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STABILISING TRENDS OF OVERWEIGHT AND OBESITY AMONG 5-14-YEAR-OLDS IN LIECHTENSTEIN BETWEEN 2004 AND 2012

Jürgen Kühnis[1], Sabine Erne[2]

[1] University of Teacher Education Schwyz, Switzerland

[2] Office of Public Health, Liechtenstein

Abstract

Background: The worldwide trends in childhood obesity and associated health-related risks are a cause of concern. In view of this alarming tendency continuous monitoring and information on a wide age-range of children is important. Therefore, the purpose of this study was to observe national trends of childhood overweight (ow) and obesity (ob) among 5-14-year-olds in Liechtenstein over a 9-year period.

Methods: The study is based on a series of 5 cross-sectional screening examinations conducted at two-year intervals from 2004 to 2012 and includes data of 3,711 children. Boys and girls are equally represented (50.1 % and 49.9 %). BMI was calculated on standardised measurements and classified by using the International Obesity Task Force (IOTF) cut-offs. Results: Using IOTF reference, currently 16.6 % of pre-schoolers and school children in Liechtenstein are overweight (incl. obesity), i.e. approximately every 6th child is affected. Over the studied 9-year period, a non-significant decrease in the combined prevalence (owob) was observed in both boys and girls. Gender specific analysis showed that differences between boys and girls were rather weakly expressed, but seemed to increase during school age with a tendency of more overweight boys in secondary school. Conclusions: This study suggests an apparent levelling off in childhood overweight and obesity in Liechtenstein between 2004 and 2012 and corroborates similar findings from other countries.

Key words: *overweight, obesity, children, prevalence, trend, Liechtenstein.*

Introduction

Over the past decades, the prevalence of childhood overweight and obesity has increased worldwide and reached epidemic level in most industrialized and developing countries [1, 6, 16, 18]. In Europe, the current prevalence of overweight (including obesity and using IOTF definitions) among 6-9-year old primary school children varies from 11.2-37.2 % in boys and 14.7-34.7 % in girls [17]. Globally, over 40 million preschool children (< 5y) are overweight or obese and a further increase of up to 60 million (9.1%) is expected for 2020 [5]. However there is also emerging evidence of stabilising trends in different regions around the globe [9, 10, 11, 15].

Overweight and obesity in childhood and adolescence are associated with serious health consequences such as cardiovascular disease, type II diabetes, orthopaedic and psychosocial problems, lower quality of life as well as an increased risk of obesity and premature mortality in later life [6, 12, 13, 14]. Due to these various short and long-term health effects, overweight and obesity have become a public health priority in the early 21st century [18]. Therefore, a continuous monitoring of prevalence and trends at global and national levels is essential for today's health policy [18].

With this background, the aim of the present study was to observe national trends in overweight and obesity among 5-14-year-old children in Liechtenstein (including kindergarten, primary and secondary school) based on a series of 5 cross-sectional samples from 2004 to 2012.

Methods

Data were obtained from an ongoing BMI-monitoring project which was established by the

national office of public health. The project was approved and funded by the national government. Based on legal guidelines and as part of routine health screening, these paediatric examinations were offered for all children aged 5 years (kindergarten), 10 years (primary school) and 14 years (secondary school); participation was voluntary and free. All concerned households were informed with an invitation letter. The only inclusion criterion was the consensus of the parents. Anthropometric measurements were performed by doctors using standardised techniques. Height was determined barefoot using a stadiometer with a precision of ± 0.2 cm. Body weight was measured in underwear and barefoot using a calibrated electronic scale exactly to ± 0.2 kg. Collected data were anonymously transferred to a national database; confidentiality was ensured. Data were checked for entry errors and implausible data were excluded from analysis. BMI was calculated with the formula kg/m2 and categorized using the age- and sex-specific cut-offs as recommended by the International Obesity Task Force (IOTF) [2].

Statistical analysis was performed using IBM SPSS Statistics version 21 (IBM Company, Armonk, NY, USA). BMI-differences were analysed by using Mann-Whitney-U and Kruskal-Wallis-test; trends in overweight prevalence by using Chi-square-test, drawn at significant level of $p < 0.05$.

Results

Overall, the dataset included a total of 3,711 preschool and school children (1,857 boys and 1,852 girls). Table 1 summarizes the sample characteristics. Since 2004, a total of 6,043 children and adolescents have been invited to these screening so far; the mean of participation rate was 61.4 % (kindergarten 70.8 %, primary school 64.3 % and secondary school 50.6 %). Over survey periods, the BMI of children did not differ within age groups, except a significant difference ($p < 0.05$) among 14-year-olds in 2010 compared to 2004 and 2012.

Table 1: Basic characteristics of the national sample

	Total	**Kindergarten (5y)**		**Primary school (10y)**		**Secondary school (14y)**	
Year	**N**	**N**	**BMI[a]**	**N**	**BMI[a]**	**N**	**BMI[a]**
2004	733	209	15.5±1.6	300	17.8±2.8	224	21.0±3.5
2006	834	296	15.7±1.7	310	17.7±3.1	228	20.8±3.5
2008	638	217	15.8±1.8	240	17.6±2.9	181	20.6±3.3
2010	773	279	15.7±1.7	249	17.8±3.3	245	20.3±3.5*
2012	733	287	15.6±1.6	247	17.5±2.7	199	21.2±4.3
	3’711	**1’288**		**1’346**		**1’077**	

[a] BMI = mean+sd

*Different from 2004 and 2012 (Mann-Whitney-U-test; $p < 0.05$)

No significant differences between observation periods within age groups (Kruskal-Wallis-test; $p>0.05$).

Proportions and trends of overweight and obesity throughout the studied period are presented in *table 2* and *figure 1*. According to the current data from 2012 (using IOTF reference) 16.6 % of children aged 5-14-years in Liechtenstein were overweight (incl. obese). Regarding the different school-levels, 11.1 % in kindergarten, 16.6 % in primary schools and 24.6 % in secondary schools were affected by overweight (incl. obesity). This increase over the three focused age groups was significantly different between 5 and 14-year olds ($p < 0.001$) and 5 and 10-year olds (only for ow, $p < 0.05$). Between 10 and 14 year-olds no statistical difference could be detected ($p > .05$).

Overall, there was no significant change (due to the low number of cases) in the combined prevalence of overweight and obesity (owob) between 2004 and 2012, even though the rates in boys decreased from 19.6 % to 17.3 % and in girls from 16.8 % to 15.9 %, respectively (table 2). However, in comparison with the baseline survey 2004 as well as data from the previous year 2010 the development within school-levels is partly divergent. While boys in primary school showed lower prevalence of overweight and obesity in 2012, the overweight prevalence among girls has increased. In secondary school, the combined prevalence (owob) in girls in 2012 was lower than 2004 and slightly higher than 2010. Adolescent boys had a significantly higher prevalence of owob in 2012 (mainly because of the increase of obesity) than in the previous survey. In general, there is a tendency towards more overweight girls in kindergarten and more overweight boys in secondary school, but only reaching statistical significance in 2012.

Table 2: Prevalence (%) of overweight (ow) and obesity (ob) by age and gender, using IOTF reference [2]

	Prevalence (ow+ob)			
	Kindergarten (5y)	**Primary school (10y)**	**Secondary school (14y)**	**All**
Boys (n = 1859)				
2004	6.1 (3.0+3.0)	24.0[a] (20.0+4.0)	25.9 (22.2+3.7)	19.6 (16.0+3.6)
2006	12.5 (9.2+3.3)	13.4[b] (10.2[b]+3.2)	18.6 (14.7+3.9)	14.4 (10.9[b]+3.4)
2008	11.9 (7.6+4.2)	21.0 (16.2+4.8)	23.7 (19.4+4.3)	18.4 (13.9+4.4)
2010	10.1 (7.4+2.7)	19.7 (15.0+4.7)	18.3 (16.0+2.3)	15.8 (12.6+3.2)
2012	10.0 (7.3+2.7)	15.6 (13.9+1.6)	30.9[a,c] (20.6+10.3[c])	17.3 (13.0+4.3)
Girls (n = 1852)				
2004	11.8 (10.0+1.8)	14.7 (12.7+2.0)	24.1 (19.0+5.2)	16.8 (13.8+2.9)
2006	15.3 (11.1+4.2)	16.3 (11.1+5.2)	18.3 (15.9+2.4)	16.5 (12.5+4.0)
2008	17.2 (11.1+6.1)	20.0 (17.0+3.0)	14.8 (13.6+1.1)	17.7 (14.3+3.4)
2010	13.7 (7.6+6.1)	14.8 (11.5+3.3)	17.5 (14.0+3.5)	15.3 (10.9+4.4)
2012	12.4 (10.2+2.2)	17.6 (14.4+3.2)	18.6 (14.7+3.9)	15.9 (12.9+3.0)

[a] significant gender differences (in the same year; $p < 0.05$)
[b] significantly different from 2004 (χ2-test; $p < 0.05$)
[c] significantly different from 2010 (χ2-test; $p < 0.05$)

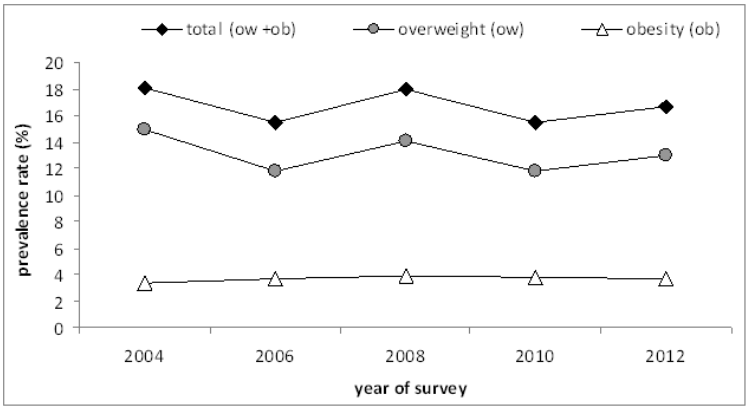

Figure 1: Trends in prevalence (%) of overweight (ow) and obesity (ob) among 5-14-year-olds in Liechtenstein, using IOTF reference [2]

Discussion

In summary, our data indicates that the prevalence of owob among 5-14-year-olds in Liechtenstein has stabilised (with a non-significant decrease of 1.5 percentage points) between 2004 and 2012. This finding is encouraging, but not an all-clear signal because the current prevalence of 16.6 % is still on a high level; on average every 9th pre-schooler, every 6th child aged 10 years and approximately every 4th adolescent aged 14 years is affected by owob. Therefore, overweight and obesity are still a serious health issue across all school levels and further surveillance and prevention is necessary [11, 15]. In addition, it cannot be said, if this is only a temporary or a sustainable trend. Any possible causes for the current positive trend (due to the cross-sectional design) can only be speculated on, but according to other studies it seems reasonable that the recent targeted educational and preventive programmes have contributed to raisiing the awareness of children, mainly in young children and their parents [10, 11, 15]. In this multiple context, the school is a central and popular setting for health promotion activities, because here all children and adolescents can be impacted during an important transition period, regardless of social or cultural origin [3, 4, 8, 18]. Thereby, combined school-based physical activity and nutrition interventions including educational and environmental components seem to be most effective [4, 8, 18].

Similar national prevalence and stabilising trends (in comparable age groups, but occurring at different levels) have also been observed in other European countries (using IOTF criteria). According to findings of a representative study in our neighbouring state Switzerland between 1999 and 2012, the current prevalence of owob among school children aged 6-12y was 17.4 % and did not change during the observed period [10]. In a study in France conducted in 1998-1999 and 2006-2007 (based on two representative samples of children aged 3-14 years) the total prevalence of 14.5 % (owob) in 2006-2007 was not significantly different from the baseline survey [9]. In general, our detected trend for stabilisation seems to be more apparent in younger (kindergarten and primary school) than in older children (secondary school); similar age-related differences have also been found in other surveys [11, 15].

We found a substantial rise of overweight during adolescence; the rate of owob in 2012 among 14-year-olds was 2.2 times higher than in kindergarten ($p < 0.001$); in the first survey even 2.7 times higher ($p < 0.001$). This peak prevalence may be attributed to pubertal development, changes in social relationships and youth autonomy, which also influence their health-related behaviour [3]. Sedentary and unhealthy habits (e.g. excessive use of media, malnutrition and less physical activity) are more common at this critical stage of life than during childhood [3, 7, 9]. Regarding overweight prevalence, our analysis suggests that boys in secondary school tend to be more overweight (but this is only significant in the recent survey 2012). This corresponds to findings from other studies. According to a current review on overweight and obesity prevalence among adolescents (aged 10-19 years) worldwide, boys showed a higher prevalence in almost half of the included national studies and a higher obesity rate in almost all countries [1]. In the HSBC survey of 2009/2010 (a WHO collaborative cross-national study conducted in 43 countries and regions across Europe and North America) adolescent boys (aged 13 to 15 years) tended to have significantly higher overweight prevalence than girls in almost all observed countries and regions [3]. The reasons for this gender difference may be due to the fact that female teenagers tend to be more weight conscious and eat more healthily than boys [3]. Furthermore, the socioeconomic status as well as geographic and cultural conditions are other important determinants for gender, regional and national differences [3, 11, 15]. In addition, it can be assumed that existing prevention efforts seem to reach adolescents less than younger children. Thus, intervention programmes for this target group should be intensified and boys and girls addressed separately [3].

Major strengths of our study are the large national sample covering all school-levels and including a 9-year monitoring period (with routinely collected data). However, since our

findings have been derived from data from a small state in a rural area (with only 37,000 inhabitants and no urbanised areas), they cannot be generalised for other regions. No causal interpretation is possible because of the cross-sectional design. Furthermore, due to the voluntary participation and anonymous collection of data, the reasons why an average of 38.1 % did not participate can only be speculated on.

Conclusions

Our analysis suggests that childhood overweight and obesity in Liechtenstein is plateauing on a high level and corroborates with similar findings from other countries. Whether this trend is sustainable remains unclear and further investigation is needed. Although the installed monitoring system does not provide detailed information about determinants of overweight, it is an essential tool to assess the situation at regular intervals.

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Correspondence

Prof. Dr. Dr. Jürgen Kühnis
University of Teacher Education Schwyz
PHSZ Schwyz, Switzerland
juergen.kuehnis@phsz.ch