Parental Perceptions of Children's Weight Status in 22 Countries: The WHO European Childhood Obesity Surveillance Initiative: COSI 2015/2017

Ramos Salas, Ximena; Buoncristiano, Marta; Williams, Julianne; Kebbe, Maryam; Spinelli, Angela; Nardone, Paola; Rito, Ana; Duleva, Vesselka; Musić Milanović, Sanja; Kunesova, Marie; ...

Source / Izvornik: **Obesity Facts, 2021, 14, 658 - 674**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.1159/000517586

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:105:095314

Obesity Facts

Research Article

Obes Facts 2021;14:658–674
DOI: 10.1159/000517586

Received: April 11, 2021
Accepted: May 28, 2021
Published online: November 5, 2021

Parental Perceptions of Children's Weight Status in 22 Countries: The WHO European Childhood Obesity Surveillance Initiative: COSI 2015/2017

Ximena Ramos Salas[a, b] Marta Buoncristiano[b] Julianne Williams[b] Maryam Kebbe[c] Angela Spinelli[d] Paola Nardone[d] Ana Rito[e] Vesselka Duleva[f] Sanja Musić Milanović[g] Marie Kunesova[h] Radka Taxová Braunerová[h] Tatjana Hejgaard[i] Mette Rasmussen[j] Lela Shengelia[k] Shynar Abdrakhmanova[l] Akbota Abildina[l] Zhamyila Usuopva[m] Jolanda Hyska[n] Genc Burazeri[n] Aušra Petrauskiene[o] Iveta Pudule[p] Victoria Farrugia Sant'Angelo[q] Enisa Kujundzic[r] Anna Fijałkowska[s] Alexandra Cucu[t] Lacramioara Aurelia Brinduse[t] Valentina Peterkova[u] Elena Bogova[u] Andrea Gualtieri[v] Marta García Solano[w] Enrique Gutiérrez-González[w] Sanavbar Rakhmatullaeva[x] Maya Tanrygulyyeva[y] Nazan Yardim[z] Daniel Weghuber[A] Päivi Mäki[B] Kenisha Russell Jonsson[C] Gregor Starc[D] Petur Benedikt Juliusson[E] Mirjam M. Heinen[F] Cecily Kelleher[F] Sergej Ostojic[G] Stevo Popovic[H] Viktoria Anna Kovacs[I] Dilorom Akhmedova[J] Nathalie J. Farpour-Lambert[K] Harry Rutter[L] Bai Li[M] Khadichamo Boymatova[N] Ivo Rakovac[b] Kremlin Wickramasinghe[O] Joao Breda[b]

[a]WHO European Office for Prevention and Control of NCDs, Country Health Programmes, WHO Regional Office for Europe, Copenhagen, Denmark; [b]European Association for the Study of Obesity, Teddington, UK; [c]Pennington Biomedical Research Center, Baton Rouge, LA, USA; [d]Istituto Superiore di Sanità, Rome, Italy; [e]National Institute of Health Dr. Ricardo Jorge I.P., Lisbon, Portugal; [f]National Center of Public Health and Analyses, Ministry of Health, Sofia, Bulgaria; [g]University of Zagreb, School of Medicine/Croatian Institute of Public Health, Zagreb, Croatia; [h]Obesity Management Centre, Institute of Endocrinology, Prague, Czech Republic; [i]Danish Health Authority, Copenhagen, Denmark; [j]National Institute of Public Health, University of Southern Denmark, Odense, Denmark; [k]National Center for Disease Control and Public Health of Georgia, Tbilisi, Georgia; [l]National Center of Public Health of the Ministry of Health of the Republic of Kazakhstan, Nur-Sultan, Kazakhstan; [m]Centre for Health Promotion, Bishkek, Kyrgyzstan; [n]Institute of Public Health, Tirana, Albania; [o]Department of Preventive Medicine, Lithuanian University of Health Sciences, Kaunas, Lithuania; [p]Centre for Disease Prevention and Control, Riga, Latvia; [q]Primary Health Care, Ministry of Health, Floriana, Malta; [r]Institute of Public Health, Podgorica, Montenegro; [s]Department of Cardiology, Institute of Mother and Child, Warsaw, Poland; [t]Department of Public Health and Management, University of Medicine and Pharmacy Carol Davila Romania, Bucharest, Romania; [u]Institute of Pediatric Endocrinology, Endocrine Research Centre, Moscow, Russian Federation; [v]Istituto per la Sicurezza Sociale, Cailungo, San Marino; [w]Observatory of Nutrition and Study of Obesity, Spanish Agency for Food Safety & Nutrition, Ministry of Health, Madrid, Spain; [x]Department for Organization of Health Services to Children, Mothers, Adolescents and Family Planning, Ministry of Health and Social Protection of the Population, Dushanbe, Tajikistan; [y]Internal Diseases Department of the Scientific Clinical Centre of Mother and Child Health, Ashgabat, Turkmenistan; [z]Ministry of Health, Public Health General Directorate, Ankara, Turkey; [A]Department of Pediatrics, Paracelsus Medical University, Salzburg, Austria; [B]National Institute for Health and Welfare, Helsinki, Finland; [C]Public Health Agency of Sweden, Solna, Sweden; [D]Faculty of Sport, University of Ljubjana, Ljubjana, Slovenia; [E]National Institute of Public Health, Oslo, Norway; [F]National Nutrition Surveillance Centre, University College Dublin, Dublin, Ireland; [G]Faculty of Sport and PE, University of Novi Sad, Novi Sad, Serbia; [H]Faculty for Sport and Physical Education, University of Montenegro, Niksic, Montenegro;

karger@karger.com
www.karger.com/ofa

Karger
OPEN ACCESS

Correspondence to:
Ximena Ramos Salas, ximenars@gmail.com

[I]Hungarian School Sport Federation, Budapest, Hungary; [J]School for Health in Europé, Ministry of Health, Tashkent, Uzbekistan; [K]European Association for the Study of Obesity, United Kingdom, and Obesity Prevention and Care Program Contrepoids, Service of Endocrinology, Diabetology and Therapeutic Education, Department of Medicine, University Hospitals of Geneva and University of Geneva, Geneva, Switzerland; [L]Department of Social and Policy Sciences, University of Bath, Bath, UK; [M]Centre for Exercise, Nutrition and Health Sciences (ENHS), University of Bristol, Bristol, UK; [N]World Health Organization, Country Office, Dushanbe, Tajikistan; [O]WHO European Office for the Prevention and Control of Noncommunicable Diseases, Moscow, Russian Federation

Keywords
Childhood obesity · Parental perceptions · Weight · World Health Organization/Europe · Childhood Obesity Surveillance Initiative

Abstract
Introduction: Parents can act as important agents of change and support for healthy childhood growth and development. Studies have found that parents may not be able to accurately perceive their child's weight status. The purpose of this study was to measure parental perceptions of their child's weight status and to identify predictors of potential parental misperceptions. ***Methods:*** We used data from the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative and 22 countries. Parents were asked to identify their perceptions of their children's weight status as "underweight," "normal weight," "a little overweight," or "extremely overweight." We categorized children's (6–9 years; *n* = 124,296) body mass index (BMI) as BMI-for-age Z-scores based on the 2007 WHO-recommended growth references. For each country included in the analysis and pooled estimates (country level), we calculated the distribution of children according to the WHO weight status classification, distribution by parental perception of child's weight status, percentages of accurate, overestimating, or underestimating perceptions, misclassification levels, and predictors of parental misperceptions using a multilevel logistic regression analysis that included only children with overweight (*including* obesity). Statistical analyses were performed using Stata version 15 1. ***Results:*** Overall, 64.1% of parents categorized their child's weight status accurately relative to the WHO growth charts. However, parents were more likely to underestimate their child's weight if the child had overweight (82.3%) or obesity (93.8%). Parents were more likely to underestimate their child's weight if the child was male (adjusted OR [adjOR]: 1.41; 95% confidence intervals [CI]: 1.28–1.55); the parent had a lower educational level (adjOR: 1.41; 95% CI: 1.26–1.57); the father was asked rather than the mother (adjOR: 1.14; 95% CI: 0.98–1.33); and the family lived in a rural area (adjOR: 1.10; 95% CI: 0.99–1.24). Overall, parents' BMI was not strongly associated with the underestimation of children's weight status, but there was a stronger association in some countries. ***Discussion/Conclusion:*** Our study supplements the current literature on factors that influence parental perceptions of their child's weight status. Public health interventions aimed at promoting healthy childhood growth and development should consider parents' knowledge and perceptions, as well as the sociocultural contexts in which children and families live.

Introduction

Childhood overweight and obesity are increasing worldwide, with the most rapid rises in low- and middle-income countries [1–3]. According to the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative (COSI), the prevalence of overweight and obesity among 6- to 9-year-old children in Europe ranged from 9 to 43% in boys and 5–43% in girls in 2015–2017 [4]. This is of concern since childhood obesity is associated with insulin resistance, increased mechanical stress on joints, obstructive sleep apnea, impaired cardiovascular function and social functioning, stigma, and reduced quality of life and mental health [5–7]. Having obesity during childhood can also predispose individuals to many other chronic diseases in the long term, such as type 2 diabetes, hypertension, and cardiovascular disease [8–10].

Although identified as a global health priority, there are widening inequalities in the prevalence of childhood obesity and preventative progress has been poor [11, 12]. Addressing childhood obesity in an equitable manner requires a comprehensive approach that takes into consideration its complex causes. Root causes of childhood obesity include biological (e.g., genetics and epigenetic variants, intrauterine exposures, early nutrition, and microbiome) and environmental (both physical and social) factors [13]. Notwithstanding this scientific understanding of obesity, public and political discourse often

simplifies obesity to, primarily, a consequence of unhealthy eating and physical inactivity [14]. Although global nutritional deficiencies and physical inactivity contribute to the development of many noncommunicable diseases including obesity, the oversimplification of obesity as a nutrition and physical activity problem may contribute to children and parents experiencing stigma, making it challenging for them to access evidence-based care [14, 15]. Stigma can also impact children's health independently of any obesity-related complications and contribute to social inequalities at the population level [16, 17].

Addressing childhood obesity requires a life-course perspective while also addressing the root causes of obesity, well beyond nutrition and physical activity [12]. To date, however, interventions to prevent childhood obesity have been mainly focused on individual approaches to promote healthy eating and increase physical activity [18]. Policy interventions to prevent childhood obesity have also been limited due to a number of factors, including a lack of public funding and resources, commercial marketing of highly palatable and high-calorie foods, industry lobbying, and a lack of public understanding of obesity-related health and social outcomes [19].

At the health care system level, failure to recognize the seriousness of childhood obesity, particularly through a life-course lens of chronic disease prevention, has resulted in limited access to evidence-based treatment strategies [20]. Many healthcare professionals lack knowledge and skills to assess and diagnose childhood obesity, as evident by the low levels of routine diagnosis and treatment for childhood obesity in pediatric health care settings [21]. A recent study found that clinicians working across primary, secondary, and tertiary pediatric care levels had received only moderate training in obesity (48%), did not routinely measure height and weight (80%), and infrequently referred children to obesity services (25%) [22].

Parents can play an important part in the prevention and treatment of childhood obesity [19, 23] and family-based interventions to treat childhood obesity may be effective even if long-term effects remain unknown [24]. However, studies have found that parents may not be able to accurately perceive their children's weight status [25–28]. Some factors that may influence parents' perceptions of their child's weight include child's age, population prevalence of obesity, parental weight status, and internalized stigma. A systematic review, which pooled results from 51 studies published between 1990 and 2011, showed that 63.4% of parents were unable to recognize excess weight in their child; however, this number was higher (86%) for parents who had younger children (2–6 years) [28]. An Italian study also found that maternal perception of their child's weight appears to be affected by the prevalence of obesity in their community [29]. Indeed, it has been suggested that parents may not be able to recognize obesity in their child because obesity has been normalized [30]. Considering that the social narrative of childhood obesity attributes blame to parents for their children's food and exercise choices, internalized stigma may also be a factor driving parental perceptions of their children's weight [31].

Parental inability to recognize children's excess weight has been proposed as a contributing factor to the rising levels of childhood obesity [32]. The premise of this argument is that if parents were able to recognize their child's obesity, they would be motivated to change their family's behaviors and seek obesity treatment. However, while this contention may have face validity, there is an absence of evidence in its favor [33], and some to the contrary [34, 35]. A focus on parental recognition of their child's weight status risks placing undue focus on families and individuals for a problem that is primarily driven by biological, environmental, commercial, social, and economic factors. Nevertheless, parents can have an important role as agents of change in health-promoting behaviors, and it is imperative that they are engaged in health promotion programs. To engage parents, we need to understand their perspectives [36]. At the population level, this knowledge can help us to identify opportunities for parental engagement to develop childhood obesity prevention programs and policies that are supportive, nonstigmatizing, and effective. Ultimately, health professionals and policy makers have a responsibility to support parents in accessing appropriate preventive and management care that can improve their child's health and well-being.

The purpose of this study was to measure updated, global parental perceptions of their child's weight status and to identify possible predictors of parental misperceptions.

Materials and Methods

Study Design and Sampling

This study uses data from the COSI. COSI is a unique system that has measured trends in overweight and obesity among primary school-aged children since 2007. COSI involves taking standardized height and weight measurements from over 300,000 chil-

dren across the WHO European Region, providing nationally representative data for participating countries, as well as a large region-wide dataset for analysis of the determinants of childhood overweight and obesity.

In 2015–2017, the fourth round of COSI took place in 36 countries of the WHO European Region, providing national representative data in all countries expect Russian Federation where data collection was implemented only in the city of Moscow. Among these countries, 22 collected information on parents' perceptions of their child's weight status through COSI Family Record Form, namely Albania (ALB), Bulgaria (BUL), Croatia (CRO), Czechia (CZH), Denmark (DEN), Georgia (GEO), Italy (ITA), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Latvia (LVA), Lithuania (LTU), Malta (MAT), Montenegro (MNE), Poland (POL), Portugal (POR), Romania (ROM), Russian Federation (only Moscow) (RUS), San Marino (SMR), Spain (SPA), Tajikistan (TJK), Turkey (TKM), and Turkmenistan (TUR) [37]. Data were gathered following a common protocol devised in 2007 by the WHO Regional Office for Europe and Member States [38] and minimally amended for COSI 2, 3, and 4 [39–41]. The COSI protocol is in accordance with the International Ethical Guidelines for Biomedical Research Involving Human Subjects [42]. Local Ethical Committees also approved the study.

A sampling approach was adopted for all countries except in Malta and San Marino, where the entire population of interest (i.e., all children in third-grade primary-school classes) was included. According to the COSI protocol, participating countries could select one or more of the following 4 age groups: 6.0–6.9, 7.0–7.9, 8.0–8.9, or 9.0–9.9 years. Out of the 22 countries, 12 countries only included 7 year olds (Bulgaria, Czechia, Denmark, Georgia, Lithuania, Malta, Montenegro, Portugal, Russian Federation – city of Moscow, Tajikistan, Turkey, and Turkmenistan); 5 only included 8 year olds (Albania, Croatia, Poland, Romania, and San Marino); 1 only included 9 year olds (Kazakhstan); and 4 included >1 age group (7.0–7.9 and 8.0–8.9 in Kyrgyzstan; 7.0–7.9 and 8.0–8.9 in Latvia; 8.0–8.9 and 9.0–9.9 in Italy; and all age groups in Spain). The effective sample size (i.e., the number of measured children per targeted age group) was mostly equal to or above the minimum suggested by the protocol [41] (i.e., 2,800 children per age group and sex). In 5 countries, the effective sample size was considerably lower (Czechia) or slightly lower (Denmark, Montenegro, Albania, Croatia, San Marino, and the Russian Federation). More information on the study design in each country is provided elsewhere [43].

Children's measurements were conducted by staff trained to measure height and weight using the WHO standardized technique. The family questionnaires were completed by parents or caregivers. The form included questions about parent's perception of their child's weight status, as well as other simple indicators of children's dietary intake, physical activity or inactivity patterns, the family's socioeconomic characteristics, and the presence of comorbid conditions associated with obesity. Further details on the fourth round of COSI data and methodology are available elsewhere [41, 43].

Inclusion and Exclusion Criteria

We only included children belonging to COSI target age groups (i.e., children between the ages of 6 and 9 years) with complete information on data needed to assess their weight status (i.e., sex, age, height, and weight). The WHO COSI study evaluates parents' perceptions about their child's weight status through a question in the Family Record Form. The person completing the form indicated their relationship to the child. We included children who had at least one parent or caregiver that completed the form.

Measures

Children's Weight Status

Children's weight status classification was based on the 2007 WHO-recommended growth references for school-aged children and adolescents [44, 45], and cutoffs were used to compute BMI-for-age Z-scores and to estimate prevalence of overweight/obesity. Each child was classified in the underweight, normal weight, overweight (excluding obesity), or obesity category. A child was classified in the overweight (excluding obesity) category if she/he had overweight but not obesity according to the WHO definitions [46]. That is, thinness is defined as a BMI-for-age value of <−2 Z-score, while overweight and obesity are defined as a BMI-for-age value of > +1 Z-score and > +2 Z-scores, respectively. Children for which a biologically implausible (or extreme) BMI-for-age value was estimated (i.e., values below −5 or above +5 Z-scores relative to the 2007 WHO growth reference median) were excluded from the analysis [45]. BMI was calculated as weight (kg) divided by height squared (m^2). We used the category "underweight" to indicate "thinness" as per the WHO classification system and definition.

Parents' Perceptions of Their Children's Weight Status

The Family Record Form asks the question "In your opinion, is your child: underweight – normal weight – a little overweight – extremely overweight." Since the Family Record form was completed by different family members, we differentiated between responses from mothers and fathers. If the Family Record Form was completed by the mother, data were referred to as "maternal perception," whereas if the form was completed by the father, data were referred to as "paternal perception."

We constructed a measure of concordance to indicate whether a parent accurately perceived their child's weight status relative to the WHO obesity categories. The perceived and actual classification of children's weight status was considered consistent in the following cases: (i) children with thinness were correctly classified as "underweight"; (ii) normal weight children as "normal weight"; (iii) children with overweight (excluding obesity) as "a little overweight"; and (iv) children with obesity as "extremely overweight."

Parental underestimation of their child's weight status was observed if (i) children with normal weight were perceived as "underweight"; (ii) children with overweight (excluding obesity) were perceived as "underweight" or "normal weight"; and (iii) children with obesity were perceived as "underweight," "normal weight," or "a little overweight." Parental overestimation of their child's weight status was observed if (i) children with thinness were perceived as "normal weight," "a little overweight," or "extremely overweight"; (ii) children with normal weight were perceived as "a little overweight" or "extremely overweight"; and (iii) children with overweight (excluding obesity) were perceived as "extremely overweight."

The accuracy of parents' perceptions of their child's weight status was also assessed by estimating underweight, normal weight, overweight (excluding obesity), or obesity using International Obesity Task Force (IOTF) cutoff points, as these are widely used in the WHO European Region. According to the IOTF, these points are age (in months) and sex specific and correspond to a BMI >25 at the age of 18 years [47].

Statistical Analysis

All country datasets were reviewed for inconsistencies and completeness in a standard manner at the WHO Regional Office for Europe before they were aggregated for the international data analysis.

Part 1: Parental Perceptions of Their Child's Weight Status

For each country included in the analysis, the distribution of children according to the WHO and IOTF weight status classification was estimated along with the distribution by parental perception of child's weight status (percentage values and 95% confidence intervals [CIs]). Percentages of accurate, overestimating, or underestimating perceptions were estimated for each mother or father and child pair. Misclassification levels were also calculated for children with normal weight, overweight (excluding obesity), and obesity separately. For children with obesity, parental underestimation was estimated separating children perceived as "a little overweight" from those seen as "normal weight." All above-mentioned estimates were produced at the country level and by pooling together all countries. Misclassification levels were not estimated in 3 countries (Denmark, San Marino, and Tajikistan) because the number of children with obesity in the sample was too low.

In order to balance the contribution of each country to the pooled estimates and to limit the differences in children's age as much as possible, pooled estimates were calculated only for children belonging to one target age group for each country: 7 year olds for 15 countries (Bulgaria, Czechia, Denmark, Kyrgyzstan, Georgia, Latvia, Lithuania, Malta, Montenegro, and Russian Federation – city of Moscow, Portugal, Spain, Tajikistan, Turkey, and Turkmenistan), 8 year olds for 6 countries (Albania, Croatia, Italy, Poland, Romania, and San Marino), and 9 year olds for 1 country (Kazakhstan).

Part 2: Predictors of Parental Misperceptions of Their Child's Weight Status

To examine factors associated with parents' misclassification of their child's weight status, we conducted a multilevel logistic regression analysis that included only children with overweight (*including* obesity). We estimated the adjusted odds ratios (adjORs) and confidence limits (95% CI) of a parent incorrectly classifying their child's weight status (compared to correct classification). The parental perception was considered incorrect when the mother or the father classified her or his child who had overweight (including obesity) as normal weight or underweight.

Covariates

Predictors of parental perceptions of their child's weight status included age in months, sex, BMI, urbanization grade of child's residence place, and respondents' characteristics (i.e., relationship with the child – mother or father, and parental educational attainment and weight status). For BMI, its squared value was also included. For educational attainment, 2 categories were considered: low-medium level (i.e., "primary school or less," "secondary or high school," and "vocational school") and high level ("undergraduate or bachelor's degree" and "master's degree or higher"). Parental weight status was estimated using maternal/paternal BMI, which was calculated based on self-reported height and weight. We used WHO definitions to classify mothers/fathers in the normal weight, overweight, and obesity categories.

We conducted a multilevel logistic regression analysis at the country level as well as by pooling countries. All models included random effects for the primary sampling units. Primary sampling units were replaced by primary schools to account for random effects specified in the Poland model. Children with a missing value for any of the covariates were excluded from the regression analysis. The regression analysis was not carried out for Denmark, San Marino, and Tajikistan due to the limited number of available observations. The regression model for Czechia and Malta did not include information about the relationship of the respondent with the child because it was not collected. Data collected in Moscow city were not included in the analysis of factors associated with parents' misclassification of their child's weight because of the high level of missing data on parents' characteristics.

The regression analysis on pooled dataset was only carried out with countries in which it was possible to estimate a specific-country model and with data available for all covariates (16 countries – all but Czechia, Denmark, Malta, and Russian Federation – city of Moscow, San Marino, and Tajikistan). The pooled model was estimated only for children belonging to one target age group for each country: 7 year olds for 10 countries (Bulgaria, Kyrgyzstan, Georgia, Latvia, Lithuania, Montenegro, Portugal, Spain, Turkey, and Turkmenistan), 8 year olds for 5 countries (Albania, Croatia, Italy, Poland, and Romania), and 9 year olds for 1 country (Kazakhstan). Pooled models were also estimated for boys and girls separately.

Poststratification weights to adjust for the sampling design, oversampling, and nonresponse were available for all countries that applied a sampling approach in round 4 of COSI (except for Lithuania) and were used in all analyses to infer the results from the sample to the population. For Lithuania, unweighted analysis was carried out. All analyses accounted for the cluster sample design. In the pooled analysis, an adjusting factor was applied to the poststratification weights to take into consideration the differences in the population size of the countries involved. The adjusting factor was calculated based on the number of children belonging to the target age group according to Eurostat figures or national official statistics for 2016. All statistical analyses were performed using the statistical software package Stata version 15.1.

Results

Twenty-two countries from the WHO European Region were included in this study. A total of 124,296 children out of over 174,000 invited to participate in COSI Round 4 were eligible for inclusion (Table 1).

The total number of children included varied among countries, ranging from below 1,000 children in San Marino and Denmark to close to 10,000 in Spain and Turkey and over 40,000 in Italy. Multiple factors affected these figures. Country sample size was affected by the number of targeted age groups and the characteristics of the national school systems through which the children were enrolled [43]. In Italy, the sample size was considerably larger because regional and national estimates were included. The level of children's participation in the survey also affected the number of available data. The proportions of children who par-

Table 1. Children's participation proportion and proportion of completed family forms in COSI/WHO Europe (round 4 by country)

Country[1]	Children invited to participate			Measured (height/weight) 6- to 9-year-old children with family form completed	Children included in the analysis[a]	
	N	proportion who participated in measurements, %[b]	proportion whose family form was completed, %[b]		*n*	%
ALB	7,113	91.8	36.2	2,527	2,259	89.4
BUL	4,090	83.7	83.1	3,400	3,238	95.2
CRO[c]	7,220	78.6	76.0	2,651	2,601	98.1
CZH	NA	NA	NA	1,406	1,395	99.2
DEN	3,202	84.6	29.9	957	935	97.7
GEO	4,143	80.7	78.4	3,246	3,057	94.2
ITA	50,902	90.2	95.2	44,020	42,496	96.5
KAZ	6,026	92.7	82.3	4,311	3,988	92.5
KGZ	8,773	91.6	86.6	7,852	5,958	75.9
LTU	5,527	70.8	69.8	3,508	3,431	97.8
LVA	8,143	80.4	71.5	5,707	5,593	98.0
MAT	4,329	91.8	73.4	3,179	3,115	98.0
MNE	4,094	84.1	66.8	2,736	2,678	97.9
POL	3,828	89.0	76.9	2,945	2,884	97.9
POR	7,475	92.1	85.6	6,391	5,992	93.8
ROM	9,094	83.7	73.6	6,610	5,885	89.0
RUS	3,900	77.7	52.6	2,052	2,001	97.5
SMR	329	95.1	93.6	306	303	99.0
SPA	14,908	73.1	70.1	10,453	10,239	98.0
TJK	3,502	94.7	93.5	3,270	2,822	86.3
TKM	4,085	96.7	95.3	3,891	3,658	94.0
TUR	14,164	81.7	81.7	11,555	9,768	84.5
Total	174,847	85.8	80.0	132,973	124,296	93.5

COSI, Childhood Obesity Surveillance Initiative; BUL, Bulgaria; CZH, Czechia; DEN, Denmark; KGZ, Kyrgyzstan; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MTA, Malta; MNE, Montenegro; RUS, Moscow city-Russian Federation; POR, Portugal; SPA, Spain; TJK, Tajikistan; TKM, Turkey; TUR, Turkmenistan, ALB, Albania; CRO, Croatia; ITA, Italy; POL, Poland; ROM, Romania; SMR, San Marino; KAZ, Kazakhstan. [1] Figures refer to primary school children from: ALB, CRO, BUL, CZH, DEN, GEO, ITA, KAZ, KGZ, LVA, LTU, MAT, MNE, POL, POR, ROM, RUS, SMR, SPA, TJK, TKM, and TUR. [a] All children with complete information on sex, whose age is between 6 and 9 years old, whose weight and height were measured, whose BMI/A Z-scores were within the normal range (≥−5–≤+5), whose mother or father has completed the family form, and with complete information about parental perception of their weight status. Percentage values refer to measured 6- to 9-year-old children with a completed family form. [b] Total figures were calculated including only countries with available information about the number of children invited to participate in the surveillance. [c] For CRO, only data on 8 year olds were available for comparison at the European level. Children's and families' participation in the survey was calculated in the whole sample (not only on 8 year olds).

ticipated in measurements also varied from country to country, ranging between 70 and 80% in Croatia, Russian Federation (city of Moscow), Latvia, and Spain to over 90% in Albania, Kazakhstan, Kyrgyzstan, Malta, Portugal, San Marino, Tajikistan, and Turkmenistan.

The lowest level of proportion with a completed family form was registered in Denmark (29.9%), Albania (36.2%), and Moscow city (52.6%). Finally, in most of the countries for almost all measured 6- to 9-year-old children with a completed family form, the information about mother/father perception of their child's weight status was available (Table 1).

Children's and Parents' Characteristics

On average, children were 7.9 years old, with the majority being male (51.3%) and residing in urban areas (71.0%). Parents on average had a low-medium education level (64.8%) and were classified as normal weight (61.7%). Mothers completed the family form most often (85.9%). Details by the country can be found in Table 2.

Parents' Perceptions of Children's Weight Status in Concordance with the WHO Classifications

Table 3 highlights children's weight status classification based on the WHO definitions and parental percep-

Table 2. Children's and parents' characteristics by country and overall

Country	Boys, %	Age in years median (Q1–Q3)	Children residing in urban areas, %	Family form completed by the mother, %	Characteristics of the parent who completed the family form			
					low-medium level of education, %	weight status, %		
						normal weight	preobesity	obesity
ALB	52.1	8.5 (8.0–9.0)	80.1	76.9	73.3	56.6	32.3	11.1
BUL	51.3	7.6 (7.4–7.8)	75.6	92.3	60.1	68.5	22.0	9.5
CRO	51.2	8.5 (8.2–8.8)	87.9	86.7	68.0	67.2	24.6	8.1
CZH	50.7	7.0 (6.9–7.1)	63	n.a.	74.2	67.5	22.6	9.9
DEN	53.1	7.2 (7.0–7.5)	81.4	86.2	41.3	61.1	27.5	11.4
GEO	51.0	7.6 (7.3–7.9)	70.0	94.8	64.5	64.9	24.4	10.7
ITA	51.5	8.8 (8.6–9.0)	72.5	88.6	76.3	70.4	22.6	7.0
KAZ	49.9	9.0 (8.6–9.5)	47.7	93.8	58.4	64.4	28.2	7.4
KGZ	50.5	7.9 (7.4–8.5)	36.7	88.3	68.5	58.9	31.0	10.1
LTU	50.6	7.8 (7.6–8.1)	80.4	95.1	42.7	67.3	23.0	9.6
LVA	48.3	7.9 (7.3–9.3)	84.8	93.5	40.2	65.6	24.8	9.7
MAT	49.8	7.8 (7.5–8.1)	99	n.a.	69.7	55.2	27.7	17.1
MNE	52.8	7.4 (6.9–7.9)	81.8	80.3	72.0	71.0	24.6	4.4
POL	50.1	8.4 (8.2–8.7)	73.0	93.4	38.7	69.0	24.1	7.0
POR	50.9	7.5 (7.0–8.0)	87.2	90.2	71.2	56.9	30.3	12.9
ROM	49.1	8.5 (7.9–9.0)	56.4	89.6	62.7	60.6	28.6	10.8
RUS	50.1	7.4 (7.1–7.7)	100.0	94.8	n.a	69.8	23.3	7.0
SMR	45.2	8.8 (8.6–9.0)	100.0	86.5	70.5	74.7	19.0	6.3
SPA	50.9	8.0 (7.0–9.0)	80.4	83.6	54.0	63.2	27.8	9.1
TJK	51.9	7.4 (7.2–7.6)	30.7	73.2	82.6	56.7	33.4	9.9
TKM	50.3	7.7 (7.5–8.0)	44.2	84.4	92.2	46.8	38.4	14.9
TUR	50.1	7.4 (7.2–7.7)	97.4	71.3	83.1	44.5	39.7	15.7
Pooled estimate[a]	51.3	7.9 (7.5–8.6)	71.0	85.9	64.8	61.7	28.5	9.7

COSI/WHO Europe round 4 (2015–17). Q1, first quartile; Q3, third quartile; n.a., not available; COSI, Childhood Obesity Surveillance Initiative; BUL, Bulgaria; CZH, Czechia; DEN, Denmark; KGZ, Kyrgyzstan; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MTA, Malta; MNE, Montenegro; RUS, Moscow city-Russian Federation; POR, Portugal; SPA, Spain; TJK, Tajikistan; TKM, Turkey; TUR, Turkmenistan, ALB, Albania; CRO, Croatia; ITA, Italy; POL, Poland; ROM, Romania; SMR, San Marino; KAZ, Kazakhstan. [a] Pooled estimates were calculated for the following age groups/countries: 7 year olds from BUL, CZH, DEN, KGZ, GEO, LVA, LTU, MAT, MNE, RUS, POL, SPA, TJK, TKM, and TUR; 8 year olds from ALB, CRO, ITA, POL, ROM, and SMR; and 9 year olds from KAZ.

tions. Overall, there were important differences between these categorizations, wherein 9.6% (95% CI: 9.1–10.1), 79.1% (95% CI: 78.5–79.8), 10.5% (95% CI: 10.0–10.9), and 0.8% (95% CI: 0.7–1.0 CI) of parents perceived their child's weight as "Underweight," "Normal weight," "A little overweight," and "Extremely overweight," respectively, compared to 2.3% (95% CI: 2.0–2.5), 68.8% (95% CI: 67.9–69.7), 17.2% (95% CI: 16.6–17.8), and 11.7% (95% CI: 11.1–12.3) being classified as such, respectively, based on WHO standards. In all countries, parents more frequently classified their children as with underweight or normal weight than WHO classification (Table 3). This finding is confirmed also considering the IOTF classification of children's weight status, even if the discrepancy with parents' perception is less pronounced (online suppl. Table 1; for all online suppl. material, see www.karger.com/doi/10.1159/000517586).

Patterns in Parents' Perceptions of Their Child's Weight Status

There were differences in the accuracy of parents' perceptions of their child's weight status based on the actual WHO weight status categories (Table 4). In the overall population, which included all of the WHO weight status categories (children with normal weight, children with overweight and obesity, children with overweight, and children with obesity categories), 64.1% of parents classified their child's weight status accurately relative to the

Table 3. WHO classification and parents' perception of child's weigh status by country and overall

Country	Classification of child's weight status based on WHO definition, % (95% CI)				Parental perception of child's weight, % (95% CI)			
	thinness	normal weight	overweight (excluding obesity)	obesity	underweight	normal weight	a little overweight	extremely overweight
ALB	2.4 (1.8–3.1)	72.8 (69.5–75.8)	15.0 (13.1–17.1)	9.9 (8.2–11.9)	7.0 (6.0–8.2)	79.5 (77.6–81.3)	12.0 (10.2–14.1)	1.4 (1.0–2.0)
BUL	3.0 (2.4–3.8)	67.2 (65.4–69.0)	16.2 (14.8–17.6)	13.6 (12.3–14.9)	7.0 (6.1–8.0)	79.7 (78.1–81.1)	12.2 (11.0–13.5)	1.2 (0.8–1.7)
CRO	1.7 (1.2–2.2)	65.1 (63.4–66.9)	19.7 (18.3–21.3)	13.5 (12.2–14.9)	1.7 (1.2–2.2)	83.8 (82.3–85.1)	13.7 (12.4–15.1)	0.9 (0.6–1.4)
CZH	4.2 (3.1–5.9)	74.9 (72.4–77.2)	13.9 (12.1–15.9)	7.0 (5.4–9.0)	5.5 (4.4–7.0)	86.1 (83.9–87.9)	7.6 (6.3–9.2)	0.8 (0.4–1.4)
DEN	2.2 (1.4–3.5)	83.9 (80.8–86.6)	10.6 (8.7–12.9)	3.2 (2.1–4.7)	6.9 (5.2–9.1)	87.6 (85.0–89.9)	5.4 (3.7–7.8)	0.1 (0.0–0.8)
GEO	1.6 (1.1–2.3)	74.0 (72.2–75.8)	15.6 (14.3–16.9)	8.8 (7.7–10.0)	10.3 (9.1–11.7)	78.8 (77.0–80.4)	10.1 (9.0–11.3)	0.8 (0.5–1.2)
ITA	1.6 (1.4–1.8)	59.0 (58.3–59.7)	22.6 (22.0–23.1)	16.8 (16.3–17.3)	7.4 (7.1–7.8)	71.8 (71.2–72.4)	19.6 (19.1–20.1)	1.2 (1.0–1.3)
KAZ	3.0 (2.0–4.3)	78.0 (75.2–80.5)	13.4 (11.7–15.2)	5.7 (4.3–7.5)	6.7 (5.5–8.1)	85.7 (83.1–87.9)	6.7 (5.4–8.2)	1.0 (0.6–1.5)
KGZ	3.0 (2.4–3.9)	87.1 (85.9–88.9)	7.2 (6.4–8.0)	2.7 (2.1–3.3)	19.3 (17.7–20.9)	76.8 (75.1–78.4)	3.7 (3.1–4.4)	0.3 (0.1–0.5)
LTU	2.0 (1.5–2.5)	71.9 (70.3–73.6)	15.7 (14.7–16.8)	10.4 (9.2–11.8)	5.7 (5.0–6.5)	82.1 (80.8–83.3)	11.0 (10.1–11.9)	1.1 (0.8–1.5)
LVA	1.6 (1.1–2.3)	73.4 (72.0–74.7)	16.9 (15.8–18.0)	8.1 (7.3–9.0)	6.6 (5.9–7.5)	80.4 (79.1–81.7)	11.9 (10.9–12.9)	1.1 (0.9–1.4)
MAT	1.0 (0.9–1.1)	63.4 (62.9–63.9)	18.4 (18.0–18.8)	17.2 (16.8–17.6)	6.2 (5.9–6.5)	79.4 (79.0–79.9)	13.7 (13.3–14.1)	0.7 (0.6–0.8)
MNE	0.9 (0.6–1.4)	65.9 (63.9–67.9)	20.4 (18.7–22.2)	12.8 (11.4–14.3)	1.8 (1.3–2.5)	88.2 (86.5–89.7)	8.6 (7.5–9.8)	1.4 (1.0–2.0)
POL	1.8 (1.3–2.7)	67.7 (65.2–70.2)	18.0 (16.0–20.1)	12.6 (10.5–14.9)	7.9 (7.2–8.8)	78.6 (77.8–79.4)	11.1 (10.8–11.5)	2.4 (1.9–3.0)
POR	0.9 (0.7–1.3)	68.8 (67.4–70.1)	18.9 (17.9–20.0)	11.4 (10.4–12.4)	7.6 (6.9–8.3)	83.3 (82.1–84.4)	8.9 (8.1–9.8)	0.2 (0.1–0.4)
ROM	6.7 (5.7–7.8)	65.3 (63.9–66.8)	17.1 (16.1–18.0)	11.0 (10.0–12.0)	6.9 (6.1–7.9)	78.1 (76.7–79.4)	14.4 (13.5–15.2)	0.6 (0.3–1.0)
RUS	2.8 (1.9–4.0)	72.3 (69.8–74.7)	15.5 (14.0–17.2)	9.4 (7.8–11.1)	7.3 (6.2–8.6)	80.1 (77.7–82.2)	11.8 (10.0–13.8)	0.8 (0.5–1.3)
SMR	1.0 (0.7–1.3)	65.7 (64.3–67.1)	21.1 (19.9–22.4)	12.2 (11.3–13.2)	6.6 (5.9–7.4)	76.9 (75.6–78.1)	15.8 (14.8–17.0)	0.7 (0.5–0.9)
SPA	0.9 (0.6–1.3)	58.8 (57.0–60.6)	23.0 (21.7–24.3)	17.4 (16.0–18.8)	6.1 (5.4–6.9)	81.3 (80.2–82.3)	11.9 (11.0–12.9)	0.7 (0.5–0.9)
TJK	4.4 (3.2–6.2)	87.9 (85.7–89.7)	6.2 (5.0–7.6)	1.5 (1.0–2.2)	7.4 (6.1–9.1)	89.6 (87.6–91.2)	2.7 (2.0–3.7)	0.3 (0.1–0.6)
TKM	4.3 (3.5–5.4)	83.8 (82.1–85.4)	8.6 (7.4–10.0)	3.2 (2.6–4.0)	4.7 (3.5–6.3)	93.3 (91.5–94.7)	1.8 (1.4–2.4)	0.1 (0.1–0.3)
TUR	1.6 (1.3–1.9)	72.1 (70.8–73.4)	15.5 (14.7–16.4)	10.8 (9.9–11.7)	25.3 (23.9–26.6)	67.5 (66.2–68.9)	6.6 (5.9–7.4)	0.6 (0.4–0.8)
Pooled estimates[a]	2.3 (2.0–2.5)	68.8 (67.9–69.7)	17.2 (16.6–17.8)	11.7 (11.1–12.3)	9.6 (9.1–10.1)	79.1 (78.5–79.8)	10.5 (10.0–10.9)	0.8 (0.7–1.0)

COSI/WHO Europe round 4 (2015–17). COSI, Childhood Obesity Surveillance Initiative; CI, confidence interval; BUL, Bulgaria; CZH, Czechia; DEN, Denmark; KGZ, Kyrgyzstan; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MTA, Malta; MNE, Montenegro; RUS, Moscow city-Russian Federation; POR, Portugal; SPA, Spain; TJK, Tajikistan; TKM, Turkey; TUR, Turkmenistan, ALB, Albania; CRO, Croatia; ITA, Italy; POL, Poland; ROM, Romania; SMR, San Marino; KAZ, Kazakhstan. [a] Pooled estimates were calculated for the following age groups/countries: 7 year olds from BUL, CZH, DEN, KGZ, GEO, LVA, LTU, MAT, MNE, RUS, POL, SPA, TJK, TKM, and TUR; 8 year olds from ALB, CRO, ITA, POL, ROM, and SMR; and 9 year olds from KAZ.

WHO classification. Similarly, most parents (86.5%) were able to accurately assess their child's weight if the child's weight fell in the normal weight category. However, for children who were classified in the overweight category (excluding obesity), only 17.4% of parents accurately assessed their child's weight status, while 82.3% underestimated their child's weight status. Last, for children who fell in the obesity category, while 6.2% of parents accurately perceived their child's weight status, 56.2% perceived their child's as "a little overweight" and 37.2% as "normal weight."

In regard to the IOTF classification of child weight status, parents' perception was slightly more accurate (relative to the WHO classification), with 72% of parents classifying their child's weight status accurately. However, there was still a high proportion of parents who underestimated their child's weight status – 68.1% among children with overweight (excluding obesity) and 90.7% among children with obesity (online suppl. Table 2).

Parents' underestimating perceptions of their child's weight status by country are shown in Figure 1 and Table 4. Normal weight children were mostly accurately perceived by parents in all countries – accurate perception accounted for <80% of children only in 2 countries (Kyrgyzstan and Turkey). As for children with overweight or obesity, data showed a higher level of heterogeneity among countries. The percentage of children classified as with overweight (excluding obesity) according to WHO's definition, and whose weight status was underestimated, varied from <70% in Latvia, Romania, and San Marino to >90% in Portugal, Tajikistan, Turkmenistan, and Turkey. This percentage increased to over 50% in 3 countries, with the highest values recorded in Turkmenistan (75.5%). In

Table 4. Accuracy of parents' perception of their child's weight status compared to WHO definition by country and overall

Country	All children[a]			Normal weight children[a]			Children with overweight (excluding obesity)[a]			Children with obesity[a]		
	accurate, %	underestimate, %	overestimate, %	accurate, %	underestimate, %	overestimate, %	accurate, %	underestimate, %	overestimate, %	accurate, %	underestimate, %	
											"a little overweight"	"normal weight"
ALB	72.4	25.1	2.6	90.3	8.1	1.6	28.7	70.4	0.9	12.7	66.5	20.7
BUL	65.3	31.3	3.4	89.9	8.4	1.8	17.8	81.2	1.0	7.4	59.7	32.9
CRO	68.4	29.3	2.3	96.8	1.9	1.3	21.5	78.5	0.0	6.8	63.7	29.5
CZH	75.3	21.5	3.2	94.1	5.0	0.9	16.8	82.8	0.4	10.3	66.1	23.6
DEN	81.6	16.8	1.6	92.6	7.1	0.3	26.3	73.7	0.0	n.a.	n.a.	n.a.
GEO	69.2	29.0	1.7	86.4	12.2	1.4	22.9	76.8	0.2	8.8	62.5	28.7
ITA	60.0	38.1	1.9	87.4	10.9	1.7	29.3	70.4	0.3	6.4	71.5	22.2
KAZ	72.5	22.0	5.5	89.0	7.2	3.8	14.7	83.5	1.9	7.4	34.1	58.5
KGZ	71.0	26.1	2.9	78.3	20.1	1.6	15.0	84.8	0.2	7.0	48.0	45.0
LTU	71.3	26.6	2.1	91.9	6.8	1.2	21.7	78.1	0.2	10.1	65.0	24.9
LVA	73.5	24.4	2.1	90.6	7.7	1.7	30.9	68.6	0.5	11.8	67.4	20.8
MAT	61.1	37.9	1.1	90.6	8.7	0.7	13.9	85.9	0.2	3.7	62.2	34.0
MNE	66.8	31.0	2.2	96.2	2.0	1.8	12.1	86.9	1.0	6.2	41.6	52.2
POL	67.7	31.1	1.2	89.6	9.9	0.5	21.0	78.5	0.4	18.1	55.7	26.2
POR	64.0	35.2	0.8	89.6	10.0	0.4	9.5	90.4	0.2	1.2	60.4	38.4
ROM	66.5	27.2	6.2	90.4	7.5	2.1	30.1	69.7	0.2	4.5	71.6	23.9
RUS	71.1	25.9	3.0	90.0	8.2	1.8	26.4	73.0	0.6	7.6	67.9	24.4
SMR	66.7	32.0	1.3	89.5	9.0	1.5	31.3	68.8	0.0	n.a.	n.a.	n.a.
SPA	56.4	42.6	1.0	89.7	9.5	0.8	11.5	88.5	0.1	3.8	50.6	45.6
TJK	80.3	13.7	6.0	90.2	7.3	2.5	6.2	93.8	0.0	n.a.	n.a.	n.a.
TKM	79.7	15.5	4.7	94.2	4.9	0.9	4.1	95.6	0.2	0.7	23.8	75.5
TUR	51.3	47.8	1.0	67.2	32.1	0.7	7.6	92.2	0.2	4.4	46.2	49.4
Pooled estimates[b]	64.1	33.5	2.3	86.5	12.2	1.3	17.4	82.3	0.3	6.2	56.6	37.2

COSI Round 4 (2015–2017). COSI, Childhood Obesity Surveillance Initiative; BUL, Bulgaria; CZH, Czechia; DEN, Denmark; KGZ, Kyrgyzstan; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MTA, Malta; MNE, Montenegro; RUS, Moscow city-Russian Federation; POR, Portugal; SPA, Spain; TJK, Tajikistan; TKM, Turkey; TUR, Turkmenistan, ALB, Albania; CRO, Croatia; ITA, Italy; POL, Poland; ROM, Romania; SMR, San Marino; KAZ, Kazakhstan. [a]Accurate perception refers to children perceived as belonging to the correct category determined by the WHO definition (e.g., normal weight children perceived as "normal weight" by their parents). Underestimating perception refers to children perceived as belonging to a higher category than determined by the WHO definition (e.g., children with overweight perceived as "normal weight" by their parents). Overestimating perception refers to children perceived as belonging to a lower category than determined by the WHO definition (e.g., normal weight children perceived as "a little overweight" by parents). The accuracy of parents' perception was not analyzed for children with obesity from DEN, SMR, and TJK due to the limited number of available observations. [b]Pooled estimates were calculated for the following age groups/countries: 7 year olds from BUL), CZH, DEN, KGZ, GEO, LVA, LTU, MAT, MNE, RUS, POL, SPA, TJK, TKM, and TUR; 8 year olds from ALB, CRO, ITA, POL, ROM, and SMR; and 9 year olds from KAZ.

7 countries, <25% of children in the obesity category were seen as "normal weight" by their parents.

Predictors of Parents' Perception of Their Child's Weight Status

We assessed predictors of parents' perceptions about their child's overweight (including obesity) weight status by estimating country-specific and pooled multilevel logistic models that included child's age in months, sex, BMI, and urbanization grade of child's residence place, as well as respondent's characteristics (i.e., relationship with the child – mother or father, and parental educational attainment and weight status) (Table 5). Based on pooled regression analyses, parents were more likely to underestimate their child's weight status if the child was male (adjOR: 1.41; 95% CI: 1.28–1.55), the mother/father had a low-medium level of educational attainment (ajdOR: 1.41; 95% CI: 1.26–1.57) and, to a less extent, if the father completed the form (adjOR: 1.14; 95% CI: 0.98–1.33) or the family lived in rural areas (adjOR: 1.10; 05% CI: 0.99–1.24). There were also important differences at the country level. First, boys with overweight (including obesity) in Georgia were 2.57 times more likely to be perceived as having normal weight or underweight. Second, parents with low-to-moderate educational attainment in Croatia, Kazakhstan, Montenegro, and Portugal were >2 times more likely to underestimate their child's weight status. Third, fathers from Albania underestimated their child's weight status more than mothers (adjOR estimate over 2). Finally, in Bulgaria, Turkmenistan, and Turkey, parents from rural areas were 2 times more likely to underestimate their child's weight status.

There was an association between a child's BMI and their parents' perceptions about their own weight status. Although not entirely linear, the odds of parents underestimating their own weight status decreased as the child's

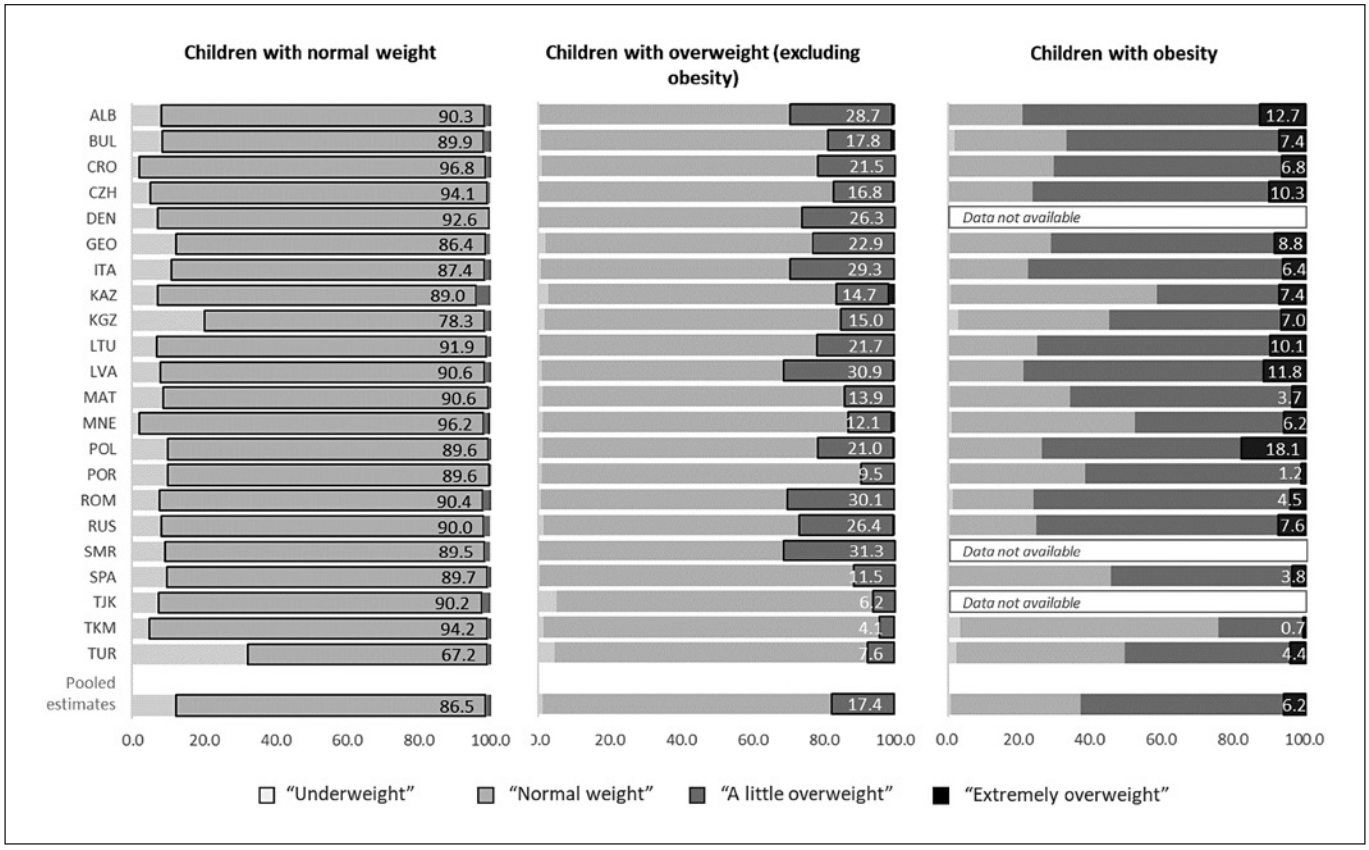

Fig. 1. Parents' perception[a] of their child's weight status among children classified as normal weight, overweight (excluding obesity), and obesity according to the WHO definition. COSI/WHO Europe round 4 (2015–17). For an explanation of the country abbreviations, see Table 1. [a]Parents' perception was not analyzed for children with obesity from Denmark, San Marino, and Tajikistan due to the limited number of available observations. Pooled estimates were calculated for the following age groups/countries: 7 year olds from BUL, CZH, DEN, KGZ, GEO, LVA, LTU, MAT, MNE, RUS, POR, SPA, TJK, TKM, and TUR; 8 year olds from ALB, CRO, ITA, POL, ROM, and SMR; and 9 year olds from KAZ. COSI, Childhood Obesity Surveillance Initiative; BUL, Bulgaria; CZH, Czechia; DEN, Denmark; KGZ, Kyrgyzstan; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MTA, Malta; MNE, Montenegro; RUS, Moscow city-Russian Federation; POR, Portugal; SPA, Spain; TJK, Tajikistan; TKM, Turkey; TUR, Turkmenistan; ALB, Albania; CRO, Croatia; ITA, Italy; POL, Poland; ROM, Romania; SMR, San Marino; KAZ, Kazakhstan.

BMI increased. However, parents' BMI was not strongly associated with underestimation of child's weight status. However, in some countries, there was a stronger association between parents' BMI and their ability to accurately perceive their child's weight status. In Croatia, Italy, Lithuania, and Spain, for example, parents with overweight or obesity were more likely to underestimate their child's weight status.

The pooled data were also analyzed separately for boys and girls (Table 5). The adjORs estimated through the regression analysis were similar for boys and girls. Nevertheless, the less accurate perception of fathers compared to mothers was more evident for boys (adjOR: 1.29; 95% CI: 1.04–1.60) than girls (adjOR: 1.05; 95% CI: 0.84–1.17).

The percentage of children with overweight (including obesity) who were perceived as "underweight" or "normal weight" by their parents is shown in Figure 2. These values varied from 49.4% in Italy to 89.4% in Turkmenistan, with other countries' values ranging between 50–60% and 70–75%. After adjusting for the child's age in months, sex, BMI, and urbanization grade of child's residence place, as well as respondent's characteristics, differences among countries in terms of parental underestimation were mostly confirmed.

Overall, parents in Croatia, Kazakhstan, Kyrgyzstan, Montenegro, Portugal, Spain, Turkey, and Turkmenistan were more likely to underestimate their children's weight status (compared to Italy). On the other

Obes Facts 2021;14:658–674
DOI: 10.1159/000517586

Table 5. adjORs of parents' perception of their child as with underweight or normal weight (compared to being perceived as with a little overweight) among children with overweight (including obesity) according to WHO's definition by country and overall

Country	*N*	adjOR (95% CI)[a]								
		child's sex (reference = girls)	age in months[b]	child's BMI[b]		characteristics of the parent who completed the form				
						urbanization grade of child's residence place (reference = rural areas)	parent who completed the form (reference = mother)	parent's educational attainment (reference = high level)	parent's weight status (reference = normal weight)	
		boys		BMI	BMI^2 (squared)	urban	father	low-medium level	preobesity	obesity
ALB	514	1.30 (0.78–2.15)	1.02 (1.00–1.05)	0.09 (0.03–0.26)	1.04 (1.01–1.07)	1.13 (0.45–2.83)	2.33 (1.11–4.89)	1.51 (0.88–2.60)	0.60 (0.40–0.91)	0.25 (0.12–0.53)
BUL	912	1.54 (1.04–2.28)	1.01 (0.93–1.09)	0.03 (0.01–0.12)	1.07 (1.03–1.10)	2.30 (1.28–4.14)	1.45 (0.68–3.10)	1.52 (0.99–2.34)	1.68 (0.96–2.97)	0.93 (0.49–1.77)
CRO	816	1.51 (1.00–2.27)	1.06 (1.00–1.12)	0.03 (0.01–0.14)	1.07 (1.03–1.10)	0.78 (0.45–1.35)	0.87 (0.47–1.6)	2.05 (1.28–3.30)	1.38 (0.86–2.23)	1.49 (0.75–2.97)
CZH	239	1.58 (0.75–3.31)	1.08 (0.98–1.20)	0.01 (0.00–0.07)	1.10 (1.05–1.16)	0.92 (0.41–2.07)	n.a.	0.72 (0.20–2.55)	0.90 (0.33–2.48)	0.46 (0.16–1.33)
GEO	637	2.57 (1.71–3.85)	1.01 (0.97–1.06)	0.04 (0.01–0.14)	1.06 (1.03–1.09)	1.00 (0.57–1.76)	0.84 (0.24–2.89)	1.95 (1.24–3.07)	0.99 (0.57–1.73)	0.90 (0.52–1.54)
ITA	15,747	1.24 (1.12–1.38)	1.01 (1.00–1.02)	0.04 (0.03–0.05)	1.06 (1.05–1.07)	1.06 (0.94–1.19)	1.03 (0.85–1.25)	1.30 (1.14–1.49)	1.11 (0.97–1.26)	1.17 (0.97–1.41)
KAZ	650	1.73 (0.95–3.15)	1.04 (0.97–1.11)	0.08 (0.02–0.33)	1.05 (1.02–1.08)	1.16 (0.57–2.39)	1.10 (0.32–3.78)	2.03 (0.80–5.16)	0.53 (0.22–1.24)	0.32 (0.10–1.02)
KGZ	541	1.13 (0.61–2.12)	0.99 (0.95–1.03)	0.01 (0.00–0.07)	1.09 (1.05–1.14)	1.61 (0.62–4.22)	1.89 (0.83–4.30)	1.16 (0.65–2.07)	0.63 (0.33–1.22)	0.43 (0.20–0.93)
LTU	766	1.69 (1.16–2.45)	0.97 (0.92–1.03)	0.02 (0.01–0.10)	1.07 (1.04–1.11)	1.41 (0.89–2.25)	1.92 (0.75–4.91)	1.19 (0.78–1.82)	1.68 (1.14–2.46)	1.39 (0.78–2.48)
LVA	1,350	2.35 (1.77–3.12)	1.01 (1.00–1.02)	0.02 (0.01–0.06)	1.07 (1.05–1.10)	1.49 (0.85–2.62)	0.99 (0.57–1.70)	1.12 (0.81–1.53)	0.79 (0.58–1.08)	1.02 (0.69–1.50)
MAT	870	1.32 (0.92–1.90)	1.00 (0.95–1.05)	0.04 (0.01–0.11)	1.06 (1.03–1.09)	n.a.	n.a.	1.45 (0.96–2.19)	0.97 (0.64–1.48)	1.67 (1.04–2.66)
MNE	838	1.96 (1.31–2.93)	0.99 (0.96–1.03)	0.02 (0.01–0.08)	1.08 (1.05–1.11)	1.35 (0.62–2.93)	0.69 (0.43–1.10)	2.13 (1.36–3.33)	1.35 (0.87–2.07)	0.93 (0.40–2.19)
POL	828	0.97 (0.57–1.65)	0.98 (0.89–1.09)	0.03 (0.01–0.12)	1.07 (1.03–1.10)	1.38 (0.85–2.24)	0.95 (0.40–2.26)	1.28 (0.68–2.39)	0.85 (0.53–1.39)	1.19 (0.57–2.50)
POR	1,671	1.00 (0.73–1.36)	1.01 (0.98–1.03)	0.02 (0.01–0.05)	1.07 (1.05–1.09)	1.03 (0.59–1.81)	1.88 (1.13–3.13)	2.44 (1.64–3.63)	0.96 (0.65–1.40)	0.67 (0.44–1.04)
ROM	1,500	1.65 (1.13–2.39)	0.99 (0.97–1.02)	0.03 (0.02–0.07)	1.07 (1.05–1.08)	0.93 (0.67–1.30)	1.02 (0.63–1.64)	1.17 (0.83–1.65)	1.24 (0.87–1.76)	0.91 (0.56–1.47)
SPA	3,707	1.18 (0.95–1.46)	1.02 (1.01–1.03)	0.05 (0.03–0.11)	1.05 (1.04–1.07)	1.25 (0.93–1.67)	0.98 (0.69–1.39)	1.29 (1.03–1.60)	1.28 (0.98–1.68)	1.40 (1.00–1.95)
TKM	381	1.26 (0.50–3.20)	0.89 (0.79–1.01)	0.03 (0.00–0.28)	1.07 (1.02–1.13)	4.38 (1.49–12.88)	1.18 (0.39–3.58)	1.83 (0.52–6.38)	0.50 (0.18–1.39)	0.14 (0.04–0.48)
TUR	2,347	1.48 (1.04–2.11)	1.01 (0.97–1.04)	0.02 (0.01–0.05)	1.08 (1.05–1.11)	2.99 (1.08–8.26)	1.54 (0.99–2.40)	1.38 (0.88–2.17)	0.73 (0.48–1.13)	0.89 (0.55–1.42)
Pooled estimate[b]										
Boys & girls	20,916	1.41 (1.28–1.55)	1.00 (0.98–1.01)	0.03 (0.02–0.04)	1.06 (1.06–1.07)	1.10 (0.99–1.24)	1.14 (0.98–1.33)	1.41 (1.26–1.57)	1.09 (0.97–1.22)	0.97 (0.83–1.12)
Boys	11,090	–	1.00 (0.87–1.02)	0.01 (0.01–0.02)	1.08 (1.07–1.09)	0.99 (0.84–1.17)	1.29 (1.04–1.60)	1.37 (1.17–1.61)	1.09 (0.91–1.30)	1.04 (0–84–1.28)
Girls	9,826	–	0.99 (0.97–1.01)	0.03 (0.02–0.05)	1.06 (1.05–1.07)	1.14 (0.97–1.34)	1.05 (0.84–1.31)	1.53 (1.30–1.81)	1.12 (0.95–1.32)	0.93 (0.75–1.15)

The following age group countries were included in the pooled analysis: 7 year olds from BUL, GEO, KGZ, LVA, LTU, MNE, POL, SPA, TKM, and TUR; 8 year olds from ALB, CRO, ITA, POL, and ROM; and 9 year olds from KAZ. COSI/WHO Europe round 4 (2015–17). adjORs, adjusted ORs; COSI, Childhood Obesity Surveillance Initiative; CI, confidence interval; BMI, body mass index; BUL, Bulgaria; CZH, Czechia; DEN, Denmark; KGZ, Kyrgyzstan; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MTA, Malta; MNE, Montenegro; RUS, Moscow city-Russian Federation; POR, Portugal; SPA, Spain; TJK, Tajikistan; TKM, Turkey; TUR, Turkmenistan, ALB, Albania; CRO, Croatia; ITA, Italy; POL, Poland; ROM, Romania; SMR, San Marino; KAZ, Kazakhstan. [a]adjORs and 95% CI were estimated through multilevel logistic regression models with random effects for primary sampling units. Country models included child's sex and age in months, urbanization grade of child's place of residence (urban or rural), the relation between the respondent and the child (father or mother), and educational attainment and weight status of the parent who completed the form. [b]Pooled estimates also included country among the covariates.

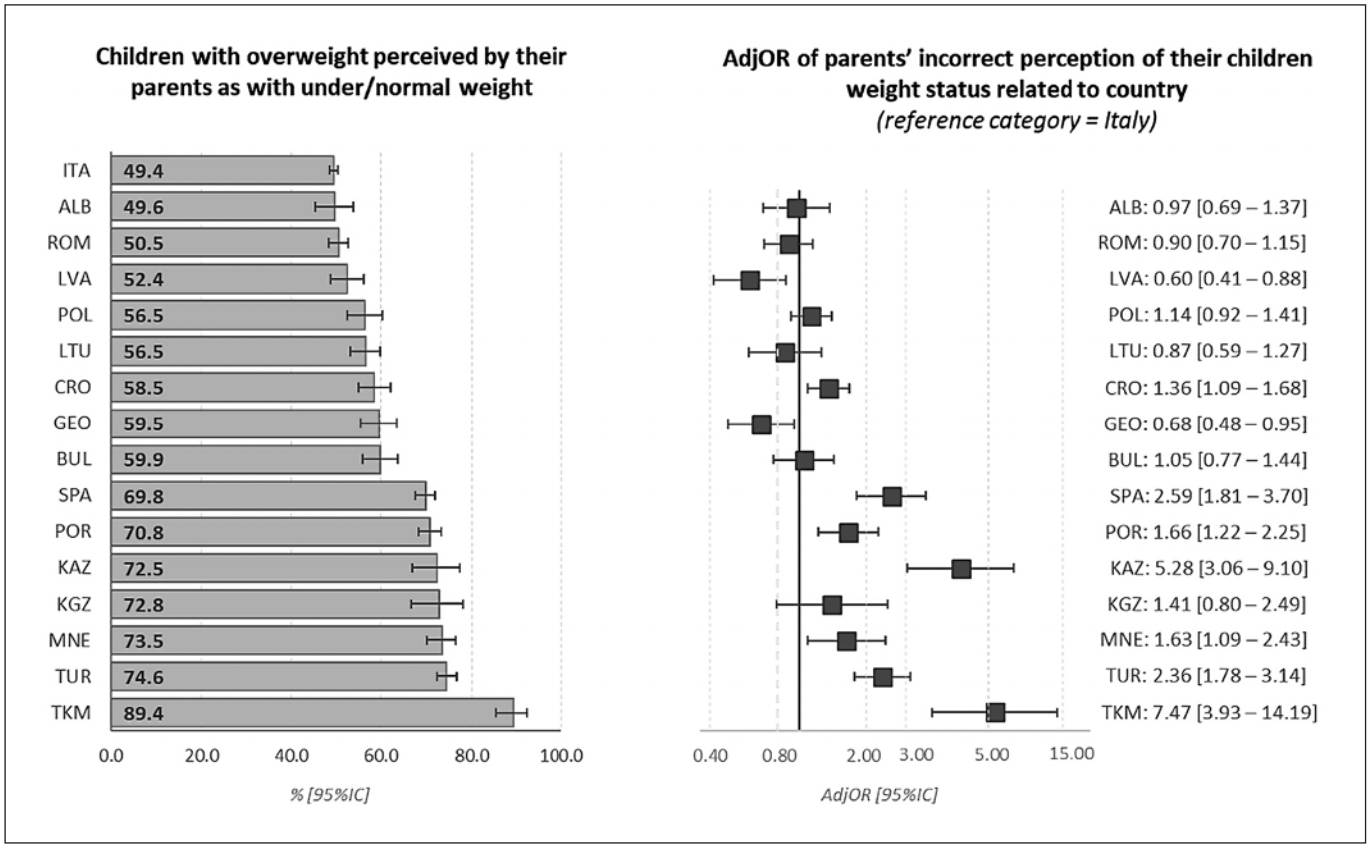

Fig. 2. Percentage of children with overweight (including obesity) according to WHO's definition who are perceived by their parents as with under/normal weight and adjORsa of parents' incorrect perception related to country. COSI/WHO Europe round 4 (2015–17). aadjORs of parents' perception of their child's weight status as with under/normal weight (compared to being perceived as "a little overweight" or "extremely overweight") among children with overweight (including obesity) and 95% CI were estimated through a multilevel logistic regression model with random effects for primary sampling units. Besides country, a pooled model included child's sex and age in months, urbanization grade of child's place of residence (urban or rural), the relation between the respondent and the child (father or mother), and educational attainment and weight status of the parent who filled in the form. Pooled estimates were obtained including the following age groups/countries: 7 year olds from BUL, GEO, LVA, LTU, MNE, POR, SPA, TUR, and TKM; 8 year olds from ALB, CRO, ITA, POL, and ROM; and 9 year olds from KAZ. adjORs, adjusted ORs; CI, confidence interval; COSI, Childhood Obesity Surveillance Initiative; BUL, Bulgaria; GEO, Georgia; LVA, Latvia; LTU, Lithuania; MNE, Montenegro; POR, Portugal; SPA, Spain; TUR, Turkmenistan; TKM, Turkey; ALB, Albania COR, Croatia; ITA, Italy; POL, Poland; ROM, Romania; KAZ, Kazakhstan.

hand, parents in Latvia and Georgia were less likely to underestimate their child's weight status (compared to Italy).

Discussion

Consistent with previous studies, our results indicate that parents tend to underestimate their child's weight status [26–28]. In our study, 82.3% and 93.8% of parents underestimated their child's weight status in the overweight (excluding obesity) and obesity categories, respectively. Further, we found that fathers were more likely to underestimate weight status in boys with overweight (excluding obesity), and that parents with low-medium educational attainment underestimated boys' more than girls' weight status. Finally, our findings also show differences between countries. Cultural and gender differences such as social expectations of boys' and girls' body weight, shape, and size may influence parental perceptions; however, more studies are needed to explore how fathers in countries such as Turkmenistan, Kazakhstan, and Montenegro perceive obesity in their children (specifically boys).

As other parental perception studies have done, we used anthropometric measures (i.e., height, weight, and

BMI) to classify children with overweight and obesity. However, parental perception studies have used different definitions to classify children with overweight and obesity. Some studies have used the US Centres for Disease Control and Prevention BMI categories, while others have used the IOTF standard or the WHO growth charts. The use of different cutoff values, standards, and growth charts can lead to different obesity classifications and may cause confusion [26]. Similar to other studies, we found that the level of underestimation of a child's weight varies depending on the obesity classification system that is used. Specifically, our study found that using the IOTF standard, parents were less likely to underestimate their child's weight status (online suppl. Table 2).

A lack of a clear definition and assessment protocol of childhood obesity limits the usability of parental perception studies. For example, a systematic review of studies conducted between 2006 and 2012 found that parents not only underestimated their child's weight status, but they also did not express concern about their child's excess weight [27]. Based on these studies, we simply do not know if parents understand the significance of weight status in relation to their child's health risk, especially if the risk has not been assessed and communicated by a qualified healthcare provider [27, 48].

Some researchers argue that quantifying health in terms of numbers on a scale has resulted in changing body size ideals globally [49]. Changing body size ideals can be demonstrated through increasing weight bias and weight-based discrimination trends. As population levels of childhood obesity have increased, so have levels of weight bias and weight-based discrimination [50, 51]. Framing healthy eating and physical activity interventions based on weight outcomes can have unintended consequences such as children only exercising and eating healthy to lose weight or engaging in unhealthy weight control strategies as opposed to engaging in these healthy living activities for health improvement and overall well-being and quality of life [52, 53]. Indeed, a limitation of parental perceptions studies to date is that weight and BMI alone are not sufficient measures to diagnose clinical obesity because they simply do not provide enough information about health risk [54, 55]. Although BMI is used to track obesity rates at the population level, at the individual level it only serves as a screening tool. Obesity should be diagnosed by a qualified healthcare professional, conducting a full medical assessment to determine if the child's weight is impairing their health. If a parent perceives their child to have health risks related to their excess weight, then it is essential for a qualified healthcare professional to conduct further clinical investigation and for healthcare services to be accessible and affordable for families [36, 56].

Various public health interventions have been developed to correct parents' misperceptions about their child's weight. In the USA and UK, schools have established initiatives to send BMI report cards to inform parents that their child may be at risk for or has developed obesity. However, there is no robust evidence that providing parents with this information leads to change in behavior. On the contrary, there is some evidence that it can be perceived as stigmatizing [57]. Specifically, children who were perceived by parents to have excess weight were at a greater risk for weight gain regardless of their actual weight and despite being more likely to be actively try to lose weight [57]. Children whose parents have identified them as having overweight also report viewing their body size negatively [57]. A possible explanation may be that obesity is highly stigmatized in society and identifying oneself or a child as having obesity could lead to unhealthy coping strategies, including unhealthy weight loss approaches, which may actually lead to more weight gain in the long run [58–60].

Promoting the idea that parents should be educated to recognize whether their child has obesity using anthropometric measures or visual cues about their child's weight or size could have harmful unintended consequences. Health messages that imply parents are unaware or simply in denial of their child's overweight or obesity may add to the pervasive stigma that children and parents experience. Internalized blame and social judgment related to parenting can reduce the quality of life and impede parent-child interactions, which may ultimately impact children's well-being [31]. Furthermore, it is important to recognize that parents' ability and motivation to take action for their child's health vary from family to family. It is the responsibility of health care professionals to be aware of any assumptions they make about parents' personal responsibility for their child's weight and health as this can contribute to further weight bias and stigma. Specifically, healthcare professionals should avoid making assumptions about parents' motivations to promote healthy behaviors in their children and explore the family's understanding of health risks, their values, and inherent socioeconomic realities [36]. Importantly, although vital signs such as height, weight, and BMI are important surveillance tools, healthcare professionals should always conduct a full medical assessment to determine a child's health risk, while also educating and supporting parents and children about the complexity of childhood obesity [36].

Our study has a number of limitations to acknowledge. First, missing or insufficient data from some countries may have resulted in inaccurate calculations of weight status perceptions and predictors. Second, results may be related to the wording of the question and variables on the record form. For example, "A little overweight" and "Extremely overweight" may have led some parents to misperceive their child's weight status due to subjective interpretations and internalized weight bias. Third, completion of this question may have been subject to disclosure error in which parents purposefully did not accurately document their perceived classification of their child's weight status. Despite these limitations, our findings underscore the importance of revisiting the way in which interventions for obesity are communicated and delivered, and the need to take stronger actions to include parents' perspectives. Considering that many interventions to date have been criticized for casting blame and shame on parents for misperceiving their child's weight status or for not being concerned about their child's weight, special attention should be given to the way information about obesity risk is provided to parents. It is also critical for healthcare professionals to systematically assess children's weight during growth and consider an ecological approach in addressing childhood obesity while practicing a nonjudgmental clinical environment to strengthen open communication and rapport with families.

Our findings also have a number of policy implications, including supporting parents and further research. Healthcare professionals should always conduct a full medical assessment to determine if a child's growth (height and weight) may present a health risk, while also educating and supporting parents and children about the complexity of childhood obesity. Special attention should be given to the way information about healthy childhood growth and development is given to parents in order to avoid unintended consequences such as weight bias and stigma. Healthcare professionals may benefit from training on the assessment and holistic treatment of overweight and obesity supported by investments in primary care. In addition, quantitative and qualitative research at the country level is needed to understand how gender, parental education, and sociocultural factors impact perception about childhood growth including weight status, and how this can impact children. Further research is needed to understand the dynamics of communicating childhood growth, including weight, information, and health risks to parents.

Conclusion

Our study supplements the current literature on factors that influence parental perceptions of their child's weight status. Public health interventions aimed at promoting healthy childhood growth and development should consider parents' knowledge and perceptions, as well as the sociocultural contexts in which children and families live. Further research is needed to understand the dynamics of communicating with parents, in particular with fathers and parents of boys, to help ensure that families have an accurate understanding of obesity risks and access to resources and support to prevent and manage childhood obesity. Continued awareness and implications of childhood obesity are deserving of increased attention by stakeholders, including parents, school staff, healthcare professionals, and policy advisors.

Acknowledgments

We gratefully acknowledge all participating children, their parents, teachers, and principals for kindly volunteering to participate in the study. We also thank the examiners and regional and local supervisors/coordinators who collected data in each country. Furthermore, we would like to acknowledge the contribution of other researchers and/or principal investigators in this study.

Statement of Ethics

The WHO COSI study protocol was approved by the International Ethical Guidelines for Biomedical Research Involving Human Subjects and all procedures were also approved by Local Ethical Committees in each country (ALB: Scientific Committee of Institute of Public Health, Decision number: 953, July 13, 2015; BUL: Project identification code – 060 – MII 325 – 68 COSI, February 25, 2016; CRO: Ethical Committee of the Croatian Institute for Public Health, Registry number: 80-2660/1-15, September 25, 2015; CZH: Ethical Committee of the Institute of Endocrinology, AZV MZČR 17-31670 A, June 20, 2016; DEN: Research and Innovation Organization, SDU, 10.829, June 27, 2016; GEO: Bioethics Council at National Center for Disease Control and Public Health of Georgia, Project identification code: 2019-52, 4 November 2019; ITA: National Institute of Health, Prot. PRE–739/15, November 10, 2015; KAZ: Scientific and technical program "Development and implementation of modern technologies for healthy lifestyle promotion and prevention of diseases based on the study of non-medical determinants of health among children," 2015; KGZ: The Ethics Committee on compliance of research to ethical norms for medical research, Project identification code: No. 1/1, February 22, 2018; LVA: Central Medical Ethics Committee, Project identification code: 01-29.1/6, September 25, 2015; LTU: Lithuanian Bioethics Committee (Lietuvos bioetikos komitetas), Project identification code: 08-02-19, February 19, 2008 and bioethics authorization renewals in on January 04, 2010, January 09, 2013, and

March 12, 2019; MAT: Malta did not go through Ethics Committee as all the work involved in COSI data collection and analysis is part and parcel of the existing School Health Service, which is an ongoing process; MNE: Ethical Committee of the Institute of Public Health of Montenegro, Project identification code: WHO 2016/627456-0, April 28, 2016; POL: Bioethics Committee of the Institute of Mother and Child, Project identification number: 22/2015, November 26, 2015; POR: National Commission of Data Protection; Aut nº5418/2016 for all rounds of COSI Portugal, June 07, 2016; ROM: Intern Ethical Committee of the National Institute of Public Health, Project identification code: WHO 2016/650301-0, April 06, 2016, RUS: National Institute of Health., Prot. PRE–739/15, November 2015; SMR: Ethical Committee of the National Institute of Health, Prot. PRE – 739/15, November 10, 2015; SPA: Data for COSI in Spain were collected as part of the ALADINO Spanish Study, which did not ask for an Ethics Committee approval, since it is not mandatory in Spain. However, the Principal Investigators confirm that the study was conducted in accordance with the Declaration of Helsinki and all parents/guardians of subjects participating in round 4 gave their informed consent for inclusion before they participated in the study; TJK: Ministry of Health and Social Protection of Tajikistan, Project identification code: #858, November 18, 2016; TUR: Keçiören Training and Research Hospital, Clinical Researches Ethics Committee, October 26, 2016; TKM: Ethics approval was granted from the Ministry of Healthcare and Medical Industry (MOHMI), Project identification code: Health System Strengthening and Support Project, LN: 8531-TR, L.2.12, Obesity Fighting Project, Subcomponent 1.1, L.2.11, 2015). Furthermore, children's parents or guardians gave their written informed consent.

Conflict of Interest Statement

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Funding Sources

The authors gratefully acknowledge support from a grant from the Russian Government in the context of the WHO European Office for the Prevention and Control of NCDs. Data collection in the countries was made possible through funding by: **Albania**: World Health Organization through the Joint Programme on Children, Food Security and Nutrition "Reducing Malnutrition in Children," funded by the Millennium Development Goals Achievement Fund, and the Institute of Public Health; **Bulgaria**: Ministry of Health, National Center of Public Health and Analyses, World Health Organization Regional Office for Europe; **Croatia**: Ministry of Health, Croatian Institute of Public Health and World Health Organization Regional Office for Europe; **Czechia**: Grants AZV MZČR 17-31670 A and MZČR – RVO EÚ 00023761; **Denmark**: Danish Ministry of Health; **France**: French Public Health Agency; **Georgia**: World Health Organization; **Ireland**: Health Service Executive; **Italy**: Ministry of Health; Istituto Superiore di sanità (National Institute of Health); **Kazakhstan**: Ministry of Health of the Republic of Kazakhstan and World Health Organization Country Office; **Latvia**: n/a; **Lithuania**: Science Foundation of Lithuanian University of Health Sciences and Lithuanian Science Council and World Health Organization; **Malta**: Ministry of Health; **Montenegro**: World Health Organization and Institute of Public Health of Montenegro; **Poland**: National Health Programme, Ministry of Health; **Portugal**: Ministry of Health Institutions, the National Institute of Health, Directorate General of Health, Regional Health Directorates and the kind technical support of Center for Studies and Research on Social Dynamics and Health (CEIDSS); **Romania**: Ministry of Health; **Russia (Moscow)**: n/a; **San Marino**: Health Ministry; Educational Ministry; Social Security Institute; the Health Authority; **Spain**: Spanish Agency for Food Safety and Nutrition (AESAN); **Tajikistan**: World Health Organization Country Office in Tajikistan and Ministry of Health and Social Protection; and **Turkmenistan**: World Health Organization Country Office in Turkmenistan and Ministry of Health. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

Author Contributions

X.R.S., M.B., and J.W. conceptualized and designed the study and were responsible for the overall direction and planning. M.B. performed data analysis and drafted and designed figures and tables. X.R.S and M.K. wrote the manuscript with support from J.W., A.S., P.N., A.R., and J.B. All authors contributed to the design and implementation of the study, the analysis of the results, and the editing of the manuscript. All authors approve the final version of the manuscript.

Data Availability Statement

The data that support the findings of this study are available from the World Health Organization.

References

1 Wijnhoven TM, van Raaij JM, Sjöberg A, Eldin N, Yngve A, Kunešová M, et al. WHO European childhood obesity surveillance initiative: school nutrition environment and body mass index in primary schools. Int J Environ Res Public Health. 2014;11:11261.
2 WHO. Obesity: preventing and managing the global epidemic. Switzerland: World Health Organization; 2000. Report No.: 0512-3054.
3 WHO. Time to deliver: report of the independent high-level commission on noncommunicable diseases. Geneva: World Health Organization; 2018.
4 WHO. WHO European childhood obesity surveillance initiative: overweight and obesity among 6–9-year-old children: WHO Regional Office for Europe; 2018. Available from: http: //www.euro.who.int/__data/assets/pdf_file/0006/372426/WH14_COSI_factsheets_v2.pdf.

5 Johannes H, Jens-Christian H, Euan W, Jennifer Lyn B, Ellen B, Dominique Durrer S, et al. A proposal of the European Association for the study of obesity to improve the ICD-11 diagnostic criteria for obesity based on the three dimensions etiology, degree of adiposity and health risk. Obes Facts. 2017;10(4):284–307.
6 Bray GA, Kim KK, Wilding JPH. Obesity: a chronic relapsing progressive disease process. A position statement of the World Obesity Federation. Obes Rev. 2017 Jul;18(7):715–23.
7 Andersen IG, Holm JC, Homøe P. Obstructive sleep apnea in obese children and adolescents, treatment methods and outcome of treatment: a systematic review. Int J Pediatr Otorhinolaryngol. 2016;87:190–7.
8 Cruz ML, Shaibi GQ, Weigensberg MJ, Spruijt-Metz D, Ball GD, Goran MI. Pediatric obesity and insulin resistance: chronic disease risk and implications for treatment and prevention beyond body weight modification. Annu Rev Nutr. 2005;25:435–68.
9 Reis JP, Loria CM, Lewis CE, Powell-Wiley TM, Wei GS, Carr JJ, et al. Association between duration of overall and abdominal obesity beginning in young adulthood and coronary artery calcification in middle age. JAMA. 2013;310:280–8.
10 Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med. 1997;337(13):869–73.
11 WHO. WHO report of the commission on ending childhood obesity Geneva. Switzerland: World Health Organization; 2016. Available from: http://apps.who.int/iris/bitstream/10665/204176/1/9789241510066_eng.pdf?ua=1.
12 Roberto CA, Swinburn B, Hawkes C, Huang TT, Costa SA, Ashe M, et al. Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking. Lancet. 2015;385:2400–9.
13 Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. J Family Med Prim Care. 2015;4(2):187–92.
14 Rubino F, Puhl RM, Cummings DE, Eckel RH, Ryan DH, Mechanick JI, et al. Joint international consensus statement for ending stigma of obesity. Nat Med. 2020;26(4):485–97.
15 Puhl RM. Weight stigmatization toward youth: a significant problem in need of societal solutions. Childhood Obesity. 2011;7(5):359.
16 Hatzenbuehler ML, Phelan JC, Link BG. Stigma as a fundamental cause of population health inequalities. Am J Public Health. 2013;103(5):813–21.
17 Puhl RM, Heuer CA. Obesity stigma: important considerations for public health. Am J Public Health. 2010;100(6):1019–28.
18 Ralston J, Brinsden H, Buse K, Candeias V, Caterson I, Hassell T, et al. Time for a new obesity narrative. Lancet. 2018;392(10156):1384–6.
19 Abu-Omar K, Messing S, Sarkadi-Nagy E, Kovács VA, Kaposvari C, Brukało K, et al. Barriers, facilitators and capacities for childhood obesity prevention in 12 European Union Member States: results of a policymaker survey. Public Health Panorama. 2018;4(3):360–7.
20 Farpour-Lambert N, Baker JL, Hassapidou M, Holm J, Nowicka P, O'Malley G, et al. Childhood obesity is a chronic disease demanding specific health care: a position statement from the Childhood Obesity Task Force (COTF) of the European Association for the Study of Obesity (EASO). Obes Facts. 2015;8:342–9.
21 Dietz WH, Baur LA, Hall K, Puhl RM, Taveras EM, Uauy R, et al. Management of obesity: improvement of health-care training and systems for prevention and care. Lancet. 2015;385(9986):2521–33.
22 Cohen J, Brennan AM, Alexander S, Henderson J, Graham C, Baur LA. Assessment of clinicians' views for managing children with obesity in the primary, secondary, and tertiary settings. Child Obes. 2019;15(8):510.
23 Lindsay AC, Sussner KM, Kim J, Gortmaker S. The role of parents in preventing childhood obesity. Future Child. 2006;16(1):169–86.
24 Berge JM, Everts JC. Family-based interventions targeting childhood obesity: a meta-analysis. Child Obes. 2011;7(2):110–21.
25 Johnson F, Cooke L, Croker H, Wardle J. Changing perceptions of weight in Great Britain: comparison of two population surveys. BMJ. 2008;337:a494–a.
26 Parry LL, Netuveli G, Parry J, Saxena S. A systematic review of parental perception of overweight status in children. J Ambul Care Manage. 2008;31(3):253–68.
27 Tompkins CL, Seablom M, Brock DW. Parental perception of child's body weight: a systematic review. J Child Fam Stud. 2015;24:1384–91.
28 Rietmeijer-Mentink M, Paulis WD, van Middelkoop M, Bindels PJ, van der Wouden JC. Difference between parental perception and actual weight status of children: a systematic review. Matern Child Nutr. 2013;9(1):3–22.
29 Binkin N, Spinelli A, Baglio G, Lamberti A. What is common becomes normal: the effect of obesity prevalence on maternal perception. Nutr Metab Cardiovasc Dis. 2013;23(5):410–6.
30 Hansen AR, Duncan DT, Tarasenko YN, Yan F, Zhang J. Generational shift in parental perceptions of overweight among school-aged children. Pediatrics. 2014;134(3):481–8.
31 Zenlea IS, Thompson B, Fierheller D, Green J, Ulloa C, Wills A, et al. Walking in the shoes of caregivers of children with obesity: supporting caregivers in paediatric weight management. Clin Obes. 2017;7(5):300–6.
32 Katz DL. Oblivobesity: looking over the overweight that parents keep overlooking. Child Obes. 2015;11(3):225–6.
33 Parkinson KN, Reilly JJ, Basterfield L, Reilly JK, Janssen X, Jones AR, et al. Mothers' perceptions of child weight status and the subsequent weight gain of their children: a population-based longitudinal study. Int J Obes. 2017;41(5):801–6.
34 Robinson E, Sutin AR. Parental perception of weight status and weight gain across childhood. Pediatrics. 2016;137(5):e20153957.
35 Gerards SMPL, Gubbels JS, Dagnelie PC, Kremers SPJ, Stafleu A, de Vries NK, et al. Parental perception of child's weight status and subsequent BMIz change: the KOALA birth cohort study. BMC Public Health. 2014;14(1):291.
36 Perez A, Ball GD. Beyond oblivobesity: seven myths about parental misperception of children's weight. Child Obes. 2015;11(6):735–7.
37 WHO. Childhood Obesity Surveillance Initiative (COSI): data collection procedures. 2016.
38 Wijnhoven T, Branca F. WHO European childhood obesity surveillance initiative: protocol. Copenhagen; 2008.
39 WHO. WHO European childhood obesity surveillance initiative- protocol. Copenhagen; 2010 Aug.
40 WHO. WHO European childhood obesity surveillance initiative: protocol. Copenhagen; 2012 Oct.
41 WHO. Childhood obesity surveillance initiative: protocol. Copenhagen; 2016.
42 WHO. International ethical guidelines for health-related research involving humans. Geneva; 2017.
43 Rito AI, Buoncristiano M, Spinelli A, Salanave B, Kunesova M, Hejgaard T, et al. Association between characteristics at birth, breastfeeding and obesity in 22 countries: the WHO European childhood obesity surveillance initiative: COSI 2015/2017. Obes Facts. 2019;12:226–43.
44 de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85:660–7.
45 WHO. WHO AnthroPlus for personal computers manual: software for assessing growth of the world's children and adolescents. Geneva: World Health Organization; 2009. Available from: https://www.who.int/growthref/tools/who_anthroplus_manual.pdf.
46 WHO. Physical status: the use and interpretation of anthropometry, Report of a WHO Expert Committee. Geneva: World Health Organization; 1995. Available from: http://whqlibdoc.who.int/trs/WHO_TRS_854.pdf.
47 Cole TJ, Lobstein T. Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. Pediatr Obes. 2012;7(4):284–94.
48 Rhee KE, De Lago CW, Arscott-Mills T, Mehta SD, Davis RK. Factors associated with parental readiness to make changes for overweight children. Pediatrics. 2005;116(1):e94–101.

49 Ramos Salas X. The ineffectiveness and unintended consequences of the public health war on obesity. Can J Public Health. 2015;106(1):e79.
50 Puhl RM, Andreyeva T, Brownell KD. Perceptions of weight discrimination: prevalence and comparison to race and gender discrimination in America. Int J Obes. 2008;32(6):992–1000.
51 Latner JD, Stunkard AJ. Getting worse: the stigmatization of obese children. Obes Res. 2003;11(3):452–6.
52 Ramos Salas X, Alberga AS, Cameron E, Estey L, Forhan M, Kirk SFL, et al. Addressing weight bias and discrimination: moving beyond raising awareness to creating change. Obes Rev. 2017;18:1323–35.
53 Madowitz J, Knatz S, Maginot T, Crow SJ, Boutelle KN. Teasing, depression and unhealthy weight control behaviour in obese children. Pediatr Obes. 2012;7(6):446–52.
54 Sharma AM, Campbell-Scherer DL. Redefining obesity: beyond the numbers. Obesity. 2017;25(4):660–1.
55 Hadjiyannakis S, Buchholz A, Chanoine JP, Jetha MM, Gaboury L, Hamilton J, et al. The Edmonton obesity staging system for pediatrics: a proposed clinical staging system for paediatric obesity. Paediatr Child Health. 2016;21(1):21–6.
56 WHO. What is health financing for universal coverage? 2019. Available from: https://www.who.int/health_financing/universal_coverage_definition/en/.
57 Robinson E, Sutin AR. Parents' perceptions of their children as overweight and children's weight concerns and weight gain. Psychol Sci. 2017;28(3):320–9.
58 Ratcliffe D, Ellison N. Obesity and internalized weight stigma: a formulation model for an emerging psychological problem. Behav Cogn Psychother. 2015;43(2):239–52.
59 Tomiyama AJ. Research review: weight stigma is stressful. A review of evidence for the cyclic obesity/weight-based Stigma model. Appetite. 2014;82:8–15.
60 Schvey NA, Puhl RM, Brownell KD. The stress of stigma: exploring the effect of weight stigma on cortisol reactivity. Psychosom Med. 2014;76(2):156–62.