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BMI, waist circumference and body fat measurements as well as NCD risk factors in 6 to 12 year old children in Switzerland

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Abstract

Background Worldwide, the prevalence of overweight and obesity is still on the rise, even though several countries have indicated stabilizations over the past decade. Switzerland has shown a stabilization of the overweight and obesity prevalence between 1999 and 2012, but whether this trend can be sustained is unclear. Thus, the principle aim of this project was to investigate the time trend in the prevalence of overweight and obesity in 6 to 12 year old children in Switzerland over the period from 2002 to 2017/18. Furthermore, a secondary objective was to assess risk factors for the later development of NCDs using a questionnaire.

Methods Using probability-proportionate to size cluster sampling we recruited a nationally representative sample of children aged 6 to 12 years in 2017/18 (n=2279). Height and weight were measured to calculate BMI (kg/m2). BMI cutoffs proposed by the Centers for Disease Control and Prevention (CDC), the International Obesity Task Force and WHO were used to determine prevalence of overweight and obesity. Waist circumference was measured and body fat calculated based on multiple skinfold thicknesses. To evaluate the time trend, data from similar surveys conducted in 2002 (n=2493), 2007 (2218), and 2012 (2963) was included.

Results Using the CDC references, the prevalence (95% CI) of overweight and obesity was 10.6% (9.4-11.9) and 5.3% (4.5-6.3), respectively. With 6.3% (5.0-7.9) the prevalence of obesity was significantly higher in boys compared to girls (4.3% (3.3-5.7)). The time trend analysis between 2002 and 2017/18 showed a weak but significant decrease in the prevalence of overweight including obesity (B(SE)=-0.012 (0.005), p=0.010, OR=0.988 (0.978-0.997)) but no change in obesity (B(SE)=-0.006 (0.008), p=0.471, OR=0.994 (0.979-1.010)). Using % body fat, the prevalence of overweight was 11% (9.8-12.4) while 3.3% (2.6-4.1) were obese. At increased risk for metabolic disease were 6.0% (5.1-7.1) based on waist circumference measurements. The most important risk factors for the development of overweight and obesity as defined by BMI were found to be parental origin, parental education, physical activity as well as gender.

Conclusion We have shown a weak but significant declining trend in the childhood overweight/obesity prevalence over the past 15 years in Switzerland. With two of the most important predictors identified as parental origin and parental education, migrant populations and people with low education seem to be the most promising target groups for prevention programs. Furthermore, our results indicate physical activity should be targeted rather than dietary factors in this age group and that prevention or weight management programs should specifically address boys.

BMI-, Bauchumfang- und Körperfett-Messungen sowie NCD-Risikofaktoren bei 6-12 jährigen in der Schweiz

Zusammenfassung

Hintergrund Weltweit steigen Übergewicht und Fettleibigkeit an, obwohl verschiedene Länder gezeigt haben, dass sich die Fälle im Laufe der vergangenen zehn Jahre stabilisiert haben. In der Schweiz hat sich eine Stabilisierung der Häufigkeit von Übergewicht und Fettleibigkeit zwischen 1999 und 2012 gezeigt, aber ob dieser Trend anhält, bleibt unklar. Folglich sollte mit diesem Projekt vor allem die Häufigkeit von Übergewicht und Fettleibigkeit bei 6- bis 12-jährigen Kindern in der Schweiz im zeitlichen Verlauf zwischen 2002 bis 2017/18 untersucht werden. Darüber hinaus sollten Risikofaktoren für die spätere Entwicklung von nicht-übertragbaren Krankheiten mit Hilfe eines Fragenbogens untersucht werden.

Methoden Mit Hilfe einer Stichprobe, die im Verhältnis zur Einwohnerzahl ausgewählt wurde, haben wir eine landesweit repräsentative Gruppe von Kindern zwischen 6 und 12 Jahren im Jahre 2017/18 (n=2279) ausgewählt. Grösse und Gewicht wurden aufgenommen, um den BMI (kg/m2) zu berechnen. Die von den Centers for Disease Control and Prevention (CDC), der International Obesity Task Force und der Weltgesundheitsorganisation vorgeschlagenen BMI-Grenzwerte wurden dazu benutzt, die Häufigkeit von Übergewicht und Fettleibigkeit zu bestimmen. Zudem wurde der Taillenumfang gemessen sowie das Körperfett auf der Basis der Hautfaltendicke berechnet. Zur Berechnung des zeitlichen Verlaufs wurden Daten aus ähnlichen Umfragen aus den Jahren 2002 (n=2493), 2007 (2218) und 2012 (2963) mit eingeschlossen.

Ergebnisse Bei Verwendung der CDC-Empfehlungen belief sich die Häufigkeit (95% CI) von Übergewicht und Fettleibigkeit auf je 10.6% (9.4-11.9) und 5.3% (4.5-6.3). Mit 6.3% (5.0-7.9) war die Häufigkeit von Fettleibigkeit bei Jungen signifikant höher als bei Mädchen (4.3% (3.3-5.7)). Die Analyse des zeitlichen Verlaufs zwischen 2002 und 2017/18 zeigt einen schwachen aber signifikanten Rückgang in der Häufigkeit von Übergewicht, einschliesslich Fettleibigkeit (B(SE)=-0.012 (0.005), p=0.010, OR=0.988 (0.978-0.997)), aber keine Veränderung in der Fettleibigkeit (B(SE)=-0.006 (0.008), p=0.471, OR=0.994 (0.979-1.010)). Unter Verwendung von Körperfett in % lag die Häufigkeit von Übergewicht bei 11% (9.8-12.4) während 3.3% (2.6-4.1) fettleibig waren. Ein erhöhtes Risiko für Stoffwechselkrankheiten zeigten 6.0% (5.1-7.1) basiert auf der Messungen des Taillenumfangs. Es hat sich herausgestellt, dass die wichtigsten Risikofaktoren für die Entwicklung von Übergewicht und Fettleibigkeit (definiert anhand des BMI) die Herkunft der Eltern, die Ausbildung der Eltern, körperliche Aktivität sowie das Geschlecht sind.

Schlussfolgerung Wir haben eine schwache, aber signifikant rückläufige Entwicklung von Übergewicht und Fettleibigkeit bei Kindern im Laufe der vergangenen 15 Jahre in der Schweiz aufgezeigt. Da Herkunft und Ausbildung der Eltern als zwei der wichtigsten Anzeichen identifiziert wurden, scheinen Migranten und Personen mit niedrigerem Ausbildungsstand die erfolgversprechendsten Zielgruppen für Präventionsprogramme zu sein. Darüber hinaus zeigen unsere Ergebnisse, dass in dieser

Altersgruppe eher physische Aktivität als Ernährungsfaktoren anvisiert werden sollten und Präventions- oder Gewichtskontrollprogramme vor allem Jungen ansprechen sollten.

IMC, tour de taille et mesure de la graisse corporelle ainsi que facteurs de risque de MNT chez les enfants âgés de 6 à 12 ans en Suisse

Résumé

Contexte Partout dans le monde, la prévalence du surpoids et de l'obésité augmente encore, bien que plusieurs pays ont déclaré des stabilisations de la prévalence au cours de la dernière décennie. La Suisse a affiché une stabilisation de prévalence du surpoids et de l'obésité entre 1999 et 2012, mais le maintien de cette tendance reste incertain. Ainsi, l'objectif principal de ce projet était l'investigation de l'évolution de la tendance dans le temps de la prévalence du surpoids et de l'obésité chez les enfants âgés de 6 à 12 ans en Suisse au cours d'une période allant de 2002 à 2017/18. En outre, un objectif secondaire était l'évaluation des facteurs de risque pour le développement ultérieur de MNT à l'aide d'un questionnaire.

Méthode Nous avons recruté un échantillon représentatif pour le pays d'enfants âgés de 6 à 12 ans en utilisant une méthode d'échantillonnage en grappes à probabilité proportionnelle à la taille en 2017/18 (n=2 279). La taille et le poids ont été mesurés pour calculer l'IMC (kg/m2). Des seuils d'IMC proposés par les Centers for Disease Control and Prevention (centres pour le contrôle et la prévention de la maladie, CDC), l'International Obesity Task Force (groupe d'intervention internationale contre l'obésité) et l'OMS ont été utilisés pour déterminer la prévalence du surpoids et de l'obésité. Le tour de taille a été mesuré et la quantité de graisse corporelle a été calculée à partir de plusieurs épaisseurs de plis cutanés. Des données d'études similaires réalisées en 2002 (n=2 493), 2007 (2 218), et 2012 (2 963) ont été incluses pour évaluer l'évolution de la tendance dans le temps.

Résultats En utilisant les références des CDC, la prévalence (IC 95 %) du surpoids et de l'obésité était respectivement de 10,6 % (9,4 à 11,9) et de 5,3 % (4,5 à 6,3). Avec 6,3 % (5,0 à 7,9), la prévalence de l'obésité était significativement plus élevée chez les garçons que chez les filles (4,3 % (3,3 à 5,7)). L'analyse de l'évolution de la tendance dans le temps entre 2002 et 2017/18 a montré une baisse faible, mais significative de la prévalence du surpoids incluant l'obésité (B(SE)=-0,012 (0,005), p=0,010, OR=0,988 (0,978 à 0,997)). Cependant aucune évolution concernant l'obésité n'a été décelée (B(SE)=-0,006 (0,008), p=0,471, OR =0,994 (0,979 à 1,010)). En utilisant le pourcentage de graisse corporelle, la prévalence du surpoids était de 11% (9,8 à 12,4) alors que 3,3 % (2,6 à 4,1) étaient obèses. 6,0 % (5,1 à 7,1) présentaient un risque accru de maladies métaboliques sur base des mesures du tour de taille. Les facteurs de risque majeurs pour le développement du surpoids et de l'obésité définis par l'IMC étaient l'origine parentale, l'éducation parentale, l'activité physique et le sexe.

Conclusion Nous avons observé un déclin léger, mais significatif dans la prévalence de l'obésité/du surpoids chez l'enfant au cours des 15 dernières années en Suisse. Étant donné que les principaux indicateurs de risque identifiés sont l'origine parentale et l'éducation parentale, les populations de migrants et les personnes dont le niveau d'éducation est faible semblent être les cibles privilégiées pour les programmes de prévention. En outre, nos résultats indiquent que l'activité physique devrait être privilégiée par rapport au régime alimentaire dans ce groupe d'âge et que les programmes de prévention ou de surveillance pondérale devraient en particulier s'adresser aux garçons.

IMC, girovita e misurazioni del grasso corporeo nonché fattori di rischio di malattie non trasmissibili nei bambini di età compresa tra i 6 e i 12 anni in Svizzera

Bozza

Retroscena In tutto il mondo la percentuale di persone affette da sovrappeso e obesità continua a crescere nonostante diversi paesi abbiano constatato una situazione stabile durante gli ultimi dieci anni. La Svizzera ha registrato una stabilizzazione della percentuale di persone affette da sovrappeso e obesità tra il 1999 e il 2012, ma non è chiaro se questa tendenza sarà mantenuta. L'obiettivo principale di questo progetto era dunque quello di esaminare l'evoluzione della percentuale di bambini di età compresa tra i 6 e i 12 anni, domiciliati in Svizzera, in sovrappeso od obesi durante il periodo dal 2002 al 2017/18. Un secondo obiettivo era quello di identificare tramite un questionario i fattori di rischio per il successivo manifestarsi di malattie non trasmissibili.

Metodi Utilizzando il metodo di campionamento probabilistico a grappolo, nel 2017/18 abbiamo selezionato un gruppo rappresentativo a livello nazionale di bambini di età compresa tra i 6 e i 12 anni (n=2279), cui sono stati misurati statura e peso per calcolare l'IMC (kg/m²). Al fine di calcolare la percentuale di bambini in sovrappeso ed obesi, sono stati applicati i valori di soglia dell'IMC secondo le raccomandazioni dei Centers for Disease Control and Prevention (CDC, centri per la prevenzione e il controllo delle malattie), dell'International Obesity Task Force (gruppo di intervenzione internazionale contro l'obesità) e dell'OMS. È stato inoltre misurato il girovita e calcolato il grasso corporeo sulla base di misurazioni multiple dello spessore delle pliche cutanee. Per valutare l'evoluzione di queste misure negli anni, sono stati considerati i dati raccolti da studi analoghi condotti nel 2002 (n=2493), nel 2007 (n=2218) e nel 2012 (n=2963).

Risultati Sulla base dei dati di riferimento dei CDC, la percentuale (*intervallo di confidenza* al *95%*, IC 95%) di sovrappeso e obesità riscontrata è stata rispettivamente del 10.6% (9.4-11.9) e del 5.3% (4.5-6.3). Con un tasso del 6.3% (5.0-7.9), la percentuale di obesità si è rivelata essere notevolmente maggiore nei maschi rispetto alle femmine (4.3% (3.3-5.7)). L'analisi dell'evoluzione tra il 2002 e il 2017/18 ha mostrato una leggera ma significativa diminuzione della percentuale totale di sovrappeso e obesità (coefficiente di regressione B (errore standard ES)=-0.012 (0.005), p=0.010, rapporto crociato OR(IC 95%)=0.988 (0.978-0.997)) ma nessun cambiamento della percentuale d'obesità (B(ES)=-0.006 (0.008), p=0.471, OR(IC 95%)=0.994 (0.979-1.010)). Sulla base del tasso di grasso corporeo, la percentuale di bambini in sovrappeso rilevata è stata dell'11% (9.8-12.4), mentre quella di bambini obesi è stata del 3.3% (2.6-4.1). Secondo le misurazioni del girovita il 6.0% (5.1-7.1) dei bambini sono a rischio di sviluppare sindrome metabolica. I fattori principali di rischio per lo sviluppo di sovrappeso e obesità riscontrati sono la predisposizione ereditaria, l'educazione dei genitori, l'attività fisica ed il sesso del bambino.

Conclusioni Negli ultimi 15 anni in Svizzera vi è stato un debole ma significativo calo della prevalenza di sovrappeso e obesità nei bambini in età scolare. A prescindere dalle due principali cause identificate, ossia la predisposizione ereditaria e l'educazione genitoriale, i programmi di prevenzione dovrebbero essere prevalentemente mirati alla sensibilizzazione di migranti e individui appartenenti agli strati

sociali più bassi. Inoltre i nostri risultati hanno rivelato che per questa fascia d'età è consigliabile avere come obiettivo la promozione dell'attività fisica piuttosto che programmi dietetici. Infine i programmi di prevenzione o di controllo del peso dovrebbero essere rivolti specialmente ai bambini maschi.

Introduction

Globally, non-communicable diseases (NCDs) are an important public health threat responsible for a sizeable rate of mortality and morbidity and therefore causing high socio-economic costs for each affected country (1). There is evidence that the major risk factors for NCDs can be associated with behavioral patterns mainly established during childhood and adolescence, which then continue into adulthood (2-4). Moreover, the onset of many NCDs, such as obesity, diabetes, and cardiovascular diseases (CVD), can be prevented when risk factors earlier in life are addressed (5). One example for such a risk factor is childhood obesity, which is associated with strong evidence to adult's NCDs (2, 4).

Worldwide the prevalence of overweight and obesity in children increased dramatically during the last decades (6, 7). In the US, the prevalence of obesity increased from 8% to 14% in 6-12 year old children between 1976 and 1994 (8). Furthermore, predictions about rapidly increasing rates in future decades were made, claiming that a majority of the children will be either overweight or obese by 2050 (9). Nevertheless, since 2007, evidence has emerged from several countries suggesting that the increase in the obesity prevalence has slowed substantially, or even leveled off. In the last national study conducted by the Human Nutrition Laboratory in 2012 we have shown that the prevalence of overweight and obesity has stabilized between 1999 and 2012 at a level of around 19% (overweight and obesity combined)(10). Whether this stabilization can be seen as a turning point or is just a transient trend is unclear and should be monitored further.

In Switzerland, the first national study determining the prevalence of overweight and obesity among 6-12 year old Swiss children was conducted in 2002. The study revealed that the prevalence of overweight (including obesity) was 20.3% and 19.1% in boys and girls, respectively, and the prevalence of obesity 7.6% and 5.9% in boys and girls, respectively (11, 12). Compared with regional data from the 1960's (1st Zurich Longitudinal Study) and the 1980's (2nd Zurich Longitudinal Study) this represented a 5-fold increase in overweight in boys and a 6-fold increase in girls (13, 14). In 2007, the national study was repeated, using the same sampling design, reporting a slight decrease in the prevalence of overweight and obesity in both girls and boys. The prevalence of overweight (including obesity) was 16.7% and 13.1% in boys and girls, respectively, and the prevalence of obesity 5.4% and 3.2% in boys and girls, respectively. As mentioned above the data from 2012 were then rather pointing towards a stabilization over the entire period between 1999 and 2012 than towards a decrease with a prevalence of overweight (including obesity) of 20% in boys and 17.8% in girls(10). Switzerland is not the only country reporting stabilizing trends but similar data was reported e.g. from Australia, China, France and the USA (15). This stabilizing trend was explained using three different hypotheses (15):

- The Intervention Hypothesis states that childhood obesity has been recognized as a major public health concern in many different countries for several years. Thus, healthy eating habits and physical activity have been successfully promoted by public health campaigns and interventions. Interventions are therefore contributing to the current trend towards the stabilization of overweight prevalence.

- The Saturation Equilibrium Hypothesis explains the stabilization of obesity rates with the reach of a point of saturation equilibrium in many countries. This equilibrium is reached, when any child with predisposition to overweight has become overweight, and the remaining children are resistant to the given environments, which offer opportunities to overeat and be inactive.
- The Self-selection Hypothesis argues that the stabilization of obesity trends might be caused by sampling bias. It is possible that with increased public awareness on childhood obesity, parents of overweight and obese children are less likely to enrol their children for studies assessing overweight and obesity in the later measurement years compared to baseline measurements.

Despite this first evidence of childhood overweight and obesity prevalence stabilizing in some countries, recent OECD projections show an overall steady increase of obesity rates until at least the year 2030 [8]. Furthermore, the OECD projects a faster increase of overall obesity prevalence in Switzerland compared to other countries (16).

Even though the direct reason for weight gain is generally a positive energy balance, the causes for obesity are multifactorial. Changes in food habits, an increasingly sedentary lifestyle as well as genetic, social and cultural factors have been described as important factors influencing obesity prevalences. Lifestyle interventions addressing different treatment aspects are generally recommended for the treatment of childhood obesity (17-19). Even though a certain effect can be achieved with such programs in randomized controlled trials, weight loss is often limited over the long term (17). Thus prevention programs to counteract the development of obesity should generally be emphasized. In order to develop more targeted and more successful strategies a better understanding of the importance of different factors in the development of childhood obesity is required.

Study objectives

The principle aim of this project was to investigate the time trend in the prevalence of overweight and obesity in 6 to 12 year old children in Switzerland over the period from 2002 to 2017/18. Furthermore, a secondary objective was to assess risk factors for the later development of NCDs using a questionnaire.

Outcome parameters

The primary outcome parameters were weight and height to calculate body mass index. This was used to classify children in weight categories.

Secondary outcome parameters were waist circumference and percent body fat as assessed by skinfold thickness measurements. Further secondary outcome parameters were related to physical activity, media consumption, dietary intake, general health as well as socioeconomic background and were assessed using a self-administered questionnaire.

Methods

Study design

In order to be comparable the current study was designed the same as the three previous ones. A probability-proportionate-to-size (PPS) cluster sampling was used to obtain a representative national sample of approximately 2500 children aged 6-12 years. PPS cluster sampling is a widely used and recommended method for anthropometric school based surveys. Current census data were used to provide a systematic sampling of urban and rural communities based on the cumulative population. The aim was to identify sixty communities and schools across Switzerland by stratified random selection. Schools that declined participation were systematically replaced by other randomly selected schools from the same strata. The location of the clusters is shown in Figure 1 and includes: green: Western region, blue: Central and eastern region, yellow: Northcentral region, grey: Northeastern region, and red: Southern region.

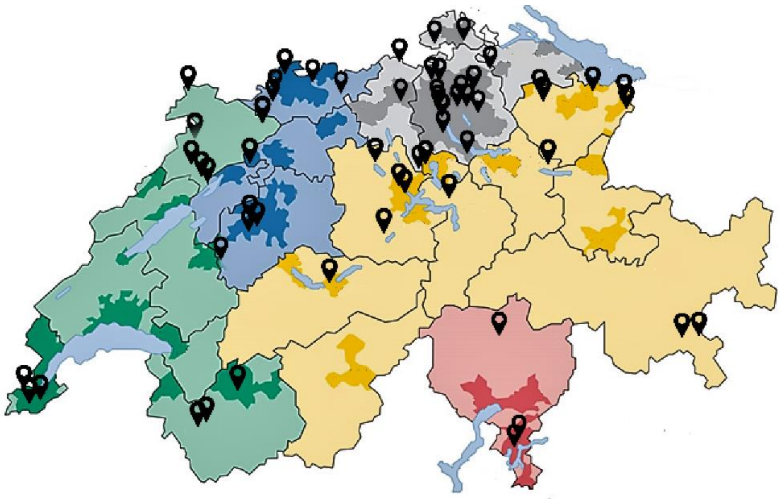

Figure 1: Map of Switzerland showing geographic regions and the location of the probability-proportionate-to-size sampling clusters (n=60). Green: Western region; blue: Central and eastern region; yellow: Northcentral region; grey: Northeastern region; red: Southern region

Three or four classrooms were randomly selected from each school and all students from the selected classrooms were invited to participate. We aimed at sampling an average of 40-45 students at each school, depending on the size of the classrooms.

An information letter describing the study and the examination process was sent to the school principal, teachers, parents and children at least 2 weeks prior to the measurement day in order to give parents/children sufficient time to consider participation. Consenting parents had to complete the consent form which the children returned to the teacher. Data was collected from September 2017 to March 2018. We obtained ethical approval from the Cantonal Ethical Committee of Zurich (Zurich, Switzerland) as a representative of all other Cantonal Ethical Committees (BASEC-Nr. 2017-01202). Where needed we obtained local authorization from cantonal or communal school or health

departments. The cantons of Vaud and Fribourg decided not to participate in the survey. The study was registered in clinicaltrials.gov (NCT03309189).

For all subjects, body weight was measured to the nearest 0.1 kg using a digital balance (Beurer GmbH, GS203 wood) and height was measured to the nearest 0.1 cm using a transportable stadiometer (SECA, 213). Body Mass Index (BMI) was calculated as weight divided by height^2. Using the BMI data, the prevalence of overweight and obesity in 6 – 12 year old children in Switzerland was calculated based on the CDC reference values using the cut offs of the 85th and the 95th percentiles (20), the IOTF reference values for overweight and obesity extrapolated from adult cut-off points (21) as well as the 85th and the 95th percentiles of the WHO BMI for age curves (22). Waist circumference was further measured in all children midway between the lowest rib and the iliac crest using a non-stretchable measuring tape. Using Swiss reference values for WC the 90th percentile was defined as a cut-off for increased risk for the development of the metabolic syndrome (23). The time trend analysis as well risk factor analysis will be done based on the CDC references as we have previously shown them to be more suitable for Swiss children compared to the IOTF references (12) unless the sensitivity and specificity analysis conducted in this study should prove the WHO references to be clearly superior.

Body fat percentage (BF%) of each child was determined by measuring skinfold thicknesses (SFT) at four sites using a Harpender Skinfold Caliper with a resolution of 0.2 mm. The four sites were triceps, biceps, subscapular and suprailiacal (24). For the triceps, the mid-point of the back of the upper arm between the tip of the olecranon and acromial process was determined by measuring with the arm flexed at 90 degrees. With the arm hanging freely at the side, the caliper was applied vertically above the olecranon at the marked level. Over the biceps, the SFT was measured at the same level as the triceps, with the arm hanging freely and the palm facing outwards. At the subscapular site, the was picked up just below the inferior angle of the scapula at 45° to the vertical along the natural cleavage lines of the skin. The suprailiac SFT was measured above the iliac crest, just posterior to the midaxillary line and parallel to the cleavage lines of the skin, the arm lightly held forward. All sites were measured on the right site of the body in duplicate. In every tenth participants measurements were conducted by two different investigators to determine inter-observer variability while in all other participants the duplicate measurements were performed by the same investigator to determine intra-observer variability.

Using the mean value of the repeated SFT measurements, the body density and BF% was calculated using the following equations (25):

BF% = (562 – 4.2 * [Age (y) – 2]) / D – (525 – 4.7 *[age(y) – 2])

where D = body density

For boys: D (g/ml) = 1.169 – 0.0788 * log10 (sum of 4 SFT [mm])

For girls: D (g/ml) = 1.2063 – 0.0999 * log10 (sum of 4 SFT [mm])

Swiss reference values for BF% were used to determine overweight and obesity based on this measurement. The 85th percentile was used for overweight and the 95th for obesity (12).

In order to determine time trends in the prevalence of overweight and obesity in schoolchildren in Switzerland, we have compared the newly assessed data to data from our previous studies conducted in 2002, 2007 and 2012 (10-12, 26).

In order to better understand the reasons for obesity in children and their risk for later development of NCD, a questionnaire was distributed to each participating child inquiring about socioeconomic background, general health, physical activity, and nutritional habits. The questionnaire (in three languages) is attached as **Annex 1.** Data entry was done using a standardized procedure by 5 trained persons (ES, SG, LH, SB and ZS).

The questionnaire contained a question on the place of birth of both parents of the child. For the analysis, the place of birth of the parents was categorized as follows: 'Both Swiss', Swiss and non-Swiss', and 'Both non Swiss'. The education level of both parents was further assessed using the following categories: 'obligatory school time', 'apprenticeship without professional maturity', apprenticeship with professional maturity', 'university of applied sciences or technical university', and 'university'. The educational levels of both parents were combined and categorized into the following three groups: 'low' (obligatory school time), 'moderate (apprenticeship with or without professional maturity), and 'high' (university of applied sciences, technical university or university).

Regarding physical activity, the children were asked for how many days in a typical week they are physically active for at least 60 minutes. Answers were categorized as follows: '≤1 day/week', '2-3 days/week' '4-5 days/week,' and '≥6 days/week'.

The children were asked how much time they spend watching TV or videos, playing at the computer, cell phone, tablet or similar, using social media and completing homework at the computer. The times for all activities were summed up to cover overall media consumption. Media consumption was then categorized into '≤1 h/day', '>1h and ≤2 h/day', '>2h and ≤3 h/day', and '>3 h/day'.

Several dietary factors were assess using the questionnaire. The children were asked how many times in the last 4 weeks they consumed the following items: soft drinks, fruit and vegetable juices, fruits, vegetables (including salad), milk and dairy products, meat and fish. The answers given were categorized as follows. For soft drinks as well as meat and fish: '≤1 day/week', '2-4 days/week', '5-6 days/week', and daily. For fruit and vegetable juices, fruits as well as vegetables: '<1 time/day', '1-2 times/day', '3-4 times/day', and '≥5 times/day'. For milk and dairy products: '≤1 day/week', '2-4 days/week', '5-6 days/week', '1 time/day' and '>1 time/day. Children were further asked about their breakfast habits and could choose from the following options: eating breakfast 'daily', 'sometimes (e.g. only on weekends)' and 'never'.

To assess the general health status of the children a few further questions were asked. Based on the time they usually go to sleep and get up the mean sleep duration was calculated. Furthermore, the children were asked whether they suffered from any disease (diabetes, asthma, other chronic disease)

and how they felt about their health in general (feeling very well, well, rather well or not well). The last two questions asked them to judge their weight status (weight perception: much too thin, too thin, about right, a little too heavy, much too heavy) and their life in general on a scale from 1 to 10 (life satisfaction).

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics 24 (IBM Company, Armonk, NY, USA) and Excel (Microsoft Office 2016, Microsoft Corporation, Redmond, WA, USA). Prevalence of overweight and obesity between gender was compared using the chi-square test followed by a z-test to check for significant differences between individual values. Similarly, prevalence of overweight and obesity between regions and communities of different sizes was done using the chi-square test followed by a z-test (including Bonferroni correction for multiple comparisons). The 95% confidence intervals for all prevalences were calculated using the Wilson procedure (27) as described by Robert Newcombe (28). A binary logistic regression was used on the trends in overweight and obesity prevalence between 1999 and 2017/18 with survey year as a continuous variable.

Multinomial logistic regressions were used to examine the associations between BMI category (by using the CDC references) and risk factors. In a first step, each individual risk factor was tested (dependent variable: BMI category; factor: each of the risk factors individually). In a second step, all factors showing a significant association in the univariate model were added in the multivariate, stepwise, backward model, controlling for age in addition (dependent variable: BMI category; factors: all significant risk factors; covariate: age). All models were checked for model fitting and parameters were only included in the final model if the likelihood ratio test showed a $p<0.05$. p values <0.05 were considered significant for all analyses.

Results

Study population

We contacted a total of 491 schools in order to recruit the 60 schools needed which resulted in a response rate of 12.2%. **Table 1** shows the number of schools expected and recruited for the different clusters. In the consenting schools, we invited 4165 children to participate in the study of which 2382 consented. On the day of measurement, 90 children were absent, resulting in a sample size of 2292 and a response rate within participating schools of 55%. Out of this number, we had to exclude data of another 13 children because their age was either below 6 years or 13 years and above. Thus, the number of participants included for data analysis was 2279. This corresponds to 1 in 212 children in this age group in Switzerland. A detailed overview of the number of participants by gender, age and cluster is given in **Table 2**.

Table 1 Overview of the expected and recruited number of schools in the different clusters.

Cluster	Geographic region	Population	Nr expected schools	Nr recruited schools
11	Western region	>99'999	2	1
12		10'000-99'999	5	2
13		>10'000	8	9
21	Central and eastern region	>99'999	0	0
22		10'000-99'999	5	6
23		>10'000	9	9
31	Northcentral region	>99'999	2	2
32		10'000-99'999	3	2
33		>10'000	6	6
41	Northeastern region	>99'999	4	4
42		10'000-99'999	5	6
43		>10'000	9	10
51	Southern region	>99'999	0	0
52		10'000-99'999	1	1
53		>10'000	2	2

Table 2 Number of study participants by gender, age and cluster

	N (%)
Gender	
Girls	1135 (49.8%)
Boys	1144 (50.2%)
Age	
6 to 8	887 (38.9%)
9 to 10	857 (37.6%)
11 to 12	535 (23.5%)
Region	
1	521 (22.9%)
2	582 (25.5%)
3	301 (13.2%)
4	759 (33.3%)
5	116 (5.1%)
Community size	
<10'000	1367 (60.0%)
10'000-<100'000	673 (29.5%)
≥ 100'000	239 (10.5%)

To evaluate the time trend in the prevalence of overweight and obesity data from three comparable previous studies was used (10-12, 26). Participant characteristics of those three study populations and the one from the current study are shown in Table 3.

Table 3 Characteristics of the study populations of four national surveys conducted in the years 2002, 2007, 2012 and 2017/18.

	2002	2007	2012	2017/18
n	2493	2218	2963	2279
Gender (% boys)	49.4	48.8	50.6	50.2
Age (y)	9.9 (6.2-13.0)[a]	10.1 (6.3-13.0)	9.9 (6.3-13.0)	9.5 (6.0-12.9)
Weight (kg)	32.7 (17.7-94.4)	33.2 (15.9-83.3)	32.7 (16.7-132.3)	33.1 (16.7-106.2)
Height (m)	1.387 ± 0.120[b]	1.400 ± 0.116	1.389 ± 0.117	1.376 ± 0.111
BMI (kg/m^2)	17.1 (12.5-35.0)	16.9 (12.3-34.7)	16.9 (12.4-42.7)	17.2 (11.9-42.5)
Nr. schools	57	60	58	60
Response rate children (%)	76.4	72.5	94.5	55.0

[a] Median (min-max) (all such values)

[b] Mean ± SD (all such values)

Overweight and obesity prevalence and time trend

The prevalence of overweight and obesity based on the different available reference values (CDC, IOTF and WHO) as well as based on body fat and waist circumference in the year 2017/18 is shown in Table 4. There were no significant gender differences in the overweight prevalence using any of the references while the prevalence of obesity was significantly higher in boys using the CDC, WHO and BF% references.

Table 4 Prevalence (% (95% CI)) of overweight and obesity or increased risk for metabolic co-morbidities based on three different BMI reference values as well as BF% (body fat percentage) and WC (waist circumference) in a national survey in Switzerland in 2017/18 (n=2279).

	CDC	IOTF	WHO	BF%	WC*
Overweight/ increased risk					
Total	10.6 (9.4-11.9)	11.7 (10.5-13.1)	16.1 (14.6-17.6)	11.0 (9.8-12.4)	6.0 (5.1-7.1)
Boys	10.8[a] (9.1-12.7)	10.8[a] (9.1-12.7)	17.3[a] (15.2-19.6)	12.0[a] (10.3-14.2)	6.9[a] (5.6-8.6)
Girls	10.4[a] (8.8-12.3)	12.7[a] (10.9-14.8)	14.8[a] (12.9-17.0)	10.0[a] (8.4-11.9)	5.1[a] (4.0-6.6)
Obesity					
Total	5.3 (4.5-6.3)	3.3 (2.6-4.1)	6.0 (5.1-7.1)	3.3 (2.6-4.1)	
Boys	6.3[a] (5.0-7.9)	3.6[a] (2.7-4.8)	7.3[a] (6.0-9.0)	4.2[a] (3.2-5.6)	
Girls	4.3[b] (3.3-5.7)	3.0[a] (2.2-4.2)	4.7[b] (3.6-6.1)	2.3[b] (1.6-3.4)	

*Only one category of 'increased risk' was defined for WC and it was based on the 90th percentile.
Different superscript letters indicate significant differences between boy and girls for each set of references and weight category (z-test, $p<0.05$).

Prevalence of overweight and obesity of all four surveys is shown in Table 5 and Figure 2 based on CDC reference values. The prevalence of overweight including obesity was the following: 2002: 20.1%, 2007: 15.3%, 2012: 18.8%, and 2017/18: 15.9%. Using a binary logistic regression a weak but significant

trend towards a reduction in childhood overweight including obesity could be identified (B(SE)=-0.012, p=0.010, OR= 0.988 (0.978-0.997)) whereas there was no change in the prevalence of obesity (B(SE)=-0.006, p=0.471, OR=0.994 (0.979-1.010)).

Table 5 Prevalence (% (95% CI)) of overweight and obesity (based on the CDC reference values) of 4 national studies in Switzerland in the 2002, 2007, 2012, and 2017/18.

	2002	2007	2012	2017/18
Overweight including obesity				
Total	20.1 (18.6-21.7)	15.3 (13.8-16.8)	18.8 (17.4-20.3)	15.9 (14.4-17.4)
Boys	21.0 (18.8-23.4)	17.2 (15.1-19.6)	20.0 (18.1-22.1)	17.1 (15.1-19.4)
Girls	19.3 (17.2-21.5)	13.5 (11.6-15.6)	17.5 (15.6-19.5)	14.7 (12.8-16.9)
Overweight				
Total	13.3 (12.0-14.7)	11.0 (9.8-12.4)	11.8 (10.7-13.0)	10.6 (9.4-11.9)
Boys	13.4[a] (11.6-15.4)	11.8[a] (10.0-13.9)	12.1[a] (10.6-13.9)	10.8[a] (9.1-12.7)
Girls	13.3[a] (11.5-15.3)	10.2[a] (8.6-12.1)	11.5[a] (10.0-13.2)	10.4[a] (8.8-12.3)
Obesity				
Total	6.8 (5.9-7.9)	4.3 (3.5-5.2)	7.0 (6.1-8.0)	5.3 (4.5-6.3)
Boys	7.6[a] (6.2-9.3)	5.4[a] (4.2-6.9)	7.9[a] (6.7-9.4)	6.3[a] (5.0-7.9)
Girls	6.0[a] (4.8-7.5)	3.3[b] (2.4-4.5)	6.0[b] (4.9-7.4)	4.3[b] (3.3-5.7)

Different superscript letters indicate significant differences between boy and girls for each set of references and weight category (z-test, p<0.05). Overweight: >85th and <95th percentile, obesity >95th percentile

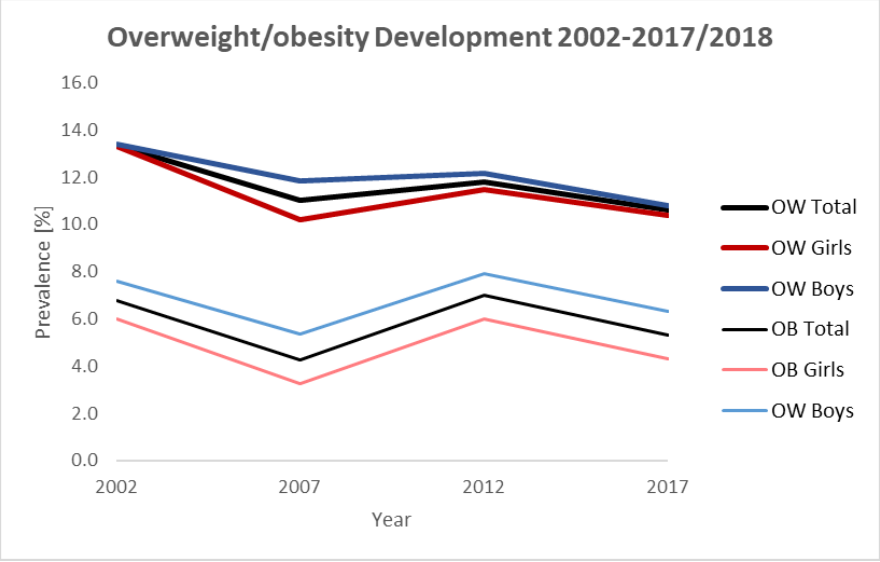

Figure 2 Development of the prevalence of overweight and obesity between 2002 and 2017/18 based on four national surveys in Switzerland and using the CDC reference values (overweight: >85th and <95th percentile, obesity >95th percentile). OW: overweight, OB: obesity; blue: boys; red: girls; black: all children

As age may be a predictor of childhood overweight and obesity, we have divided our sample into three age groups for comparison. Prevalence by age group is shown in **Table 6**. There were no significant differences in overweight or obesity between the three age groups.

Table 6 Prevalence (% (95% CI)) of overweight and obesity by age group in 6-12 year old schoolchildren in Switzerland (n=2279)

	6 to 8 years	9 to 10 years	11 to 12 years
N	887	857	535
Overweight	10.8 [a] (8.9-13.0)	11.0 [a] (9.1-13.2)	9.5[a] (7.3-12.3)
Obesity	5.5 [a] (4.2-7.2)	6.1 [a] (4.7-7.9)	3.7 [a] (2.4-5.7)

Different superscript letters indicate significant differences between age groups for each weight category (chi-square test followed by z-test (Bonferroni correction for multiple comparisons), p<0.05)

The prevalences of overweight and obesity by region are shown in **Table 7**. Even though obesity seems to be considerably more common in the Southern region (Ticino), and overweight less common in the Central Eastern region, there was no significant difference in the distributions between regions.

Table 7 Prevalence (% (95% CI)) of overweight and obesity by region in 6-12 year old schoolchildren in Switzerland (n=2279)

	Western region	Central and Eastern region	Northcentral region	Northeastern region	Southern region
N	522	581	302	758	116
Overweight	12.3[a] (9.7-15.4)	8.4[a] (6.4-11.0)	9.3[a] (6.5-13.1)	11.3[a] (9.3-13.8)	12.1[a] (7.3-19.2)
Obesity	5.6[a] (3.9-7.9)	5.2[a] (3.6-7.3)	4.6[a] (2.8-7.6)	5.1[a] (3.8-7.0)	7.8[a] (4.1-14.1)

Different superscript letters indicate significant differences between regions for each weight category (chi-square test followed by z-test (Bonferroni correction for multiple comparisons), p<0.05).

The prevalence of overweight and obesity by population size of the communities is shown in **Table 8**. While the prevalence of overweight is highest in the large cities (>100'000 inhabitants, p<0.05), the prevalence of obesity is highest in the medium sized communities (10'000 – 100'000 inhabitants), even though this difference was not significant.

Table 8 Prevalence (% (95% CI)) of overweight and obesity by community population size in 6-12 year old schoolchildren in Switzerland (n=2292)

	<10'000 inhabitants	10'000-100'000 inhabitants	>100'000 inhabitants
N	1367	673	239
Overweight	9.7 [a] (8.2-11.3)	10.5 [a,b] (8.5-13.1)	15.9 [b] (11.8-21.1)
Obesity	4.6 [a] (3.6-5.9)	6.8 [a] (5.2-9.0)	5.0 [a] (2.9-8.6)

Different superscript letters indicate significant differences between population size for each weight category (chi-square test followed by z-test (Bonferroni correction for multiple comparisons), p<0.05).

We have used three different measures to determine overweight/obesity in the study population and three different cut-offs for BMI. To compare the different values, we are presenting the sensitivity and specificity of WC and BMI cut-offs compared to BF cut-offs in **Table 9**. As we have previously shown the CDC reference values to be better suitable for Swiss children compared to the IOTF references (12) and the analysis in Table 9 also points overall towards the best performance of

the CDC references (high specificity with still reasonably high sensitivity), we have done all the analyses related to time trend and risk factors using those.

Table 9 Sensitivity and specificity of the CDC BMI reference and the WC reference for overweight/obesity when compared to the %BF references

	Sensitivity	**Specificity**
CDC references		
Overweight+ obesity	74.4%	93.9%
Obesity	77.0%	97.1%
WHO references		
Overweight+ obesity	84.3%	88.4%
Obesity	79.7%	96.4%
IOTF references		
Overweight+ obesity	74.1%	94.9%
Obesity	60.8%	98.6%
WC references		
Increased risk	39.8%	99.6%

Risk factors

Potential risk factors for overweight and obesity were assessed using a questionnaire as described above. The questionnaire was returned by 2149 children (94.3%). An overview of the answers (frequency (%)) by weight status group is given in **supplementary Table 1**. Logistic regression models in two steps were used to investigate the effect of the different potential risk on weight status as described earlier. The factors showing a significant association with weight status (as defined using the CDC BMI references) in the individual models, and thus included into the multivariate model, were parental origin, parental education, media consumption, physical activity, sleep duration (tertiles), eating breakfast and vegetable consumption. The individual model could not be calculated for several factors due to very small numbers in some of the categories: Soft drinks, fruit/vegetable juice, milk and dairy products, meat and fish, any disease, general health, life satisfaction, and self perception of weight. Furthermore, the individual model was not significant for fruit consumption. The results of the multiple stepwise regression which, besides the factors mentioned above also included gender as well as age as a covariate, are shown in **Table 10**. Only parental education, parental origin, physical activity, and gender remained in the final model as significant predictors of overweight and/or obesity. Based on the pseudo R-Square (Naglekerke's adjuste value), however, the model only explains 11.7% of the variability in the dependent variable. **Figure 3** shows the differences in overweight and obesity prevalence by parental origin (A) and parental education (B). **Figure 4** shows the prevalence of overweight and obesity according to physical activity which was based on the number of days children reported to be physically active for more than 1 hour within the past week. The median number of days children reported to have been physically active in the past 7 days was 5 (4-5) for normal weight, 4 (4-4) for overweight and 3 (3-4) for obese children, with a significant difference between normal weight and overweight as well as obese (both $p<0.001$) but not between overweight and obese ($p=0.058$).

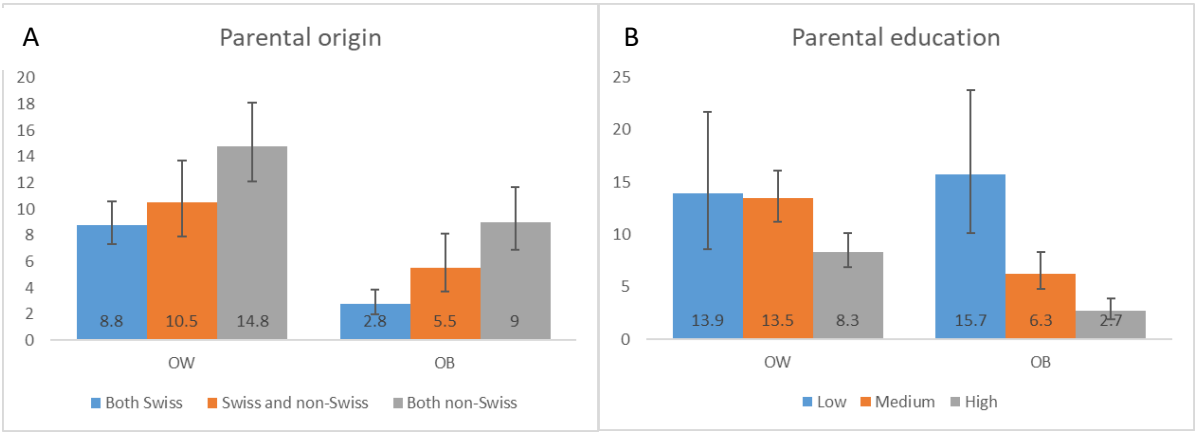

Figure 3 Prevalence of overweight and obesity by parental origin (A) and parental education (B) in a nationally representative sample of schoolchildren in Switzerland (n=2149). OW: overweight, OB: obese

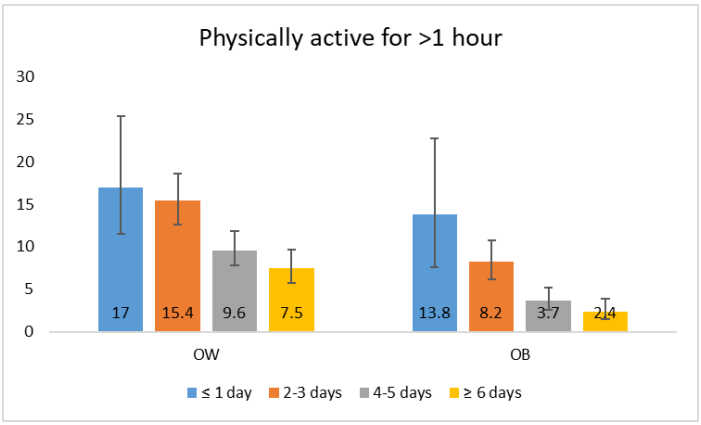

Figure 4 Prevalence of overweight and obesity by physical activity (number of days children reported to be physically active for more than 1 hour in the past 7 days) in a nationally representative sample of schoolchildren in Switzerland (n=2149). OW: overweight, OB: obese

Table 10 Risk factors for overweight and obesity in a national sample of school aged children in Switzerland (n=2149)

	Normal weight	**Overweight**			**Obese**		
	%	%	OR (95% CI)	P	%	OR (95% CI)	p
Parental origin							
Both CH	56.9	44.7	0.590 (0.404-0.861)	0.006	30.8	0.491 (0.278-0.868)	0.014
CH and non-CH	19.8	19.5	0.729 (0.464-1.145)	0.170	22.1	0.861 (0.466-1.590)	0.633
Both non-CH	23.3	35.8	0		47.1	0	
Parental education							
Low	4.4	7.0	1.319 (0.662-2.630)	0.431	17.7	3.118 (1.458-6.666)	0.003
Medium	35.3	47.7	1.721 (1.245-2.377)	0.001	50.0	1.945 (1.181-3.204)	0.009
High	60.2	45.3	0		32.3	0	
Physical activity							
≤ 1 day	3.6	7.0	2.203 (1.058-4.588)	0.035	12.5	5.073 (2.083-12.355)	<0.001
2-3 days	23.2	36.7	2.238 (1.476-3.392)	<0.001	43.3	3.307 (1.755-6.231)	<0.001
4-5 days	39.5	34.5	1.387 (0.927-2.078)	0.112	28.8	1.393 (0.714-2.717)	0.331
≥ 6 days	33.6	21.8			15.4		
Gender							
Girls	50.5	49.0	0.824 (0.604-1.124)	0.222	40.5	0.554 (0.350-0.879)	0.012
Boys	49.5	51.0			59.5		

As most of the factors related to general health could not be taken into account in the model they are described in more detail here. The median life satisfaction (10=best life you can imagine, 1= worst life you can imagine) was 9 with 29.9%, 24.8% and 25.2% in this category in the normal weight, overweight and obese categories, respectively. Adding all children up who selected a score of 8 and higher, the proportion was 83.6% (n=1487) in the normal weight, 82.0% (n=182) in the overweight, and 81.5% (n=84) in the obese group.

In the questionnaire we asked the children whether they suffered from diabetes, asthma or any other chronic disease. As the positive answers were small for all three categories, a new variable was created that included all diseases. In the normal weight group 7.4% of the children indicated to have any chronic disease while it was 7.9% in the overweight and 3.3% in the obese groups, with no significant differences between the groups. When judging their general health, the majority stated to be of very good health (80.4%, 74.0% and 70.2% in normal weight, overweight and obese children, respectively), but the proportion was significantly higher in the normal weight group compared to the obese. On the other hand, the proportion of children indicating good health (18.3%, 25.6%, and 26.9% in normal weight, overweight and obese children, respectively) was significantly lower in the normal weight compared to the overweight group.

Sleep duration in hours by age group and weight category is shown in T**able 11**. In all age groups, sleep duration is decreasing from the normal weight to the obese children with significant differences in the youngest and oldest age groups.

Table 11 Sleep duration in hours (median (95% CI) in normal weight, overweight and obese children from nationally representative sample of schoolchildren in Switzerland (n=2149) by age group.

	Normal weight	**Overweight**	**Obese**
6-8 years	10.82 (10.80-10.86)[a]	10.71 (10.57-10.93) [b]	10.64 (10.43-10.71) [b]
9-10 years	10.46 (10.39-10.50) [a]	10.36 (10.27-10.5) [a]	10.18 (10.02-10.31) [a]
11-12 years	10.11 (10.04-10.18) [a]	9.97 (9.82-10.16) [b]	9.68 (9.07-10.19) [b]

Values not sharing a common superscript letter are significantly different between weight categories (one-way ANOVA with post hoc Bonferroni correction, $p<0.05$).

The same logistic regression models in two steps as above were used to investigate the risk factors for high WC and %BF. **Table 12** shows the final multivariate model for WC, which includes physical activity, parental origin, parental education, media consumption as well as soft drink consumption. All other factors were excluded either due to model insufficiency in the individual model or because they did not show a significant effect in the individual model (eating breakfast and gender). Based on the pseudo R-Square (Naglekerke's adjuste value), the model explains 15.4% of the variability in the dependent variable.

Table 12 Risk factors for increased waist circumference (WC) in a national sample of school aged children in Switzerland (n=2149)

	Normal weight	**Increased WC**		
	%	%	OR (95% CI)	P
Parental origin				
Both CH	55.8	29.7	0.461 (0.273-0.778)	0.004
CH and non-CH	19.8	22.9	0.953 (0.545-1.664)	0.864
Both non-CH	24.4	47.5	0	
Parental education				
Low	4.8	14.8	1.982 (0.939-4.184)	0.073
Medium	36.5	52.8	2.025 (1.273-3.221)	0.003
High	58.8	32.4	0	
Physical activity				
≤ 1 day	4.0	10.9	2.877 (1.251-6.612)	0.013
2-3 days	24.6	43.7	2.511 (1.418-4.444)	0.002
4-5 days	39.0	28.6	1.056 (0.574-1.943)	0.861
≥ 6 days	32.4	16.8		
Media consumption				
≤1 hour/day	54.0	29.7	0.323 (0.156-0.668)	0.002
>1-2 hours/day	30.9	33.9	0.565 (0.284-1.126)	0.104
2-3 hours/day	9.6	22.0	1.009 (0.483-2.106)	0.981
>3 hours/day	5.4	14.4	0	
Soft drink consumption				
≤ once/week	62.6	50.8	1.196 (0.631-2.266)	0.584
2-4 times/week	18.3	32.5	2.641 (1.352-5.159)	0.004
5-6 times/week	4.0	2.5	0.639 (0.174-2.346)	0.500
Daily	15.1	14.2	0	

Table 13 shows, the results of the corresponding multivariate model for %BF, which includes physical activity, parental origin, parental education, media consumption, sleep duration (in tertiles), fruit consumption, vegetable consumption, eating breakfast and gender. In the backward stepwise model vegetable consumption and physical activity were removed from the model and, even though they were included in the final model, media consumption and eating breakfast did not show any significant prediction of either overweight or obesity, so they are not included in the table. Based on the pseudo R-Square (Naglekerke's adjuste value), the model explains 12.5% of the variability in the dependent variable.

Table 13 Risk factors for overweight and obesity defined by %BF (body fat percentage) in a national sample of school aged children in Switzerland (n=2149)

	Normal weight	**Overweight**			**Obese**		
	%	%	OR (95% CI)	P	%	OR (95% CI)	p
Parental origin							
Both CH	57.3	34.1	0.341 (0.234-0.497)	<0.001	44.8	0.730 (0.380-1.404)	0.346
CH and non-CH	19.9	21.8	0.644 (0.424-0.980)	0.040	14.9	0.492 (0.206-1.173)	0.110
Both non-CH	22.7	44.1	0		40.3	0	
Parental education							
Low	4.3	10.6	1.706 (0.930-3.130)	0.084	15.9	3.001 (1.122-8.029)	0.029
Medium	35.9	44.5	1.525 (1.097-2.119)	0.012	52.4	2.029 (1.120-3.675)	0.020
High	59.8	45.0	0		31.7	0	
Sleep duration (tertiles)							
Lowest	33.0	32.9	0.653 (0.437-0.977)	0.038	55.4	1.855 (0.878-3.920)	0.105
Middle	33.2	35.1	0.873 (0.598-1.275)	0.483	23.1	0.985 (0.432-2.244)	0.971
Highest	33.8	32.0			21.5		
Fruit consumption							
< once/day	32.9	40.4	0.646 (0.416-1.002)	0.051	49.2	4.712 (1.098-20.233)	0.037
1-2 times/day	53.2	40.0	0.543 (0.356-0.828)	0.005	47.7	3.622 (0.846-15.509)	0.083
≥ 3 times/day	13.9	19.6	0		3.1		
Gender							
Girls	51.0	45.2	0.728 (0.535-0.990)	0.043	35.1	0.577 (0.332-1.005)	0.052
Boys	49.0	54.8			64.9		

Discussion

Sample

In recent years it has become more and more difficult to recruit schools and children within those schools to participate in surveys. By contacting a total of almost 500 schools in Switzerland we have been able to include the required 60 schools. However, in some clusters it was not possible to recruit the correct amount of schools as all the available schools were contacted and not enough agreed to participate. However, we replaced the missing schools with schools from other clusters. Two cantons, namely the cantons of Vaud and Fribourg, decided not to participate in the study at all, which made recruitment in the concerned western region challenging, especially in cluster 12 as shown in Table 1. Like the response rate of the schools, the one of the children has also declined over time. In the first two studies in the years 2002 and 2007 the same form of consent was used, and the response rate was with around 75% considerably higher compared to the current response rate of 55%. We are not sure what the reason is for this decline in the response rate, but one factor could be, that the procedure of recruitment has become more complicated. As since 2014 all studies collecting health related data in Switzerland need to be approved by the cantonal ethical committees, we are obliged to use standardized information sheets and consent forms that include information which may not be so relevant for a study assessing weight status and distributing a questionnaire. This has led to longer and more complex information sheets for parents and consent form, which may prevent especially those who have trouble reading the respective national language, from participating. Also, the general public

has become more aware of the obesity problematic since our first study in 2002. Thus, some parents of overweight children may have decided not to let their children participate out of fear of stigmatization or similar. In order to prevent this we had been careful not to use the word overweight or obesity anywhere in the participant information, but as we were assessing weight and body fat it was not so difficult to make the connection. How big an impact on the consent of the parents the weight status of the children has is debated, even though an earlier study found that active and passive consent lead to similar prevalence estimates, thus indicating no such bias (29). Still, based on the low response rate we cannot exclude a certain bias within our data, even though we cannot exactly define it.

Overweight/obesity prevalence and time trend

The results of our time trend analysis have shown a reducing trend in the prevalence of childhood overweight and obesity in Switzerland. However, even though this reducing trend was shown to be significant in a logistic regression it should be interpreted with caution as the model only showed a weak trend with an OR of 0.988. When looking at Figure 2 it seems to be more of a stabilization at a still high level rather than a relevant decrease. A similar stabilizing trend with some fluctuations was shown in several countries over the past two decade (15, 16, 30). A large German study recently reported a stabilizing, and in some age groups even decreasing trend in overweight and obesity prevalences between 2005 and 2015 (31). In a report based on the WHO COSI surveys 2007/2008 and 2009/2010, some countries showed an increase in prevalence while others showed a decrease over the same period of time (32). However, this is not necessarily in conflict with our results and those of several other countries. As the time frame for the WHO comparison was only two years, short term fluctuations in both directions were registered rather than a longer term trend. In Switzerland, a similar decreasing trend as in the current study was already demonstrated by the BMI monitoring program of school physicians of the three large cities Bern, Basel and Zurich. In the age group comparable to our current survey (6-12 years) they reported an overall prevalence of overweight including obesity of 22% between 2005 and 2009 and 21% between 2013 and 2016 (33).

This BMI monitoring program includes a total of 143’113 children from the three large cities Bern, Basel and Zurich and is conducted by the school physicians. The advantage of this program is that the biggest part of all children attending public schools in those cities were included in the measurements as they are done as part of the normal school curriculum, thus reducing the non-responder bias. On the other hand, they only include children in three large cities in the German speaking part of Switzerland and are therefore not necessarily representative for the entire population. When comparing the prevalence of overweight and obesity (combined) between the BMI monitoring and our data for communities with >100’000 inhabitants, we should be able to better compare the data. As the prevalence was calculated using the IOTF references in the BMI monitoring, we have recalculated the overweight and obesity prevalence in large cities in our sample using the same references. With a prevalence of 19.6% (overweight 16.3% and obesity 3.3%) for our data and a prevalence of 21% for the years 2013-2016 in the BMI monitoring, the results are indeed comparable. As shown in Table 8

we have found a significantly higher overweight prevalence in the large cities compared to smaller villages. Therefore, our overall prevalence of overweight and obesity combined of 15.0% based on the IOTF reference values is considerably lower compared to the BMI monitoring (21%) while the prevalence in the bigger cities is comparable. This indicates, that the data of the BMI monitoring may not represent the entire population of schoolchildren in Switzerland. The BMI monitoring also included additional age groups, namely younger children (kindergarden) and older children/adolescents (ca. 13 to 16 years). The prevalence of overweight and obesity was found to be considerably lower in the younger children (12.2%) while it was higher in the older children (24.6%). Thus, those data indicate an increase in the prevalence of overweight and obesity with increasing age. We did not see this trend in our analysis where we found no significant differences between age groups (Table 6). If anything, there was a trend towards lower overweight and obesity rates in the 11-12 year old children.

Risk factors for overweight and obesity

For the second time after 2012 we have tried to identify the most important predictors for overweight and obesity using a questionnaire assessing dietary and lifestyle habits as well as some socioeconomic data. Using a stepwise logistic regression model we have identified parental origin, parental education as well as physical activity and gender as important factors for the development of overweight and obesity when it was defined using BMI. In children where both parents were born in Switzerland the risk for both overweight and obesity was around 50% lower compared to children with both parents born outside of Switzerland. Furthermore, low parental education increased the risk for obesity >3 fold compared to high education. Thus, prevention programs addressing families with migration background and/or low education can be expected to have the highest impact. With respect to physical activity there was also an important effects, even though the method of assessment has its limitations as described later. Physical activity, assessed as the number of days children are active for more than 1 hour in a normal week, showed important effects on both overweight and obesity. Compared to those children who were active on 6 and more days per week, those who were active only on 1 or 2-3 days had a 2.2 fold increased risk for obesity and a 13.8 and 8.2 times increased risk for obesity. On the other hand, we have not been able to determine any dietary components that showed a significant effect on the overweight or obesity risk. Thus, physical activity seems to be another important point for prevention programs in this age group rather than focusing on dietary factors. Finally, we found girls to have an almost 50% reduced risk for obesity compared to boys, which is in line with the significantly higher prevalence shown in Table 4. In our previous surveys the trend has been similar always with larger differences in obesity compared to overweight. This finding of a higher obesity prevalence in boys compared to girls is also in agreement with data from other European countries (34-37). It might therefore be important to especially emphasize boys in prevention programs in the future. The main risk factors for overweight and obesity identified using the questionnaire in our current study are comparable to those described in the previous survey from 2012 (38) with the exception of media consumption. Especially in boys media consumption was an important risk factor in 2012 while it did not remain significant in the overall model. This may be due to the fact that for the current analysis we decided to include both boys and girls in the same model and test the effect of

gender as a factor. When looking at boys and girls individually media consumption seemed to be an individual predicting factor in boys but the model could not be calculated in girls due to small numbers. This again indicates a certain impact of media consumption in boys, even though the factor did not remain significant in the overall model.

When using the same stepwise logistic regression model with WC or %BF as the determinant for obesity instead of BMI, the results looked slightly different as shown it Tables 12 and 13. What was interesting was, that parental origin as well as parental education remained significant predictors in both models. However, physical activity was only a predictor when determining overweight using WC and gender only when using %BF. On the other hand, overweight as determined by WC was also predicted by media consumption as well as the frequency of soft drink consumption while overweight as determined by %BF was predicted by sleep duration (tertiles) as well as the frequency of fruit consumption. This clearly indicates, that a variety of factors contribute to the development of overweight and obesity in children and that is difficult to pin down specific factors, especially with the tool that was used in this study which did not allow precise assessment of some of the factors. For example all data on dietary intake are based on the answers to the small food frequency questionnaire which only allows an estimate of actual intake. On the other hand, the results clearly demonstrate that both parental origin and parental education seem to be very important factors contributing to the development of childhood overweight and obesity.

Reference values

When comparing data on overweight and obesity prevalence in children it is important to know how the data was calculated and which reference curves were used. We have calculated the prevalence of overweight and obesity for our current study based on three different BMI reference values, namely those from the CDC, IOTF and WHO. Each of those references was created in a different way, using different population groups and different methods. The results show comparable values for overweight between CDC and IOTF while the obesity prevalence seems to be lower when using the IOTF references. This is in line with our previous findings where we showed that compared to data as assessed using BF% the IOTF references underestimated obesity prevalence (12). When looking at the overweight prevalence calculated using WHO references, those estimates are higher compared to both CDC and IOTF. On the other hand, the WHO obesity prevalence is similar to the CDC estimate. The combined prevalence of overweight and obesity was 15.9% for CDC, 15.0% for IOTF and 22.1% for WHO. These differences again indicate the importance of only comparing values calculated using the same reference curves. We have also determined overweight and obesity using BF% as measured by skinfold thicknesses and national reference curves defined using our study population in 2002 (11). Interestingly, the prevalence of overweight is again comparable to both the CDC and the IOTF estimates, while the prevalence of obesity is closer to the IOTF estimate and not the CDC as in 2002.

The comparison between overweight/obesity as determined using %BF with BMI (using different reference values) or WC has shown a high specificity (94%-99%) for all except the WHO reference for

overweight including obesity (88%%). This indicates, that 12% of the children classified as normal weight by %BF were classified as overweight or obese by the WHO BMI reference. Sensitivity varied between 61% (IOTF obesity) and 84% (WHO overweight including obesity) for the BMI references which indicates that the IOTF obesity reference failed to identify 40% of the children identified as obese using %BF. The sensitivity for WC was very low with just below 40%. Thus, BMI seems to be a comparably reliable measure to determine overweight and obesity to %BF as assessed using skinfold thickness, even though there were differences between the methods. On the other hand, the WC reference used failed to identify 60% of the overweight/obese children as such. This can be mainly explained by the fact, that for WC the cut-off for increased risk was set at the 90th percentile of the reference population, while for BMI and %BF we used the 85th percentile for overweight and the 95th for obesity. Thus, even with a perfect agreement between the two methods we have to expect all children between the 85th and the 90th percentile not being captured as an at risk group with the WC cut-off used. It is therefore not really useful to compare the two measures in this way.

Strengths and limitations

Our study has several strengths and limitations. Using the PPS cluster sampling we have selected a representative sample of school aged children in Switzerland. Our study teams have personally visited all participating schools and have collected data that is comparable between schools. Besides anthropometric data, we collected data on physical activity/inactivity, dietary habits as well as general health and socioeconomic background of the children. This allows us to not only interpret the weight status itself, but also relate it to potential risk factors.

As our study was based on voluntary participation and we had to ask written consent from all parents of the participating children, we had a response rate of only 55%. This, combined with the even lower response rate of schools of 12%, may have led to a certain selection bias in our study population. Furthermore, as two entire cantons in one region decided not to participate in the survey, we encountered even bigger problems with recruitment in this region. We asked the children to complete the questionnaire at home with the help of their parents. However, we cannot be sure who really answered the questions in the end. Furthermore, for some questions we encountered difficulties with regard to the interpretation of the answers. When the answers to a question were not clear or several options were ticked, the respective answer was not considered in the analysis. Especially one question was almost impossible to analyze: we asked the children whether they performed any sport and if so, for how long each week. The sports activities listed were so varied and the time indications so unclear, that we decided to not include those answers in the analysis. Thus, physical activity was only judged by the answer to the question how many times in a normal week children are active for more than 1 hour, which is a rather rough estimate of physical activity. We assessed the intake of several food groups with a short food frequency questionnaire integrated into the questionnaire. This only asked about frequencies of consumption and not quantities. This may have contributed to the fact that we have not been able to identify any of the dietary factors as predictors of overweight and/or obesity.

To conclude, we have shown a weak but significant decreasing trend in the prevalence of overweight including obesity, but not of obesity on its own, in 6 to 12 year old children in Switzerland over the past 15 years. Nevertheless, with almost 16% of overweight including obesity, the prevalence remains a public health concern. The most important predictors for the development of overweight or obesity were parental origin and education as well as physical activity and gender. Thus, obesity prevention should focus on population groups with a migration background and/or lower education levels and especially address boys. Furthermore, it seems as if physical activity should be emphasized more than dietary aspects in this age group.

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Supplementary Table 1 Frequencies (%) or mean (±SD) values of answers given to the questions in self administered questionnaire by weight status group (based on CDC reference values)

	Normal weight	**overweight**	**obese**
Physically active for min 1 hour			
≤ 1 day	65 (3.6%)	16 (7.0%)	13 (12.5%)
2-3 days	418 (23.2%)	84 (36.7%)	45 (43.3%)
4-5 days	711 (39.5%)	79 (34.5%)	30 (28.8%)
6 days	214 (11.9%)	17 (7.4 %)	8 (7.7%)
7 days	390 (21.7%)	33 (14.4%)	8 (7.7%)
Softdrink consumption			
≤ once/week	1115 (62.6%)	134 (59.8%)	58 (54.7%)
2-4 times/week	329 (18.5%)	43 (19.2%)	31 (29.2%)
5-6 times/week	70 (3.9%)	10 (4.5%)	3 (2.8%)
daily	267 (15%)	37 (16.5%)	14 (13.2%)
Fruit- and vegetable juice consumption			
< once per day	1347 (76.1%)	175 (78.1%)	69 (69%)
1-2 times/day	370 (20.9%))	43 (19.2%)	24 (24.0%)
3 and more/day	53 (3.0%)	6 (2.7%)	7 (7.0%)
Fruit consumption			
< once per day	584 (33.1%)	87 (39.0%)	44 (43.1%)
1-2 times/day	937 (53.1%)	100 (44.8%)	42 (41.2%)
3-4 times/day	203 (11.5%)	30 (13.5%)	10 (9.8%)
5 and more/day	42 (2.4%)	6 (2.7%)	6 (5.9%)
Vegetable consumption			
< once per day	556 (31.2%)	83 (37.6%)	44 (42.7%)
1-2 times/day	1089 (61.2%)	114 (51.6%)	51 (49.5%)
3-4 times/day	97 (5.4%)	18 (8.1%)	5 (4.9%)
5 and more/day	38 (2.1%)	6 (2.7%)	3 (2.9%)
Fruit and vegetable consumption			
< 1/day	360 (20.5%)	57 (25.8%)	28 (28.0%)
Once/day	239 (13.9%)	36 (16.3%)	15 (15.0%)
2 times/day	353 (20.1%)	37 (16.7%)	24 (24%)
3 times/day	325 (18.5%)	32 (14.5%)	8 (8%)
4 times/day	267 (15.2%)	23 (10.4%)	10 (10%)
≥5 times/day	211 (12%)	36 (16.3%)	15 (15%)
Milk and dairy product consumption			
≤ once/week	111 (6.2%)	19 (8.6%)	13 (12.4%)
2-4 times/week	189 (10.6%)	23 (10.4%)	10 (9.5%)
5-6 times/week	170 (9.6%)	25 (11.3%)	15 (14.3%)
once/day	570 (32.0%)	72 (32.6%)	33 (31.4%)
> once/day	740 (41.6%)	82 (37.1%)	34 (32.4%)
Meat and fish consumption			
≤ once/week	173 (9.7%)	21 (9.4%)	18 (17.8%)
2-4 times/week	628 (35.3%)	70 (31.4%)	26 (25.7%)
5-6 times/week	352 (19.8%)	46 (20.6%)	19 (18.8%)
daily	626 (35.2%)	86 (38.6%)	38 (37.6%)

Supplementary Table 1 (continued)

	Normal weight	overweight	obese
Do you normally eat breakfast			
Yes, always	1341 (74%)	153 (67.7%)	63 (59.4%)
Only on weeknds/sometimes	290 (16.1%)	48 (21.2%)	28 (26.4%)
No, never	167 (9.3%)	25 (11.1%)	15 (14.2%)
Media consumption (total)			
≤ 1h/day	955 (54.6%)	103 (46.2%)	36 (34.6%)
> 1 h – 2 h/day	542 (31.0%)	68 (30.5%)	34 (32.7%)
> 2 h – 3 h/day	159 (9.1%)	34 (15.2%)	21 (20.2%)
> 3 h/day	93 (5.3%)	18 (8.1%)	13 (12.5%)
Parental origin			
Both CH	1017 (56.9%)	101 (44.7%)	32 (30.8%)
CH and non-CH	354 (19.8%)	44 (19.5%)	23 (22.1%)
Both non-CH	416 (23.3%)	81 (35.8%)	49 (47.1%)
Parental education			
Low	76 (4.4%)	15 (7.0%)	17 (17.7%)
Medium	607 (35.3%)	102 (47.7%)	48 (50.0%)
High	1035 (60.2%)	97 (45.3%)	31 (32.3%)
Diabetes			
Yes	5* (0.3%)	0 (0%)	0 (0%)
No	1912 (99.7%)	241 (100%)	121 (100%)
Asthma			
Yes	55 (2.9%)	5 (2.1%)	1 (0.8%)
No	1862 (97.1%)	236 (97.9%)	120 (99.2%)
Health perception (How do you judge your health?)			
Very good	1436 (80.4%)	165 (74%)	73 (70.2%)
Good	327 (18.3%)	57 (25.6%)	28 (26.9%)
Reasonably good	20 (1.1%)	1 (0.4%)	3 (2.9%)
bad	3 (0.2%)	0 (0%)	0 (0%)
Weight perception (Which description best matches you?)			
Much too thin	25 (1.4%)	2 (0.9%)	0 (0%)
Too thin	271 (15.2%)	3 (1.3%)	3 (3.0%)
About right	1425 (80.1%)	168 (74.3%)	29 (28.7%)
Too heavy	53 (3.0%)	53 (23.5%)	59 (58.4%)
Much too heavy	4 (0.2%)	0 (0%)	10 (9.9%)
Life satisfaction (1-10)	8.7±1.4	8.7±1.3	8.5±1.6
Sleep duration (h)	10.49±0.61	10.37±0.65	10.25±0.68

* 3 cases were identified as type 1 while the other 2 are unknown.

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Eidgenössische Technische Hochschule Zürich
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Labor für Humanernährung

Nationale Studie Gesundheit und Ernährung von Primarschülern

Fragebogen

Probandennummer: **_____**

Geburtsjahr: _____

1. Geschlecht: ☐ Junge ☐ Mädchen

I. Körperlich/sportliche Aktivität allgemein

2. An wievielen der letzten 7 Tage warst Du für mindestens 1 Stunde körperlich aktiv?
Bitte kreuze nur eine Antwort an!

0 Tage	1	2	3	4	5	6	7 Tage
☐	☐	☐	☐	☐	☐	☐	☐

II. Sportliche Aktivität in der Freizeit

3. Machst du Sport? (im Verein, privat)

☐ Ja ☐ Nein Falls ja:

Welche Sportart machst du?	Wie häufig machst du diese Sportart pro Woche?	Wie lange dauert das Training (Ohne Wegzeit, Umziehen und Duschen)*?*
1._____ (Sportart)	____ mal pro Woche	____ min pro Training
2._____ (Sportart)	____ mal pro Woche	____ min pro Training
3._____ (Sportart)	____ mal pro Woche	____ min pro Training

4. Machen Deine Eltern mit Dir zusammen Sport?

nie	selten	häufig	immer
☐	☐	☐	☐

III. Körperliche Aktivität im Alltag

5. Wie gehst du in die Schule? ***Bitte kreuze nur eine Antwort an!***

   ☐ zu Fuss

   ☐ mit dem Velo/Kickboard/Skateboard

   ☐ mit dem Bus oder Zug

   ☐ mit dem Auto

6. Wie häufig spielst du **pro Woche** draussen (z.B. Fangis, auf dem Spielplatz, ins Schwimmbad gehen…)?

   nie <1x 1x 2x 3x 4x 5x 6x täglich

7. Wie lange spielst Du normalerweise draussen?

   Ca. ____ Minuten pro Tag

V. Essverhalten

8. Wie oft hast du in den letzten vier Wochen folgende Sachen getrunken oder gegessen? ***Bitte kreuze jeweils nur eine Antwort pro Zeile an!***

	Durchschnittliche Aufnahmehäufigkeit									
	Selten - nie	1-3x / Monat	1x / Woche	2-4x / Woche	5-6x / Woche	1x / Tag	2x / Tag	3x / Tag	4x / Tag	5x / Tag
Süssgetränke (z.B. Sirup, Cola, Eistee, Capri Sonne usw.)										
Frucht- oder Gemüsesaft										
Früchte/ Obst										
Gemüse inkl. Salat										
Milch und Milch-produkte (Käse, Joghurt, etc.)										
Fleisch und Fisch										

9. Frühstückst Du normalerweise (mehr als ein Glas Milch oder Fruchtsaft)?

   ☐ Ja, immer ☐ Nein, nie ☐ manchmal _____

   Bitte erklären (z.B. nur am Wochenende)

10. Wie häufig isst Du eine Hauptmahlzeit zusammen mit Deiner Familie?

    ☐ jeden Tag

    ☐ an den meisten Tagen

    ☐ ungefähr einmal pro Woche

    ☐ weniger als einmal pro Woche

    ☐ nie

IV. Medienkonsum

11. Wie lange beschäftigst Du dich durchschnittlich pro Tag mit den folgenden Dingen?

Fernsehen, Videos (inkl. YouTube), DVD schauen	ca. _____ Minuten pro Tag
Spielen am Computer, Handy, Spielkonsole, Tablet, etc. (ohne Bewegungsspiele)	ca. _____ Minuten pro Tag
Soziale Medien (Facebook, Twitter, Chats, E-Mails, etc.)	ca. _____ Minuten pro Tag
Hausaufgaben am Computer, Tablet, Handy	ca. _____ Minuten pro Tag

VI. Schlaf und Gesundheit

12. Um welche Zeit gehst du schlafen?
    unter der Woche: _____ Uhr
    am Wochenende: _____ Uhr

13. Wann stehst Du auf?
    unter der Woche: _____ Uhr
    am Wochenende: _____ Uhr

14. Hast du eine der folgenden Krankheiten?

    ☐ Diabetes (Zuckerkrankheit)
    Falls ja: ☐ Typ I ☐ Typ II

    ☐ Asthma

    ☐ Andere chronische Krankheit. Falls ja, welche: _____

    ☐ Nein

15. Wie geht es dir gesundheitlich?
    ☐ Sehr gut
    ☐ Gut
    ☐ Einigermassen gut
    ☐ Schlecht

16. Welcher Satz passt am besten zu dir?
    ☐ Ich bin viel zu dünn.
    ☐ Ich bin ein bisschen zu dünn.
    ☐ Ich habe ungefähr das richtige Gewicht.
    ☐ Ich bin ein bisschen zu dick.
    ☐ Ich bin viel zu dick.

17. Auf einer Leiter von 0 bis 10, wo stehst du hin, wenn du an dein Leben denkst?

'10' bedeutet: Du hast das beste Leben, das du dir vorstellen kannst.
'0' bedeutet: Du hast das schlechteste Leben, das du dir vorstellen kannst.

10	☐
9	☐
8	☐
7	☐
6	☐
5	☐
4	☐
3	☐
2	☐
1	☐
0	☐

VII. Allgemeine Fragen

18. In welchem Land bist Du geboren?

☐ In der Schweiz

☐ In einem anderen Land: _____

19. In welchem Land sind Deine Eltern geboren?

MUTTER	VATER
☐ In der Schweiz	☐ In der Schweiz
☐ In einem anderen Land: _____	☐ In einem anderen Land: _____

20. Höchster Berufs-/Schulabschluss. ***Bitte für beide ausfüllen!***

MUTTER:	VATER:
☐ Obligatorische Schulzeit	☐ Obligatorische Schulzeit
☐ Lehre	☐ Lehre
☐Lehre mit Berufsmatur	☐ Lehre mit Berufsmatur
☐ Fachhochschule, Technikum	☐ Fachhochschule, Technikum
☐ Universität	☐ Universität
☐ Keinen	☐ Keinen
☐ Anderes _____	☐ Anderes _____

21. Arbeiten deine Eltern? ***Bitte für beide ausfüllen!***

MUTTER:	VATER:
☐Ja _____%	☐ Ja _____%
☐Nein	☐ Nein

Étude nationale sur la santé et l'alimentation des écoliers

Questionnaire

Numéro de particpant : _____

Année de naissance: |__|__|__|__|

1. Sexe: ☐ Garçon ☐ Fille

2. J'ai rempli le questionnaire en ligne : ☐ Oui ☐ Non

I. Activité physique/sportive en général

3. Ces derniers 7 jours, combien de jours as-tu été physiquement actif pour au moins 60 minutes ?

0 jours	1	2	3	4	5	6	7 jours
☐	☐	☐	☐	☐	☐	☐	☐

II. Activité sportive pendant tes loisirs

4. Pratiques-tu une discipline sportive ? (Dans un club, en privé)

☐ Oui ☐ Non Si oui :

Quelle discipline sportive pratiques-tu ?	Combien de fois pratiques-tu ce sport par semaine ?	Combien de temps dure l'entraînement (sans le trajet, te changer, te doucher*) ?*
1._____ (discipline sportive)	____ fois par semaine	____ min par semaine
2._____ (discipline sportive	____ fois par semaine	____ min par semaine
3._____ (discipline sportive)	____ fois par semaine	____ min par semaine

5. Tes parents font-ils du sport avec toi ?

jamais	rarement	souvent	toujours
☐	☐	☐	☐

III. Activité physique dans la vie quotidienne

6. Comment viens-tu à l'école ? ***Coche une seule réponse s'il te plaît !***

☐ à pied

☐ à vélo/trottinette/skateboard

☐ en bus ou train

☐ en voiture

7. Combien de fois **par semaine** joues-tu en plein air habituellement ? (Par ex. jouer à chat perché, jouer à l'élastique, aller à la piscine…)

jamais <1x 1x 2x 3x 4x 5x 6x quotidiennement

8. Combien de temps joues-tu en plein air en moyenne un de ces jours ?

Environ ____ minutes par jour

V. Comportement alimentaire

9. Combien de fois as-tu bu ou mangé les produits suivants lors des quatre semaines dernières ? ***S'il te plait coche une seule réponse par ligne !***

	Fréquence moyenne de consommation									
	Jamais - rare-ment	1-3x / mois	1x / se-maine	2-4x / se-maine	5-6x / se-maine	1x / jour	2x / jour	3x / jour	4x / jour	5x / jour
Boissons sucrées (par ex. Coca, thé glacé, Capri Sun, etc.)										
Jus de fruit ou de légumes										
Fruits										
Légumes (y compris la salade)										
Lait et produits laitiers										
Viandes et poissons										

10. Prends-tu habituellement un petit-déjeuner ? (soit plus qu'un verre du lait ou de jus de fruit)

☐ Oui, tous les jours ☐ Non, jamais

☐ quelquefois _____ Précise s'il te plaît (par ex. seulement le week-end)

11. Combien de fois prends-tu habituellement un repas principal avec ta famille ?

☐ tous les jours

☐ la plupart des jours

☐ environ une fois par semaine

☐ moins d'une fois par semaine

☐ jamais

IV. Consommation de médias

12. Combien de temps passes-tu en moyenne par jour avec ces activités ?

La télé, vidéos (y compris YouTube), regarder un DVD	environ _____ minutes par jour
Jouer sur l'ordinateur, mobile, console de jeux, tablette, etc. (sans les jeux de mouvement)	environ _____ minutes par jour
Réseaux sociaux (Facebook, Twitter, Chats, E-Mails, etc.)	environ _____ minutes par jour
Devoirs sur l'ordinateur, tablette, mobile	environ _____ minutes par jour

VI. Sommeil et Santé

13. À quelle heure te couches-tu habituellement ? En semaine : _____ heures

Le week-end : _____ heures

14. Quand te lèves-tu habituellement ? En semaine : _____ heures

Le week-end : _____ heures

15. Souffres-tu d'une maladie suivante ?

☐ Diabète

Si oui : ☐ Type I ☐ Type II

☐ Asthme

☐ Autre maladie chronique. Si oui, laquelle ? _____

☐ Non, je ne souffre pas d'une maladie chronique

16. Comment décrirais-tu ton état de santé ?

☐ Excellent

☐ Bon

☐ Relativement bon

☐ Mauvais

17. A ton avis, quelle phrase s'applique à toi ?

☐ Je suis trop maigre

☐ Je suis un peu trop maigre

☐ J'ai plus ou moins mon poids idéal

☐ Je suis un peu trop gros

☐ Je suis trop gros

18. Où te situerais-tu sur cette échelle, si tu considères ta vie actuelle ?
Le '10' veut dire : La meilleure vie que tu puisses imaginer
Le '0' veut dire : La pire vie que tu puisses imaginer

10	☐
9	☐
8	☐
7	☐
6	☐
5	☐
4	☐
3	☐
2	☐
1	☐
0	☐

VII. Questions générales

19. Dans quel pays es-tu né ?

☐ En Suisse

☐ Dans un autre pays, à savoir : _____

20. Dans quel pays tes parents sont-ils nés ?

MÈRE	PÈRE
☐ En Suisse	☐ En Suisse
☐ Dans un autre pays, à savoir : _____	☐ Dans un autre pays, à savoir : _____

21. Plus haut diplôme scolaire/professionnel obtenu par tes parents. ***Remplis s'il te plaît pour les deux !***

MÈRE:	PÈRE:
☐ Scolarité obligatoire	☐ Scolarité obligatoire
☐ Apprentissage	☐ Apprentissage
☐ Apprentissage avec maturité professionnelle	☐ Apprentissage avec maturité professionnelle
☐ Haute école spécialisée	☐ Haute école spécialisée
☐ Université	☐ Université
☐ Autre _____	☐ Autre _____

22. Tes parents ont-ils un emploi / travaillent-ils actuellement ? ***Remplis s'il te plaît pour les deux !***

MÈRE:	PÈRE:
☐ Oui _____%	☐ Oui _____%

Merci beaucoup pour ta participation!

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Institut für Lebensmittelwissenschaften, Ernährung und Gesundheit

Laboratorio di Nutrizione Umana

Studio nazionale sulla salute e l'alimentazione nelle scuole elementari

Questionario

Numero del candidato: _____

Anno di nascita: _____

1. Sesso: ☐ Maschio ☐ Femmina

I. Attività fisica/sportiva in generale

2. Quante volte negli ultimi 7 giorni hai fatto attività fisica per almeno 1 ora?

0 Giorni	1	2	3	4	5	6	7 Giorni
☐	☐	☐	☐	☐	☐	☐	☐

II. Attività sportive nel tempo libero

3. Pratichi dello sport? (in una società o in privato)

☐ Si ☐ No Se si:

Quali tipi di sport fai?	Quante volte alla settimana pratichi il tuo sport?	Quanto dura il tuo allenamento (senza contare il tragitto, il cambiarsi e la doccia)?
1._____ (tipo di sport)	____ volte per settimana	____ min per allenamento
2._____ (tipo di sport)	____ volte per settimana	____ min per allenamento
3._____ (tipo di sport)	____ volte per settimana	____ min per allenamento

4. I tuoi genitori praticano sport con te?

mai	di rado	spesso	sempre
☐	☐	☐	☐

III. Attività fisica quotidiana

6. Come ti rechi a scuola? ***Per favore scegli solo una risposta!***

☐ A piedi

☐ In bicicletta/trotinette/skatebord

☐ In bus o in treno

☐ In auto

7. Quante volte alla settimana giochi all'aperto? (es: al parco giochi, al campo sportivo o in piscina)?
   mai <1x 1x 2x 3x 4x 5x 6x tutti i giorni

8. Quanto tempo giochi normalmente all'aperto??

   Ca. ____ minuti al giorno

V. Comportamento alimentare

9. Nelle ultime quattro settimane, quante volte hai bevuto o mangiato i seguenti alimenti?
   Per favore metti solo una crocetta per riga!

	Consumo medio									
	poco - mai	1-3x / mese	1x / sett.	2-4x / sett.	5-6x / sett.	1x / giorno	2x/ giorno	3x / giorno	4x / giorno	5x / giorno
Bevande dolci (es. sciroppo, Coca Cola, tè freddo, Capri Sonne ecc.)										
Succhi di frutta o di verdura										
Frutta										
Verdura, inclusa l'insalata										
Latte e latticini (formaggio, jogurt ecc.)										
Carne e pesce										

10. Normalmente fai colazione (più di una tazza di latte o di un bicchiere di succo di frutta)?

    ☐ Si, sempre ☐ No, mai ☐ a volte: _____
    Specificare (es. "solo nel fine settimana")

11. Quanto spesso consumi un pasto principale con la tua famiglia?

    ☐ ogni giorno

    ☐ la maggior parte dei giorni

    ☐ circa una volta alla settimana

    ☐ meno di una volta alla settimana

    ☐ mai

IV. Tempo dedicato alle attività mediatiche

12. Quanto tempo dedichi mediamente al giorno alle seguenti attività?

Televisione, video (incluso You Tube), DVD	ca. _____ min al giorno
Giocare al computer, telefonino, console di gioco (es. Play Station), tablet ecc.(senza fare movimento)	ca. _____ min al giorno
Social media (Facebook, Twitter, Chats, e-Mails ecc.)	ca. _____ min al giorno
Compiti di scuola al computer, tablet, telefonino	ca. _____ min al giorno

VI. Riposo e salute

13. A che ora vai a dormire?
In settimana: _____ (ora)
Nel fine settimana: _____ (ora)

14. A che ora ti alzi?
In settimana: _____ (ora)
Nel fine settimana: _____ (ora)

15. Soffri di una delle seguenti malattie o disturbi?

☐ Diabete, Se si: ☐ Tipo I ☐ Tipo II

☐ Asma

☐ Altre malattie croniche. Se si, quali: _____

☐ No

16. In generale, qual è il tuo stato di salute?

☐ molto buono

☐ buono

☐ abbastanza buono

☐ non buono

17. Quale di queste frasi ti descrive meglio?

☐ sono troppo magro

☐ sono un po‘magro

☐ ho più o meno il peso ideale

☐ sono un po‘ grasso

☐ sono troppo grasso.

18. Su una scala da 0 a 10 dove ti collocheresti se dovessi pensare al grado di soddisfazione che hai dalla tua vita?

'10' significa: è la migliore vita che si possa avere.
'0' significa: è la peggior vita che si possa avere.

10	☐
9	☐
8	☐
7	☐
6	☐
5	☐
4	☐
3	☐
2	☐
1	☐
0	☐

VII. Domande generali

19. In quale paese sei nato?

☐ In Svizzera

☐ In un altro paese: _____

20. In quale paese sono nati i tuoi genitori? ***Per favore compila per entrambi!***

MADRE	PADRE
☐ In Svizzera	☐ In Svizzera
☐ In un altro paese: _____	☐ In un altro paese: _____

21. Quale il diploma scolastico più alto che è stato conseguito dai tuoi genitori? ***Per favore compila per entrambi!***

MADRE:	PADRE:
☐ scuola dell'obbligo	☐ scuola dell'obbligo
☐ apprendistato	☐ apprendistato
☐ apprendistato con maturità	☐ apprendistato con maturità
☐ Scuola professionale (Supsi)	☐ scuola professionale (Supsi)
☐ università/politecnico	☐ università/politecnico
☐ nessuno	☐ nessuno
☐ altro _____	☐ altro_____

22. I tuoi genitori lavorano? ***Per favore compila per entrambi!***

MADRE:	PADRE:
☐ Si _____%	☐ Si _____%
☐ No	☐ No

Grazie mille per la tua partecipazione!