



## TEMPORAL TRENDS OF OVERWEIGHT AND OBESITY AMONG 4–14 YEAR-OLD CHILDREN IN LIECHTENSTEIN. RESULTS OF A MONITORING PROJECT FROM 2004 TO 2018

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### Abstract

Monitoring data analysis forms a central basis for the assessment of the prevalence and development of overweight and obesity in children and adolescents, thus identifying a potential need for action and adopting preventive measures. Based on data of 5'515 children and adolescents aged between 4 and 14, this article presents a current trend analysis for Liechtenstein for in the period between 2004 and 2018. This study is based on cross-sectional data from health screening examinations supervised by the national Office of Public Health. The Body Mass Index (BMI) was calculated from anthropometric measurements and classified with reference to the age and gender-specific cut-off criteria of the International Obesity Task Force (IOTF). Across the examined age groups, 15.6% of all children and adolescents in Liechtenstein are currently considered to be overweight or obese. This is a similar prevalence as in neighbouring regions and shows a stable development over the 15-year monitoring period.

**Key words:** overweight, children, obesity prevalence, monitoring, Liechtenstein

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### Introduction

Over the past decades, childhood overweight and obesity have increased worldwide, becoming a major public health challenge of the 21st century [1-4]. According to a recent global study, more than 300 million children and adolescents aged 5-19 years were overweight or obese in 2016 [4]. In Switzerland [5], 16.3% of children and adolescents at all school levels (kindergarten to secondary school) are currently considered to be overweight (incl. obese); in the urban agglomerations of Basel, Bern and Zurich (according to the latest data) the corresponding figure is 17.3% of all schoolchildren [6]. In Germany [7] the prevalence of overweight (including obesity) among 3 to 17-year-olds is 19.3%, roughly equal to that revealed in Austria [8] among 4-19-year-olds. i.e. about 19%. Overweight and obesity in childhood and adolescence are associated with serious short and long-term health risks (e.g. cardiovascular

disease, type 2 diabetes, lower quality of life, mobbing and social isolation [1,2,9-11]) and high costs of treatment and follow-up [12,13]. In 2012, the total direct and indirect costs attributed to overweight and obesity-related diseases in Switzerland were estimated at around CHF 8 billion [13]. From a public health perspective, both prevention and continuous monitoring for trend and impact analyses at global and national levels have a high priority [1-3,5,6].

In Liechtenstein, a national BMI monitoring was endorsed by the government and conducted by the Office of Public Health in 2004. The aim of this project is to obtain a periodic overview of overweight and obesity prevalence and the development of overweight from kindergarten and primary school (4-5-year-olds and 10-year-olds respectively), to secondary school level (14-year-olds), based on data obtained from health screening examinations. The purpose of this paper is to

present a current overview and to investigate trends in overweight and obesity among pre-schoolers and school children in Liechtenstein based on the statistics for the period of 2004–2018 and to compare them with findings from neighbouring countries and regions.

## Methods

### Study design and sample

The study is based on a series of 8 cross-sectional surveys performed in two-year intervals and includes a total of 5'515 children (51.1% boys and 48.9% girls) (table 1). Data were obtained from an ongoing monitoring project in Liechtenstein as part of national health screening under the direction of the Office of Public Health. Children are invited to voluntary paediatric screening examinations at regular intervals in a letter sent to their parents.

Since 2004, a total of 9'523 children and adolescents have been invited to these screenings with a 57.8% mean participation rate.

### Measured variables and data analysis

Children's body weights and heights were measured by physicians using standardised techniques (electronic scales with an accuracy of +0.2 kg and a stadiometer with an accuracy of +0.2 cm) and anonymously transferred to a national database. Overweight and obesity were classified on the basis of the calculated BMI (kg/m<sup>2</sup>) and using age- and gender-specific cut-offs as recommended by the International Obesity Task Force (IOTF) [14]. The data were checked for possible entry errors and implausible data were excluded from the analysis. A descriptive analysis (significance level  $p < .05$ ) was performed using SPSS Statistics version 24 (IBM Company, NY, US).

**Table 1.** Characteristics (BMI = mean±SD) of the national sample (n = 5'515)

Year	Total			Kindergarten (4-5y)		Primary school (10y)		Secondary school (14y)	
	n	Boys	Girls	n	BMI	n	BMI	n	BMI
2004	733	48.7 %	51.3 %	209	15.5±1.6	300	17.8±2.8	224	21.0±3.5
2006	834	49.3 %	50.7 %	296	15.7±1.7	310	17.7±3.1	228	20.8±3.5
2008	638	49.5 %	50.5 %	217	15.8±1.8	240	17.6±2.9	181	20.6±3.3
2010	773	52.5 %	47.5 %	279	15.7±1.7	249	17.8±3.3	245	20.3±3.5 <sup>a</sup>
2012	733	50.3 %	49.7 %	287	15.6±1.6	247	17.5±2.7	199	21.2±4.3
2014	526	50.8 %	49.2 %	242	15.7±1.5	164	17.4±3.2	120	21.6±4.1
2016	702	52.7 %	47.3 %	284	15.8±1.5	227	17.8±3.0	191	20.5±3.2 <sup>b</sup>
2018	576	55.6 %	44.4 %	228	15.5±1.8	185	17.9±3.3	163	20.8±4.4
	5'515			1'814		1'737		1'388	

<sup>a</sup> Different from first survey 2004 and the surveys 2012 and 2014 (Mann-Whitney-U-test;  $p < .05$ )

<sup>b</sup> Different from 2014 (Mann-Whitney-U-test;  $p < .05$ )

No significant differences between survey periods within age groups (Kruskal-Wallis-test;  $p > .05$ ).

## Results

Table 2 groups the results obtained by survey periods, gender and age. According to the current data from 2018, the overall prevalence of overweight (incl. obesity) is 15.6%. Throughout the investigation period (2004–2018), no significant statistical differences could be detected between boys and girls within their age groups, with the exception of combined prevalence (overweight + obesity)

among 10-year-olds in 2004 as well as among 14-year-olds in 2010 with a higher proportion of boys. Overall, gender differences were rather weak, although there was a tendency towards more overweight girls in kindergarten and more overweight boys in secondary school. However, there are clear differences between the focussed age groups, with a lower prevalence among 4-5-year-olds.

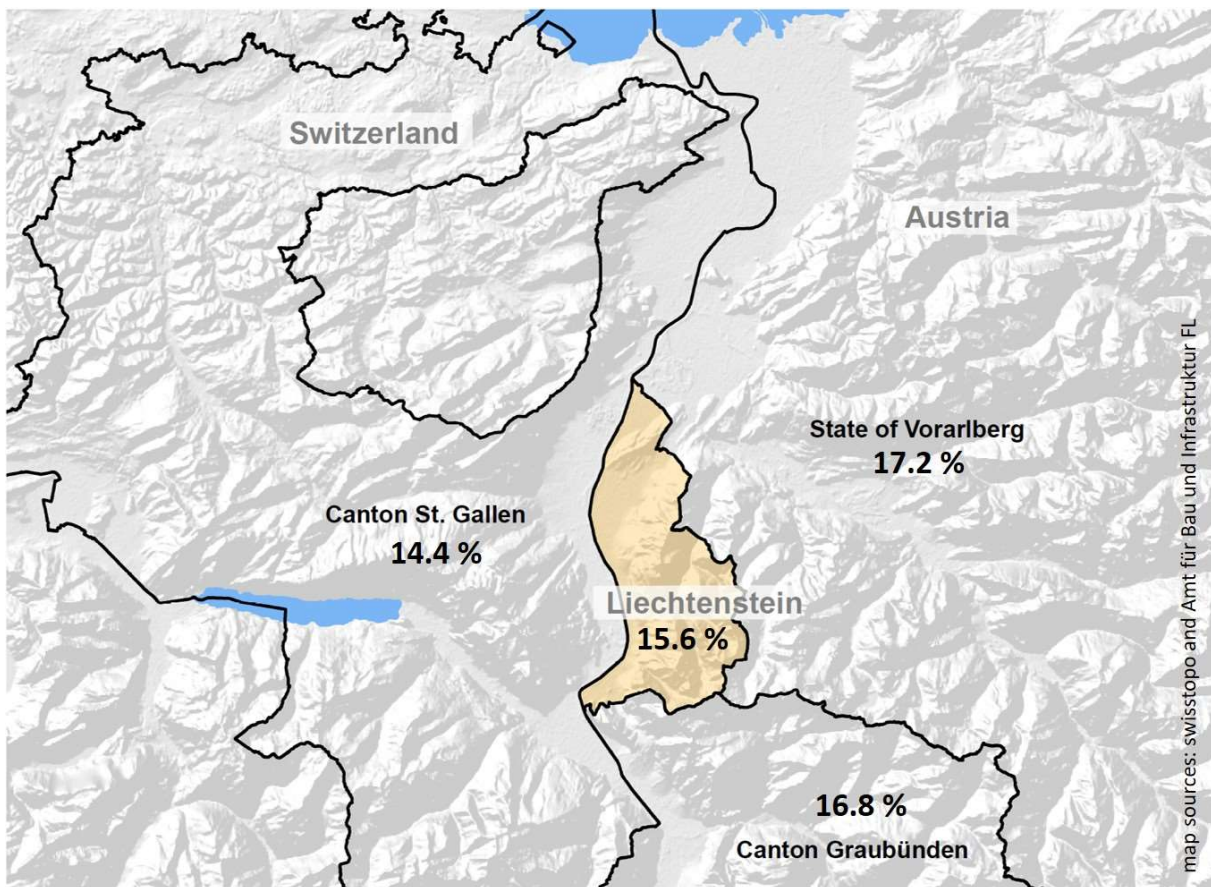
During the 15-year observation period the average BMI (table 1) seems to be balanced at all observed levels of education and the prevalence of overweight (incl. obesity) remained stable (table 2). However, long-term comparisons between different age groups

reveal variations. While the prevalence among 4-5-year-olds shows a relatively constant development, figures for 2016 and 2018 indicate a slight increase among 10-year-olds and a decline among the 14 year-olds respectively.

**Table 2.** Prevalence (%) of overweight (ow) and obesity (ob), using IOTF reference [14]

Year	All age groups	Kindergarten (4-5y)		Primary school (10y)		Secondary school (14y)	
	ow+ob	Boys	Girls	Boys	Girls	Boys	Girls
2004	14.9+3.3	3.0+3.0	10.0+1.8	20.0+4.0	12.7+2.0	22.2+3.7	19.0+5.2
2006	11.8+3.7	9.2+3.3	11.1+4.2	10.2+3.2	11.1+5.2	14.7+3.9	15.9+2.4
2008	14.1+3.9	7.6+4.2	11.1+6.1	16.2+4.8	17.0+3.0	19.4+4.3	13.6+1.1
2010	11.8+3.8	7.4+2.7	7.6+6.1	15.0+4.7	11.5+3.3	16.0+2.3	14.0+3.5
2012	13.0+3.7	7.3+2.7	10.2+2.2	13.9+1.6	14.4+3.2	20.6+10.3	14.7+3.9
2014	11.2+4.4	7.5+2.3	10.1+2.8	7.9+7.9	9.9+5.0	19.7+7.0	18.4+4.1
2016	12.8+3.8	7.5+2.1	8.7+3.6	18.1+4.3	16.2+5.4	16.7+4.6	12.0+3.6
2018	11.8+3.8	8.8+2.2	8.7+1.1	19.1+5.3	11.0+7.7*	11.1+5.6	13.7+1.4

\* significantly different from first survey 2004 ( $\chi^2$ -test;  $p < .05$ )



**Figure 1.** Current prevalence in Liechtenstein compared with neighbouring regions [5, 15].

## Discussion

In general, the prevalence of excess body weight among children and adolescents in Liechtenstein is comparable to the national prevalence of 16.3% in Switzerland [5].

Of particular interest is the comparison with studies from our neighbouring regions (figure 1). With 14.4% in Canton St. Gallen (including kindergarten, 5th and 8th grade [5]), 16.8% in Canton Graubünden (including 1st, 5th and 9th grade [5]) as well as 17.2% in the State of Vorarlberg, Austria (including 6-16-year-olds [15]) similar prevalences can be observed in this cross-border context. However, in contrast to the Swiss reference study (using IOTF cut-offs [14]), the prevalence rates obtained in Vorarlberg are based on German cut-off criteria [16]. Following these German standards, 13.9% of children and adolescents in Liechtenstein would be considered overweight.

Consistent with other studies [3,5-7], minor gender differences in the level and development of overweight and obesity have been observed, with the lowest prevalence is found among preschoolers [5-8]. While Swiss reference studies conducted between 2004 and 2014 [5,6] indicated the highest prevalence at secondary level, this trend seems to have been reversed since 2016 by a shift to 10-year-olds at primary school level (table 2). However, the current 21.6% among 10-year-olds corresponds to the average prevalence of 19.3% among primary school children in the cities of Zurich, Basel and Berne in the school year 2017/18 [3]. In Germany [7] the peak value of 26.2% was recorded for 11-13-year-olds, whereas in Austria [8] the peak was among 9-12-year-olds with a prevalence rate of 25.8%. In Both countries record a decrease in older age groups (up to 17 and 18-year-olds) respectively. Findings on prevalence in school-age children are therefore inconsistent and show variable development.

The major strengths of this study are the time span of 15 years of the monitoring period and the large national sample including children from three different age groups.

However, despite the high average participation rate of 57.8%, a potential bias cannot be excluded, as children and adolescents in extreme weight categories may be less willing to participate [17]. Moreover, these data, obtained in cross-sectional studies, do not allow any causal conclusions.

## Conclusion

Based on the previous findings of this monitoring project [18] and in accordance with Swiss reference studies [5,6] as well as international findings [19], this study documents a stable prevalence of childhood overweight in Liechtenstein over the past 15 years (within a fluctuation range of 2.6%). On the one hand, this result is probably due to targeted action programmes and campaigns to promote healthy body weight among children and adolescents, and – on the other hand – due to a general public awareness of the risks associated with overweight [4,5]. However, it must be admitted that prevalence rates remain high, which would imply that the promotion of daily physical activity and healthy eating and dietary behaviour, especially in kindergarten and school settings, is an important measure in the prevention of overweight [20]. According to current recommendations, children and adolescents should be physically active at least 60 minutes per day [21]. Data from a 2015 cross-sectional questionnaire survey among schoolchildren in Liechtenstein (n=448, aged 11, 13 and 15) show, however, that merely 23% achieve this recommendation [22]. In a Swiss 2014 survey the proportion in this age group is 14.2% [23]. Existing health-promoting efforts and projects should therefore be continued and even expanded to reduce overweight prevalence in the long term, especially at primary and secondary school levels. This includes the need for continued promotion and improvement to ensure healthy school environments. The creation of activity-friendly structures ([www.schulebewegt.ch](http://www.schulebewegt.ch)), in particular, is an idea which has not been fully implemented so far.

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**Received:** June 2020

**Accepted:** July 2020

**Published:** November 2020

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