system OKkio alla salute, which as already mentioned, involves aged 8-9 years children [3]. The temporal decrease in childhood overweight and obesity is a very positive fact that can be associated with the preventive actions carried out in the last decade at the local and national level. The increase in coverage of our survey in the last birth cohorts may have been helpful in highlighting this trend.

The proportion of overweight subjects does not seem to be influenced by the chronological moment in which the evaluation of the 6th year of life is carried out, just as it does not vary in relation to the territorial area of residence of the children, urban and rural area. There is a strong variation in the prevalence of overweight and obesity amongst family pediatricians. Since every primary care pediatrician has children in care who reside in homogeneous and differentiated communities, we can hypothesize that the differences are not related to the pediatrician but to the specific characteristics of the individual communities. We found up to a 16-percentage-point difference in obesity levels and up to 10 – percentage –point difference in overweight among six-year-old children between communities, for both sexes. This suggests that the community in

which a child lives may be a particularly strong predictor of their obesity risk. This is consistent with previous research showing that local environments are important predictors of child obesity risk [15-18]. Factors such as ethnicity, socio-economic level and the level of deprivation tend to be distributed heterogeneously in the territory and therefore affect different degrees of health as well as a differentiated risk of childhood obesity [19]. The prevalence of children with a foreign mother is very heterogeneous among family pediatricians. The prevalence of overweight and obesity is higher in immigrants, especially those of the second generation [20]. The greater the proportion of foreign children registered with a primary care pediatrician, the greater the proportion of overweight and obesity associated to that primary care pediatrician. Socio-cultural factors may explain the higher prevalence of overweight and obesity in immigrants [21]. The estimate of overweight or obesity at age 6, in addition to the logistical conditions, can be affected by adiposity rebound phenomenon, that is the age at which BMI reaches its minimum value before its physiological increase. The adiposity rebound average corresponds to the age of 5-6 years [22,23], even if new evidence indicate its earliest occurrence than reported in the past [24].

Nevertheless, the six-year pediatric forms, disregarding potential reproducibility limitations, provides two important indications: a) A large number of overweight and obese children can be identified at this young age. b) The collection of weight status data at the age of 6 years may allow for a personalized approach, with the primary care pediatrician taking early charge of overweight children at the age when compulsory school attendance begins. Moreover, the pediatric forms can provide the basis for local longitudinal studies designed to answer questions regarding associations between perinatal variables and outcome variables at the age of 6 [25,26].

The surveillance system based on primary care pediatricians can integrate with the national surveillance system “OKkio alla SALUTE” with the second oriented towards the general population and the first oriented towards individual “case” children, providing a possible tool for identifying and taking charge of overweight children [26,27]. It is important to raise awareness among family pediatricians about the usefulness of the data collected in order to create the conditions for improving the quality and reproducibility of the data recording. The role of the family pediatrician could be supported through the development of specific training courses [28-30] and a favorable organizational system, as has already been envisaged by some other Italian regions [31]. The population approach, which focuses more on the whole population, including mostly low-risk subjects, integrated with a case-based approach, which focuses on high-risk subjects, may lead to improved efficacy in the prevention strategy for complex phenomena such as childhood overweight and obesity, addressed in a general sense in the work of Professor Rose [32]. Taking charge of overweight/obese children could occur even before the 6-year evaluation, given that individual family pediatricians have access to the child’s history and development through the data contained in his or her pediatric health booklet. Pediatricians can be informed about potential risk factors of increased BMI, e.g. children who were not breastfed and children who were born prematurely and/

or with a low birth weight. The role of the family pediatrician must undoubtedly be enhanced since the pediatrician has the opportunity to continuously follow the child and his or her family from birth. The interconnection between the various personal, family and environmental factors that contribute to determining the weight of the child, must urge pediatricians to network with associations, local authorities and schools so that change becomes possible.

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