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Evolution of overweight and obesity among 5–6-year-old schoolchildren in Geneva

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Summary

Questions under study: In view of the alarming trend in childhood obesity (O) and overweight (OW) observed in certain countries, the aim of the study is to measure the prevalence of O and OW in successive cohorts of elementary school children in Geneva.

Methods: All 5–6-year-old children attending public schools in the Canton of Geneva were measured and weighed during a systematic health check at school from 2003 to 2008. BMI was calculated and plotted on standardised BMI for age tables, using Cole's and Kromeyer's references.

Results: Using Cole's references, the overall trend was a small non-significant decrease for OW 0.7 points (p = 0.33) and O 0.5 points (p = 0.23) over the 5-year period. For girls, OW decreased by 1.1 point (p = 0.47) and O decreased by 0.5 points (p = 0.61), whilst for boys OW decreased by 0.3 points (p = 0.54) and O decreased by 0.6 points (p = 0.23). A non-significant decrease or stabilisation in the prevalence of overweight and obesity was observed over the 5-year period in both boys and girls.

Conclusion: These observations corroborate observations from Sweden and France, showing a levelling off in obesity and overweight in young children.

Key words: *obesity; overweight; prevalence; children; trend*

Introduction

In recent decades the prevalence of obesity and overweight has increased steadily in both developed and developing countries [1–4]. Obesity in youth has serious medium and long-term consequences including endocrine, cardiovascular, renal, pulmonary, orthopaedic and gastroenterological diseases [5, 6]. Overweight and obese youths may also face psychological challenges resulting in harm to their self-image.

For the above reasons, obesity and overweight have become a public health priority [7], particularly in school settings where the children affected may suffer stigmatisation and be confronted with learning difficulties [8].

It is therefore of interest to have robust data on the prevalence of overweight and obesity in different parts of Switzerland, to be able to monitor the effect of preventive interventions and/or regional variations.

Few longitudinal data collected in a systematic manner exist for preschool children in Switzerland. Because of the potentially important role attributed to schools in the prevention of overweight and obesity [9], it is of interest to have data on its prevalence among children entering school. This may also allow better targeted prevention programmes.

The aim of our study was to systematically weigh and measure, over a five-year period starting in 2003, 5–6-year-old children entering the Geneva public school system in order to establish their absolute and relative BMI for age.

Subjects and methods

Subjects

All 5–6-year-old children (mean age 5.76 yr.) entering the public school system in Geneva were included in the study (~3700 new children/year).

A total of 18 596 children (9102 girls and 9494 boys) were included over the 5-year period (2003–2008), thus making it possible to estimate the prevalence of overweight and obesity for each school year.

Method

All children newly enrolled in public schools in Geneva underwent a health visit, together with their parents, during the first year of school. During this visit the nurses questioned the parents and the child about health-related topics including vaccination, nutrition, exercise, well-being and integration. Very few parents refused the weight and height measurements.

For the purpose of the study, school nurses, in agreement with the parents, weighed and measured all children and plotted their data on a weight-to-height and BMI curve [10]. Children were measured on regularly calibrated SECA balances (kg) and measured on either wall-mounted or balance-mounted height scales (cm). Children were in their underclothes to measure weight and during inspiration for height. The data were discussed with the child and the parents. If the parents or the child showed concern about the values, the nurse scheduled another meeting for further explanations.

The data collected by the nurses was anonymously transferred to a database where the BMI could be calculated and compared to international norms [11], thus making it possible to estimate the prevalence for each school year.

Children attending private schools in Geneva (n = 3276 for the 5-year period) were not included in the study.

Statistics

Body Mass Index (BMI) for each child was calculated as weight in kilograms divided by height in metres squared (kg/m^2) [2]. Differences in BMI distribution between the five school-year periods were compared to the mean BMI for each age group, using the ISO-BMI classification [11]. Children were divided into normal (including underweight) ISO-BMI <25; overweight ISO-BMI 25–30, and obese ISO-BMI >30. The comparison between percentages was calculated using the chi^2 test.

The data was also analysed using Kromeyer's norms, as suggested by the Swiss Society of Paediatrics, where overweight is defined by a BMI between the 90th and the 97th percentiles and obesity as >97th [12, 13].

Statistical analysis was performed using STATA 10 for Windows (STATACorp, Texas, USA) and significance was set at $p < 0.05$.

Results

Taking the entire group into consideration and using Cole's references [11], there was an overall tendency towards a non-significant decrease: –0.7 points (p = 0.25) for overweight (OW) and –0.5 points (p >0.23) for obesity (O) over the 5-year study period.

Following a small increase in the percentage of OW + O from 2003–4 to 2004–5 and a 1.8 point decrease from 2004–5 to 2005–6, a stabilisation has been observed in OW + O at around 12.6% (table 1 and fig. 1). When computing changes on a yearly basis we observed a significant 1.5 point decrease in overweight children between 2004–5 and 2005–6 (11.3 vs 9.8%; p = 0.033). This was not the case for obesity (3.1 vs 2.8%; p = 0.44).

When analysing boys and girls separately, girls showed a higher overall prevalence of OW + O than boys (14.2 vs 11.8%).

Over the 5-year period girls showed a larger decrease in OW (–1.1 points, p = 0.27) and O (–0.5 points, p = 0.48) than boys (OW: –0.3 points, p = 0.3; and O: –0.6 points, p = 0.73). There was no statistically significant difference for the decrease in OW and O between boys and girls (tables 2 and 3).

In view of the recommendations of the Swiss Paediatric Society we also analysed our data in an identical manner, using Kromeyer's references (tab. 4). In so doing there was no longer a decrease in OW but a stagnation, whilst O decreased by –0.5 points between 2003–4 and 2007–8 in a similar way to Cole's referential.

Girls showed a 0.2 point increase in OW compared to a 1.1 point decrease with Cole's referential, but O decreased in a similar fashion (–0.5 points). Boys showed similar variations to those seen with Cole's referential (table 4).

Discussion

Despite worrying international trends in childhood OW and O [7, 14], our study showed no further rise in the prevalence of OW and O after 2005 in 6-year-old children living in the Canton of Geneva (both with Cole's and Kromey-

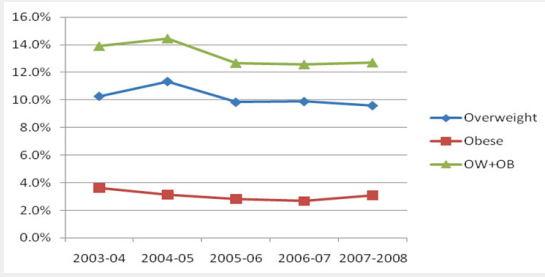

Figure 1

BMI over time for the entire group.

Table 1
Distribution of the prevalence (95% confidence intervals) divided into ISO-BMI subgroups for the entire group.

Prevalence	2003–4		2004–5		2005–6		2006–7		2007–8	
	N = 3728		N = 3908		N = 3718		N = 3709		N = 3533	
ISO-BMI <25	86.1%	84.9–87.1	85.5%	84.3–86.5	87.3%	86.2–88.3	87.4%	86.3–88.4	87.3%	86.1–88.3
ISO-BMI 25–30	10.3%	9.3–11.3	11.3%	10.3–12.3	9.8%	8.9–10.8	9.9%	8.9–10.9	9.6%	8.6–10.6
ISO-BMI >30	3.6%	3–4.2	3.1%	2.5–3.6	2.8%	2.3–3.4	2.7%	2.2–3.2	3.1%	2.6–3.7

Table 2
Distribution of prevalence (95% confidence intervals) divided into ISO-BMI subgroups for girls.

Prevalence	2003–4		2004–5		2005–6		2006–7		2007–8	
	N = 1802		N = 1927		N = 1834		N = 1775		N = 1764	
ISO-BMI <25	84.2%	82.4–85.8	83.8%	82.1–85.4	86.5%	84.8–88	85.6%	83.9–87.1	85.8%	84–87.3
ISO-BMI 25–30	12.0%	10.6–13.6	12.9%	11.4–14.4	10.6%	9.3–12.11	11.3%	9.9–12.9	10.9%	9.5–12.4
ISO-BMI >30	3.8%	2.9–4.7	3.3%	2.5–4.1	2.9%	2.2–3.7	3.1%	2.3–4	3.3%	2.6–4.2

er's references). On the contrary, a small non-significant decrease in OW and O was observed after 2005 and has stayed constant since (Cole's referentials).

Compared to some other studies from Switzerland, our data tend to show relatively lower levels of OW and O [15, 16].

However, when comparing our data with the data collected on whole population samples of similar-age children in the cities of Bern, Basel and Zurich [17], the trend and the values are very similar and seem to confirm the trend in large Swiss cities. It must be borne in mind that the prevalence of OW and O may vary between different geographical areas and between urban and rural areas.

Our data also corroborate results found in Swedish 10-year-old children from the Stockholm area, where a similar decrease in the prevalence of OW and O was shown between 1999 and 2003 [18]. Obesity levels in both boys and girls were relatively similar to those found in our 5–6-year-old children (boys: 3.5 vs 3.8%, girls: 3.8 vs 2.8%) but the prevalence of OW was considerably higher in their group of 10-year-old children (boys: 8.6 vs 20.5%, girls: 12 vs 19.2%). This could be due to the increasing prevalence of O and OW with age.

A similar trend was also observed in the Bordeaux area where the Programme National Nutrition Santé (PNNS) is implemented. A significant 3.1% ($p < 0.01$) decrease in OW + O in 6-year-old children between 2005 and 2007 was reported [19].

Globally there seems to be a trend in OW and O in certain areas of Europe towards a clearcut levelling of the "epidemic" or even an improvement. These are encouraging data even though the underlying causes of the change are not yet clear. The hypotheses range from the effect of prevention and public awareness to a change in body image. One could also hypothesise that the genetic susceptibility (tendency to gain weight) of the population in these areas has struck a balance with the "obesogenic" effect of the environment to which they are exposed, even though this will be difficult to prove.

The fact that the BMI change in Bordeaux was of a similar magnitude and at exactly the same time (2004–5 to 2005–6) in both Geneva and Bordeaux is intriguing. Interestingly, comparing the average temperature for the 4 winter months in both areas shows that the 2 winters preceding the decline in BMI were significantly colder than the average. Could this be a thermogenic effect due to low outdoor temperatures, which is known to stimulate brown fat, as proposed by Farmer [20]? Could it be that global warming is contributing to a progressive decrease in the stimulation of brown fat, thus leading to a drop in basal metabolism? Are we overheating our homes and overdressing our children? All these questions may well be related to the current trend in OW and O. Further research will be needed to clarify this.

Even though socio-economic differences were not evaluated in our study, both previous research [21] and the studies by Sundblom and Ruello [18, 19] underline the important effect socio-economic factors have on the prevalence and evolution of OW and O. Special attention should be paid to these groups if long-term solutions are to be found for this problem.

When comparing boys to girls, girls showed a higher prevalence of OW and O than boys, as described in the literature. Girls, however, showed a larger, non-significant, decrease in OW and O over the 5-year period. A clear explanation for this is difficult to find bearing in mind the young age group, where conscious behaviour changes are improbable. Parental preoccupation with the girl's future morphology may be of interest compared to boys, in whom corpulence may be an asset at this young age.

This is encouraging data even though the prevalence of OW and O at school admission (12.6%) can be considered relatively high and warrants an early-age approach to the problem. All approaches touching pre-school children, such as perinatal information, day-care interventions (nutrition, physical activity) and parental advice, should be strongly encouraged.

Comparing the two referentials (Cole, Kromeyer) underpins the major differences found in the prevalence of OW and O, depending on which references are used. A 4% difference was found for OW and 0.35% for O.

Obesity has many implications for children's health. It is therefore important that youth health departments participate in the early detection and prevention of OW and O.

Preventive approaches have shown some success, especially when whole community approaches are adopted [22]. Considering the difficulties in inducing behavioural changes, structural approaches such as limiting of access to certain foods and generating a health-promoting environment must be encouraged [9, 23].

Table 3
Distribution of prevalence (95% confidence intervals) divided into ISO-BMI subgroups for boys.

Prevalence	**2003–4**		**2004–5**		**2005–6**		**2006–7**		**2007–8**	
	N = 1926		**N = 1981**		**N = 1884**		**N = 1934**		**N = 1769**	
ISO-BMI <25	87.9%	86.4–89.3	87.2%	85.7–88.6	88.2%	86.6–89.6	89.1%	87.7–90.4	88.8%	87.3–90.2
ISO-BMI 25–30	8.6%	7.4–9.9	9.8%	8.5–11.1	9.1%	7.8–10.4	8.6%	7.4–9.9	8.3%	7–9.6
ISO-BMI >30	3.5%	2.7–4.4	3.0%	2.3–3.8	2.8%	2.1–3.6	2.3%	1.7–3	2.9%	2.2–3.7

Table 4
Distribution of prevalence using Kromeyer's references for the entire group and divided into gender subgroups.

		2003–4	**2004–5**	**2005–6**	**2006–7**	**2007–8**
Entire group	Overweight	5.7%	7.3%	5.8%	6.3%	5.7%
	Obese	3.9%	3.4%	3.0%	2.9%	3.4%
Girls	Overweight	5.4%	7.6%	5.3%	6.0%	5.6%
	Obese	3.8%	3.1%	2.8%	2.9%	3.3%
Boys	Overweight	6.0%	6.9%	6.3%	6.5%	5.8%

In conclusion, the data collected between 2003 and 2008 among 18 596 5–6-year-old children in Geneva show a non-significant decrease in the prevalence of O and OW (Coles's references). This finding corroborates findings in other cities in Switzerland, Sweden and France and may be among the first signs of a changing trend in O and OW. The relatively high level of O and OW at 5 years of age, however, merits special attention in that 13–14% of children already fall into the O and OW groups. Even if no clear conclusions can be drawn as to the reasons for this change, it is probable that both environmental and individual factors contribute to influencing people's behaviour. An intriguing finding was the concomitant drop in O and OW in both Bordeaux and Geneva between 2004–5 and 2005–6. There seems to be a link between particularly cold winters and the drop in BMI. The influence of environmental temperature on brown fat metabolism may be of interest for future research.

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No conflict of interest in relation to this article.

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