Received: 28 December 2020 | Revised: 30 December 2020 | Accepted: 31 December 2020

DOI: 10.1111/obr.13211

SUPPLEMENT ARTICLE

OBESITY Reviews WILEY

Socioeconomic differences in food habits among 6- to 9-year-old children from 23 countries—WHO European Childhood Obesity Surveillance Initiative (COSI 2015/2017)

Anne-Siri Fismen[1] | Marta Buoncristiano[2] | Julianne Williams[2] | Arnfinn Helleve[3] | Márta Bakacs[4] | Ingunn Holden Bergh[5] | Vesselka Duleva[6] | Anna Fijałkowska[7] | Andrea Gualtieri[8] | Tatjana Hejgaard[9] | Jolanda Hyska[10] | Cecily C. Kelleher[11] | Lene Kierkegaard[12] | Enisa Kujundžić[13] | Marie Kunešová[14] | Sanja Musić Milanović[15,16] | Paola Nardone[17] | Eha Nurk[18] | Sergej M. Ostojic[19] | Ausra Petrauskiene[20] | Ivo Rakovac[2] | Ana Isabel Rito[21] | Harry Rutter[22] | Elena Sacchini[8] | Dragana Stojisavljević[23,24] | Victoria Farrugia Sant'Angelo[25] | Lela Shengelia[26] | Angela Spinelli[17] | Igor Spiroski[27,28] | Maya Tanrygulyyeva[29] | Daniel Weghuber[30] | João Breda[2]

[1]Department of Health Promotion and Centre for Evaluation of Public Health Measures, Norwegian Institute of Public Health, Bergen, Norway

[2]World Health Organization (WHO) European Office for the Prevention and Control of Noncommunicable Diseases, Division of Country Health Programmes, WHO Regional Office for Europe, Moscow, Russian Federation

[3]Centre for Evaluation of Public Health Measures, Norwegian Institute of Health, Oslo, Norway

[4]Department of Nutrition and Epidemiology, National Institute of Pharmacy and Nutrition, Budapest, Hungary

[5]Department of Health and Inequality, Division of Mental and Physical Health, Norwegian Institute of Public Health, Oslo, Norway

[6]Department Food and Nutrition, National Centre of Public Health and Analyses, Sofia, Bulgaria

[7]Department of Cardiology, Institute of Mother and Child, Warsaw, Poland

[8]Health Authority, Ministry of Health, San Marino, San Marino

[9]Health Promotion and Inequality, Danish Health Authority, Copenhagen, Denmark

[10]Nutrition and Food Safety Sector, Institute of Public Health, Tirana, Albania

[11]College of Health and Agricultural Sciences, University College Dublin, Dublin, Ireland

[12]National Institute of Public Health, University of Southern Denmark, Odense, Denmark

[13]Center for Health Ecology, Institute of Public Health, Podgorica, Montenegro

[14]Obesity Management Centre, Institute of Endocrinology, Prague, Czech Republic

[15]Croatian Institute of Public Health, Zagreb, Croatia

[16]School of Medicine, University of Zagreb, Zagreb, Croatia

[17]National Centre for Disease Prevention and Health Promotion, Italian National Institute of Health (Istituto Superiore di Sanità), Rome, Italy

[18]Department of Nutrition Research, National Institute for Health Development, Tallinn, Estonia

[19]Biomedical Sciences Department, Faculty of Sport and Physical Education, University of Novi Sad, Novi Sad, Serbia

[20]Department of Preventive Medicine, Lithuanian University of Health Sciences, Kaunas, Lithuania

Abbreviations: CI, confidence interval; COSI, WHO European Childhood Obesity Surveillance Initiative; HICs, high-income countries; LMICs, lower-middle-income countries; OR, odds ratio; SES, socioeconomic status; UMICs, upper-middle-income countries; WHO, World Health Organization.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.
© 2021 The World Health Organization. *Obesity Reviews* published by John Wiley & Sons Ltd on behalf of World Obesity Federation.

[21]WHO/Europe Collaborating Center for Nutrition and Childhood Obesity - Food and Nutrition Department, National Institute of Health Dr. Ricardo Jorge, Lisbon, Portugal

[22]Department of Social and Policy Sciences, University of Bath, Bath, UK

[23]Faculty of Medicine, University of Banja Luka, Banja Luka, Bosnia and Herzegovina

[24]Public Health Institute of Republic of Srpska, Banja Luka, Bosnia and Herzegovina

[25]Primary Child Health Unit, Primary Health Care, Floriana, Malta

[26]Maternal, Child and Reproductive Health, National Center for Disease Control and Public Health of Georgia, Tbilisi, Georgia

[27]Institute of Public Health, Skopje, North Macedonia

[28]Faculty of Medicine, SS. Cyril and Methodius University, Skopje, North Macedonia

[29]Scientific Research Institute of Maternal and Child Health, Ashgabat, Turkmenistan

[30]Department of Pediatrics, Paracelsus Medical University, Salzburg, Austria

Correspondence
Anne-Siri Fismen, Department of Health Promotion and Centre for Evaluation of Public Health Measures, Norwegian Institute of Public Health, Bergen, Norway.
Email: asfi@fhi.no

Summary

Background: Socioeconomic differences in children's food habits are a key public health concern. In order to inform policy makers, cross-country surveillance studies of dietary patterns across socioeconomic groups are required. The purpose of this study was to examine associations between socioeconomic status (SES) and children's food habits.

Methods: The study was based on nationally representative data from children aged 6–9 years (n = 129,164) in 23 countries in the World Health Organization (WHO) European Region. Multivariate multilevel analyses were used to explore associations between children's food habits (consumption of fruit, vegetables, and sugar-containing soft drinks) and parental education, perceived family wealth and parental employment status.

Results: Overall, the present study suggests that unhealthy food habits are associated with lower SES, particularly as assessed by parental education and family perceived wealth, but not parental employment status. We found cross-national and regional variation in associations between SES and food habits and differences in the extent to which the respective indicators of SES were related to children's diet.

Conclusion: Socioeconomic differences in children's food habits exist in the majority of European and Asian countries examined in this study. The results are of relevance when addressing strategies, policy actions, and interventions targeting social inequalities in children's diets.

KEYWORDS
children, food habits, social inequalities, socioeconomic differences

1 | INTRODUCTION

Socioeconomic inequalities in dietary behavior are widespread.[1,2] Diet and nutritional factors are among the main determinants of overweight/obesity and noncommunicable diseases,[3] all of which follow a socioeconomic gradient.[4] Childhood overweight has been on the political agenda in recent decades; in many countries, great effort has been devoted to initiatives aiming to reduce obesity-related inequalities in the younger population.[1,5,6] Although the relevance of monitoring children's food habits is embodied in international strategies,[1,5,6] studies reporting comparative surveillance data among primary school children are scarce. Such studies are of particular interest in the context of widening inequality between social groups[2,7,8] and broadening socioeconomic differences in overweight and obesity among children and adolescents.[9]

Socioeconomic characteristics such as education, income, and occupation are considered major determinants of differences in health outcomes.[10] In epidemiological research, one or more of these

characteristics may be described using the general term "socioeconomic status" (SES). Generally speaking, positive associations between SES and diet are reported in Europe, with fewer healthy food habits identified in lower versus higher SES groups.[11,12] However, given wide economic disparities and the great variation in access to education worldwide, there is reason to believe that the influence of SES varies among countries as a function of differing degrees of socioeconomic development and equity.[13] This is a key consideration when seeking to understand pathways of absolute versus relative dietary inequalities and when exploring the complex mechanisms behind them. While one dimension of the SES construct may play an important role for children in one country, another dimension may be of particular importance for children living in another part of the world. Further, pathways of dietary inequalities may be differently related to different types of food habits, a perspective suggested in previous research.[14,15] The relationship between SES and diet is more complex than it first appears, and this complexity must be taken into account when interrogating large international datasets.

Examining dietary inequalities in a cross-national context can provide useful information to policy makers and others aiming to reduce dietary disparities and health inequalities through universal and targeted policy actions. However, cross-national comparison is often challenged by a lack of comparable data, the use of different SES indicators, and other methodological issues. In order to increase knowledge about differences in children's food habits and their associations with SES, coordinated data collection and international collaboration are needed.

The World Health Organization (WHO) European Childhood Obesity Surveillance Initiative (COSI)[16] uses standardized procedures to collect data from nationally representative samples of children, thus providing an opportunity to make cross-national comparisons of children's food habits and their associations with SES. Based on COSI data from the fourth round of data collection in 2015–2017, the present study aims to explore associations between selected food habits and parental education, perceived wealth, and occupational status among children aged 6–9 years from 23 European and Asian countries. More specifically, the study examines the relationship between SES indicators and intake of fruit, vegetables, and sugar-containing soft drinks.

2 | METHODS

In 2015–2017, the fourth round of COSI data collection took place in 36 countries belonging to the WHO European region. Of these countries, 23 collected information on food habits of children and on family socioeconomic characteristics via the optional COSI family record form administered to parents/caregivers and were included in this analysis (viz., Albania, Bulgaria, Croatia, Czechia, Denmark, Georgia, Ireland, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Malta, Montenegro, Poland, Portugal, Romania, Russian Federation (Moscow city), San Marino, Spain, Tajikistan, Turkey, and Turkmenistan). The study was carried out following a common protocol.[17] According to this protocol, countries could choose to target one or more of the following age groups: 6.0–6.9, 7.0–7.9, 8.0–8.9, or 9.0–9.9 years. Most of the countries considered 7-year-olds as the only targeted age group, and some countries had extra age groups in addition to the 7-year-olds. Nationally representative samples of children were drawn in all countries except for the Russian Federation, where data collection was carried out only in the city of Moscow. In Malta and San Marino, all children in the relevant age group were invited to participate in the study. The children were enrolled in the study through the school system (i.e., primary schools) in all countries except Czechia where the setting of enrolment was the pediatric clinics. A detailed description of COSI study characteristics, including its implementation in 2015–2017, is provided elsewhere.[18,19]

2.1 | Food habits included in the analysis

COSI collected information on children's eating-related behaviors via a family record form filled out by parents or a caregiver.[16] Among these, this paper focuses on the consumption frequency of fresh fruit, vegetables, and sugar-containing soft drinks, which are of particular interest for WHO due to the epidemiological evidence of their associations with health[20–22] and the link to social health inequalities.[23] Parents were asked: "over a typical or usual week, how often does your child eat or drink the following kinds of foods or beverages?" This was followed by a tick box, where parents answered "never," "less than once a week," "some days (1–3 days)," "most days (4–6 days)," or "every day." More details on the methodology for collection of these data are provided elsewhere.[24]

In relation to each food habit included in the paper, the following were classified as "less healthy" behaviors: (i) not eating fresh fruit every day (i.e., "never," "less than once a week," "some days (1–3 days)," or "most days (4–6 days)"); (ii) not eating vegetables every day (i.e., "never," "less than once a week," "some days (1–3 days)," or "most days (4–6 days)"); (iii) consuming sugar-containing soft drinks more than 3 days a week (i.e., "most days (4–6 days)" or "every day").

2.2 | Family SES

Family SES was assessed using three variables: parental education, family perceived wealth, and parental employment. The COSI family form included an item on the education and employment of the responding caregiver and his/her partner/spouse. Therefore, the information about parental education and employment was available only if the form was completed by the mother or the father. In Bulgaria, Czechia, Italy, Malta, San Marino, Spain, and Turkey, data on education level and employment status specifically of the parents was gathered, regardless of which caregiver completed the self-completion questionnaire. Because the family composition was not gathered in COSI round 4, it was not possible

to identify children living in a single-parent family, nor to properly classify the educational attainment and the employment status of their parent. These children were thus excluded from the analysis that focused on children living in a traditional two-parent family structure.

Parents who reported their educational attainment as "primary school or less," "secondary or high school," and "vocational school" were described as having "lower education." Parents who reported their educational attainment as "undergraduate or bachelor degree" and "master degree or higher" were described as having "higher education." Three categories of parental education were then created: (1) low parental education (both parents with lower education); (2) medium parental education (one parent with lower education, one parent with higher education); (3) high parental education (both parents with higher education).

Family perceived wealth was defined using three categories: (1) low family perceived wealth (those who had trouble meeting the end of the month with their own earnings); (2) medium family perceived wealth (those who met the end of the month with their own earnings without serious problems); (3) high family perceived wealth (those who easily met the end of the month with their own earnings).

For parental employment status, two categories were created: (1) low parental employment (one or more parent(s) unemployed or inactive); (2) high parental employment (both parents employed). More details on how data on family SES variables were gathered are provided elsewhere.[25]

The information on family perceived wealth was not gathered in Ireland and Malta, and data on parental employment were not collected in Italy, San Marino, or Turkmenistan. Due to the high level of missing data on parental educational attainment and employment, these variables were not included in the analysis of the data from the Russian Federation (Moscow only).

For the purpose of this paper, the following inclusion criteria were applied: (i) children aged between 6 and 9 years with information about sex available; (ii) children with available information on at least one of the food habits included in the analysis; (iii) children with available information on education or employment status of both parents.

To facilitate comparison of results, countries were grouped into five macro-regions according to United Nations "Standard Country or Area Codes for Statistical Use"[26]; Northern Europe (Denmark, Ireland, Lithuania, Latvia), Eastern Europe (Bulgaria, Czechia, Poland, Romania, Russian Federation), Southern Europe (Albania, Croatia, Italy, Malta, Montenegro, Portugal, San Marino, Spain), Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan), and Western Asia (Georgia, Turkey). The World Bank classification of countries by income was also used to report and discuss results. Countries were classified considering the year of the data collection in the following groups: high-income countries (HICs)—Croatia, Czechia, Denmark, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, San Marino and Spain; upper middle-income countries (UMICs)—Albania, Bulgaria, Kazakhstan, Montenegro, Romania, Russian Federation, Turkmenistan and Turkey; and lower middle-income countries (LMICs)—Kyrgyzstan, Georgia and Tajikistan.[27]

2.3 | Data analysis

The prevalence values of each food-related "less healthy" behavior stratified by SES variables were estimated at country level and by pooling data. Differences across SES categories were tested using Pearson's χ^2 test corrected using the Rao–Scott method to take account of the survey design.

A multivariate multilevel logistic regression analysis was carried out to estimate the odds ratios (ORs) and their 95% confidence intervals (CI) of having a "less healthy" dietary habit (reference category: "healthy dietary habit") for parental education (reference category: high parental education), family perceived wealth (reference category: high perceived wealth), and parental education (reference category: high employment). The ORs were estimated adjusting for the child's sex and age, the degree of urbanization of the child's residence or school, and the region/administrative division of the family's place of residence. A country-specific model and a pooled model were estimated for each eating habit. All models included random effects for primary schools attended by children to consider the clustered structure of the data. For Czechia's models, pediatric clinics where children were enrolled were used instead of primary schools. The pooled regression models were estimated including the country where data were gathered as a covariate. In the multivariable regression analysis, children with a missing value for the dependent variable or any of the covariates were excluded.

Due to the heterogeneity in number and type of age group(s) targeted by each country, the pooled analysis included only one target age group per country in order to balance the contribution of each country to the pooled estimates and to limit as much as possible the differences in children's ages. For the pooled analysis, 7-year-olds were selected if they were targeted by COSI, otherwise the nearest target age group was chosen. Data from Ireland, Italy, Malta, Russian Federation, San Marino, and Turkmenistan were not included in pooled analyses because information on one or more food habits or SES variables was unavailable.

Sampling weights to adjust for the sampling design, oversampling, and nonresponse at the child level were used in all analyses. For Lithuania, an unweighted analysis was carried out because sampling weights were not available. All analyses took account of the cluster sample design. In the pooled analysis, an adjusting factor was applied to the sampling weights to consider the differences in the population size of the countries involved. The adjusting factor was calculated based on the number of children belonging to the targeted age group according to Eurostat figures or national official statistics for 2016. A p value of 0.05 was used to define statistical significance. All statistical analyses were performed in the statistical software package Stata version 15.1 (StataCorp LLC, College Station, TX, USA).

3 | RESULTS

3.1 | Children's characteristics

A total of 119,083 children were included in the analysis, 89.9% of all children aged 6–9 years with a completed COSI family record form. The number of included children varied widely between country, from less than 1000 in Denmark, Ireland, and San Marino to more than 9000 in Italy, Spain, and Turkey (Table S1). These variations were due to differences in study design characteristics and in the proportion of children whose parents completed the family forms (Table S1). The subgroup of children without any missing values for the variables used for the multivariate regression analyses numbered in total 112,841. More details are provided in Table S1. In pooled analysis, we included just one targeted age group for each country with complete information on all investigated food habits for a total of 42,063 children.

TABLE 1 Percentage of boys, children's age (mean and SD), parental education level, parental employment status and family perceived wealth (i.e., how the family met the end of the month with earnings at its disposal) by country: COSI/WHO Europe round 4 (2015–17)

			Parental education (%)			Parental employment (%)		Family perceived wealth (%)		
	Boys (%)	Age in years mean (SD)	Low	Medium	High	Low	High	Low	Medium	High
Northern Europe										
DEN	52.2	7.2 (0.5)	33.9	31.6	34.5	15.3	84.7	6.9	35.6	57.5
IRE	52.2	7.1 (0.4)	28.6	28.2	43.3	35.9	64.1	n.a.	n.a.	n.a.
LTU	50.9	7.8 (2.1)	36.2	29.9	34.0	22.3	77.7	18.8	46.7	34.5
LVA	48.4	8.3 (2.9)	32.4	31.7	35.8	22.4	77.6	18.8	60.6	20.6
Eastern Europe										
BUL	51.5	7.6 (0.3)	56.8	21.0	22.3	29.7	70.3	30.6	52.2	17.2
CZH	51.1	7.0 (0.1)	64.1	21.3	14.6	24.4	75.6	12.6	51.0	36.4
POL	49.7	8.4 (0.2)	33.3	26.4	40.3	25.6	74.4	13.6	60.3	26.2
ROM	49.3	8.5 (0.6)	58.7	14.5	26.8	37.1	62.9	23.6	46.0	30.4
RUS	49.8	7.4 (0.5)	n.a.	n.a.	n.a.	n.a.	n.a.	9.8	40.1	50.1
Southern Europe										
ALB	52.6	8.5 (1.4)	69.4	11.0	19.6	42.9	57.1	28.6	29.1	42.3
CRO	51.2	8.5 (0.5)	60.5	22.4	17.1	28.5	71.5	20.1	50.6	29.3
ITA	51.6	8.8 (0.7)	69.8	18.3	12.0	n.a.	n.a.	48.9	41.1	10.0
MAT	50.0	7.8 (2.0)	58.4	22.8	18.8	37.0	63.0	n.a.	n.a.	n.a.
MNE	52.8	7.4 (1.9)	62.8	22.1	15.1	42.0	58.0	26.1	48.0	25.9
POR	50.8	7.5 (0.9)	65.7	19.8	14.6	26.5	73.5	29.8	44.1	26.1
SMR	45.6	8.8 (1.8)	61.7	25.1	13.2	n.a.	n.a.	34.8	52.7	12.5
SPA	50.8	8.0 (0.6)	44.5	27.9	27.7	41.5	58.5	16.5	37.8	45.7
Central Asia										
KAZ	50.1	9.0 (0.3)	46.6	25.2	28.2	45.6	54.4	33.2	30.3	36.4
KGZ	50.8	7.9 (0.8)	60.6	20.0	19.4	67.4	32.6	44.2	20.4	35.4
TJK	51.8	7.4 (0.3)	73.1	21.3	5.5	74.5	25.5	45.2	22.4	32.4
TKM	50.2	7.7 (0.4)	83.4	12.8	3.7	n.a.	n.a.	7.4	32.3	60.3
Western Asia										
GEO	51.0	7.6 (0.6)	58.6	15.3	26.1	40.4	59.6	25.1	38.3	36.6
TUR	50.9	7.5 (0.3)	76.8	12.9	10.3	84.3	15.7	40.9	33.5	25.6
Pooled estimates[a]	51.4	7.8 (0.7)	60.0	19.7	20.3	55.8	44.2	29.5	38.5	32.0

Abbreviations: n.a., not available; SD, standard deviation.

Country abbreviations: Albania (ALB); Bulgaria (BUL); Croatia (CRO); Czechia (CZH); Denmark (DEN); Georgia (GEO); Ireland (IRL); Italy (ITA); Kazakhstan (KAZ); Kyrgyzstan (KGZ); Latvia (LVA); Lithuania (LTU); Malta (MAT); Montenegro (MNE); Poland (POL); Portugal (POR); Romania (ROM); Russian Federation-Moscow city (RUS); San Marino (SMR); Spain (SPA); Tajikistan (TJK); Turkey (TUR); Turkmenistan (TKM).

[a]Pooled values were estimated including the following age groups/countries: 7-year-olds from Bulgaria, Czechia, Denmark, Kyrgyzstan, Georgia, Latvia, Lithuania, Montenegro, Portugal, Spain, Tajikistan and Turkey; 8-year-olds from Albania, Croatia, Poland and Romania; and 9-year-olds from Kazakhstan.

Table 1 summarizes some characteristics of the children studied in the 23 countries. The mean age ranged from 7.0 years in Czechia to 9.0 years in Kazakhstan. In almost all countries from Eastern and Southern Europe and from Central and Western Asia, most parents had a low level of education. The percentage of children with low parental employment ranged from 15.3% to 84.3%, mirroring differences among countries in terms of both the unemployment rate and the proportion of parents who were not part of the labor force—meaning they were neither unemployed or employed—such as stay-at-home parents. The percentage of children living in families with low perceived wealth varied between 6.9% and 48.9%.

3.2 | Not eating fresh fruit every day

The percentage of children who did not eat fresh fruit every day varied widely between the countries, ranging from 19% to 82%.[24]

The pooled analysis showed that the proportion of children with this "less healthy" behavior was higher among children with lower parental education and lower family perceived wealth compared with those with higher parental education and family perceived wealth—63.9% versus 54.5% and 68.4% versus 55.8%, respectively (Table S2). This result was confirmed by the multivariate analysis. As shown in Figure 1, children whose parents had lower education status were less likely to eat fresh fruit every day than those with higher parental education—the adjusted OR for not consuming fresh fruit every day was equal to 1.48 (95% CI: 1.29–1.70) in the pooled analysis (comparing low vs. high parental education). Similarly, children from families with lower perceived wealth were less likely to have fresh fruit daily than those with a higher level of perceived wealth—the OR for not consuming fresh fruit every day was 1.83 (95% CI: 1.64–2.04) in the pooled analysis (comparing low vs. high perceived wealth). This association for both these variables was found in almost all countries, with values of the ORs equal to or over 2.00 in five countries (for parental education: Ireland, Portugal, San Marino, Spain, Turkmenistan; for family perceived wealth: Czechia, Kazakhstan, Kyrgyzstan, Montenegro, Romania). The data showed a different picture for parental employment, which was less frequently and less strongly associated with the "less healthy" eating habit of not consuming fresh fruit daily than the other two SES variables. Moreover, in all countries where an association was found (except in Denmark), a reverse direction emerged: children with lower parental employment were less likely to not eat fresh fruit every day, compared with children with higher parental employment. As regards parental education and family perceived wealth, the data showed similar patterns for countries belonging to the same macro-region, even in those macro-regions where there are both HICs and UMICs (such as Eastern and Southern Europe). Moreover, no evident differences emerged between macro-regions with the exception of countries from Central and Western Asia, which are classified as LMICs and UMICs, where there was no association or a weaker association with parental education. More details on the results of the multivariate regression analysis are provided in Table S3.

3.3 | Not eating vegetables every day

The habit of not consuming vegetables every day was differently spread among countries, with the percentage of children having this "less healthy" behavior ranging from 26% to 91%.[24]

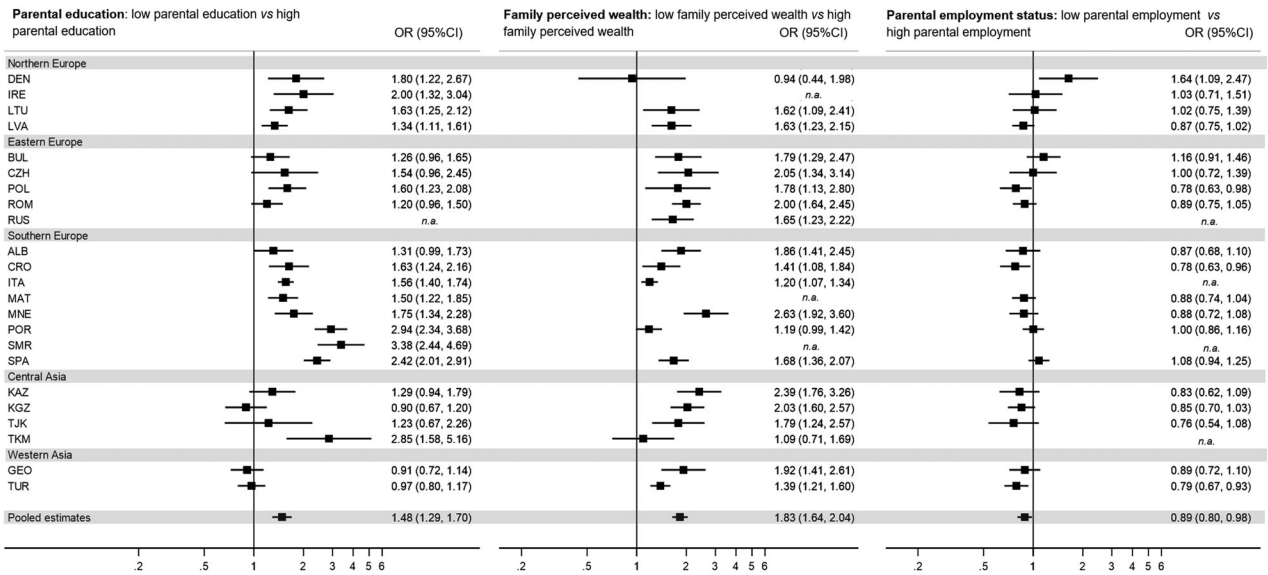

FIGURE 1 Country-specific and pooled adjusted odds ratios (ORs) of not consuming fresh fruit every day (compared with consuming fresh fruit every day) related to parental education, family perceived wealth and parental employment status. COSI/WHO Europe round 4 (2015–2017). For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'. Pooled values were estimated including the following age groups/countries: 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Latvia, Lithuania, Montenegro, Portugal, Spain, Tajikistan and Turkey; 8-year-olds from Albania, Croatia, Poland and Romania; and 9-year-olds from Kazakhstan.

As already seen for the consumption of fresh fruit, the "less heathy" habit regarding vegetable consumption was more prevalent among children whose parents had a low education compared with children whose parents had a high education—the pooled value was 78.8% versus 73.2%—and among children from families with low perceived wealth compared with children from families with high perceived wealth—the pooled value was 78.9% versus 74.0% (Table S3).

Figure 2 shows the adjusted ORs for not consuming vegetables daily for low parental education (compared with high), low family perceived wealth (compared with high) and low parental employment (compared with high). If the parents had low education, the children were significantly more likely to not eat vegetables every day in 19 out of 23 countries (pooled estimate OR 1.36, 95% CI: 1.18–1.57). A similar pattern was found for children from families with low perceived wealth (pooled estimate OR 1.37, 95% CI: 1.20–1.57). In most of the countries, there was a weak association or no association at all between not consuming vegetables every day and parental employment. The strongest association with parental employment was estimated in Latvia, where children with low parental employment were less likely to have a "less healthy" habit than those with high parental employment (OR 0.79, 95% CI: 0.66–0.95). Kyrgyzstan was the only country showing a reverse direction of the association (OR 1.16, 95% CI: 1.00–1.34). Looking at the macro-regions, a certain level of homogeneity emerged both within and between macro-regions of Europe for all SES indicators, with countries of different levels of economic development having similar patterns. More details on the results of the multivariate regression analysis are provided in Table S3.

3.4 | Consuming sugar-containing soft drinks more than 3 days a week

The proportion of children consuming sugar-containing soft drinks more than 3 days a week varied between 1% and 45%.[24]

In most countries, the prevalence this "less healthy" behavior was higher among children with low parental education and low family perceived wealth, whereas differences by parental employment status were limited.

Figure 3 shows that in all countries except Kazakhstan, Kyrgyzstan, and Tajikistan, children whose parents had lower education were more likely to consume sugar-containing soft drinks more than 3 days a week, with country-specific OR estimates ranging from 1.27 (95% CI: 0.87–1.85) in Poland to 4.39 (95% CI: 1.88–10.24) in Denmark. The OR estimate from the pooled analysis was 1.47 (95% CI: 1.24–1.74) when comparing lower versus higher educational level. When looking at family perceived wealth, the situation was more heterogeneous. In five countries (Croatia, Latvia, Romania, Tajikistan, and Turkmenistan), the odds of having a "less healthy" behavior did not differ when comparing children with low and high family perceived wealth. In another five countries (Georgia, Kazakhstan, Kyrgyzstan, Russian Federation [Moscow only], and Turkey), children from families with low perceived family wealth were (or tended to be) less likely than children with high perceived family wealth, to consume sugar-containing soft drinks more than 3 days a week, whereas it was the other way around in the remaining nine countries (Albania, Bulgaria, Czechia, Denmark, Lithuania, Montenegro, Poland, Portugal, and Spain) with available data. The OR estimate

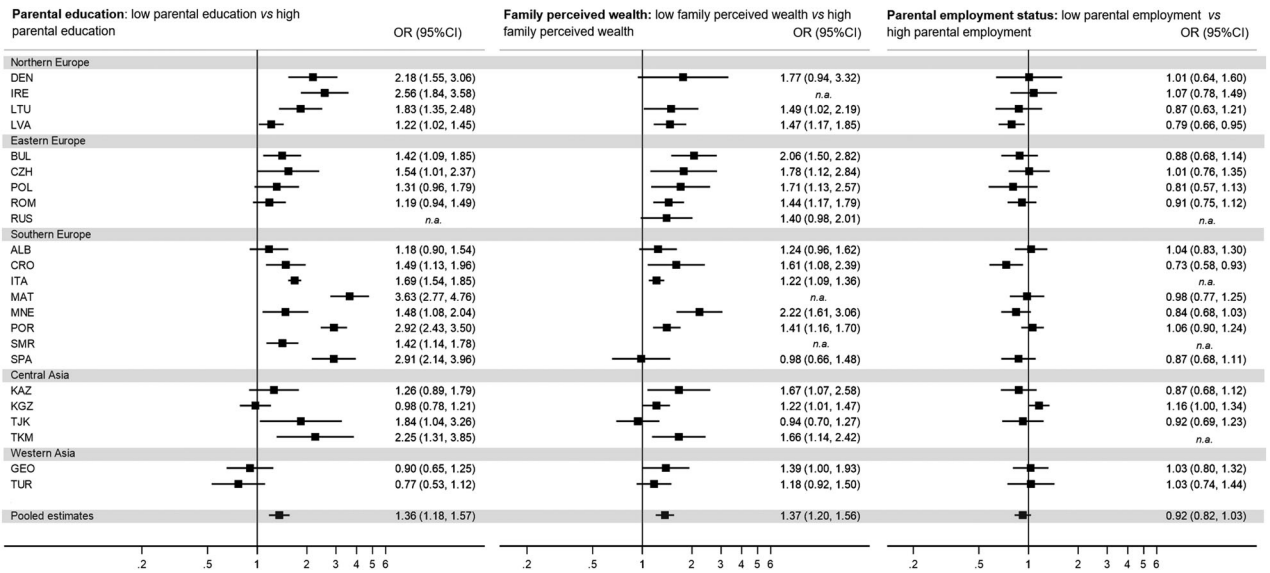

FIGURE 2 Country-specific and pooled adjusted odds ratios (ORs) of not consuming vegetables every day (compared with consuming vegetables every day) related to parental education, family perceived wealth and parental employment status. COSI/WHO Europe round 4 (2015–2017). For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'. Pooled values were estimated including the following age groups/countries: 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Latvia, Lithuania, Montenegro, Portugal, Spain, Tajikistan and Turkey; 8-year-olds from Albania, Croatia, Poland and Romania; and 9-year-olds from Kazakhstan

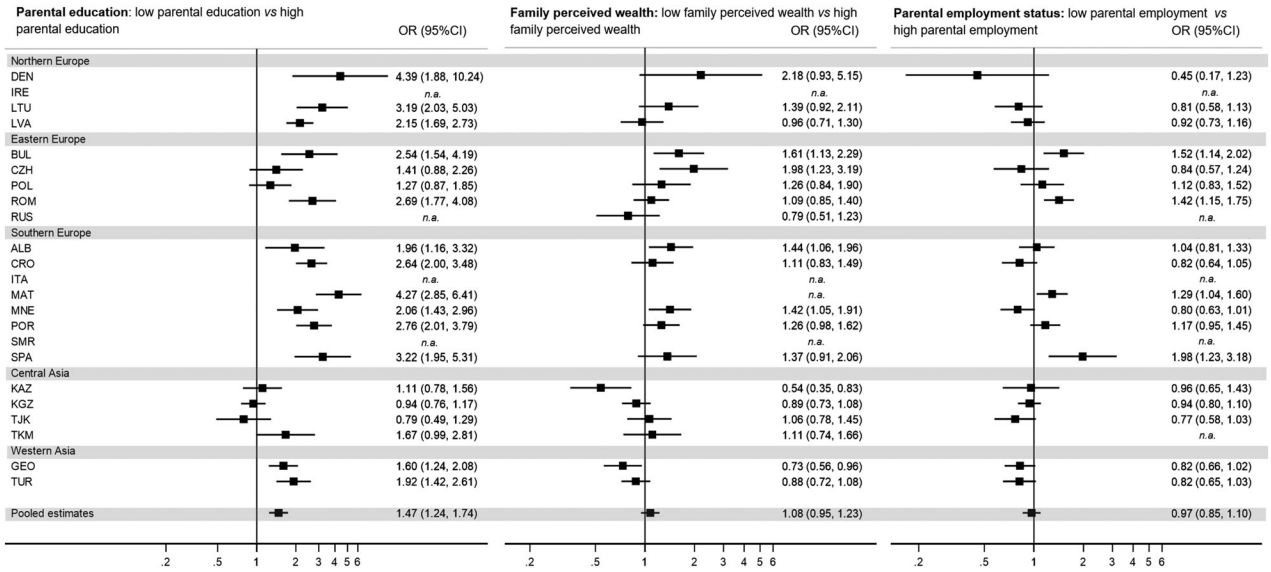

FIGURE 3 Country-specific and pooled adjusted odds ratios (ORs) of consuming sugar-containing soft drinks on more than 3 days a week (compared with having a less frequent consumption) related to parental education, family perceived wealth and parental employment status, COSI/WHO Europe round 4 (2015–2017). For an explanation of the country abbreviations, see Table 1. Abbreviation 'n.a.' means 'not available'. Pooled values were estimated including the following age groups/countries: 7-year-olds from Bulgaria, Czechia, Denmark, Georgia, Kyrgyzstan, Latvia, Lithuania, Montenegro, Portugal, Spain, Tajikistan and Turkey; 8-year-olds from Albania, Croatia, Poland and Romania; and 9-year-olds from Kazakhstan

from the pooled analysis was 1.08 (95% CI: 0.95–1.23). A similar pattern emerged for parental employment (pooled OR estimate: 0.97, 95% CI: 0.85–1.10). Finally, as for parental education, the association showed similar patterns among countries within and between macro-regions, with the exception of Western Asia where three out of the four countries tended to record no association or a reversed association. If we look only at the level of economic development, no clear patterns were observed with European UMICs that showed associations more similar to European HICs than to UMICs or LMICs from Asia. More details on the results of the multivariate regression analysis are provided in Table S4.

4 | DISCUSSION

The present findings show substantial inequalities in selected children's food habits related to SES in most of the countries examined in this study. The findings are thus in line with previous systematic reviews on children[28,29] and adolescents.[30] However, our results yield a complex picture, including considerable cross-national and regional variation in the associations between SES and food habits and substantial differences in the extent to which the respective SES indicators were related to children's diet.

Overall, the present study suggests that "less healthy" food habits are associated with lower SES as assessed by lower parental education and lower family perceived wealth but not by lower parental employment status.

4.1 | Differences among countries in socioeconomic disparities in children's food habits

A consistent pattern of socioeconomic differences was demonstrated in all European regions, with significant associations between less healthy food habits and parental education and family perceived wealth in the majority of countries. In these regions, no evident differences between HICs and UMICs emerged. In terms of variation between regions, the influence of family educational and financial resources (or lack thereof) might be mediated via national and regional contextual conditions.[31,32] To this concern, attention should be devoted to trend studies reporting country-specific patterns in how prevalence and social inequalities in children's overweight develop.[33,34] The findings of educational and financial disparities in countries from Northern Europe might be surprising as at least some of them are traditionally associated with egalitarian welfare policies[35] and with a particular focus on interventions aiming to reduce social inequalities.[36] However, other studies also report that relative socioeconomic differences in Northern European countries are at the same level or even greater than in other European countries.[37]

The present results should be viewed in light of the limited number of food habits included. The findings of SES differences in consumption of fruit, vegetables, and sugar-containing soft drinks are in line with previous studies[28,29] and were therefore expected. However, it should be noted that associations with SES may appear differently for other food items, as suggested in an international study of

socioeconomic differences in sweets consumption,[38] in which lower sweets intake was demonstrated in lower, compared with higher, SES groups.

In countries from Central and Western Asia, which are classified as LMICs and UMICs, SES differences appeared less systematically than in European countries, mainly belonging to the high-income category, particularly with regard to parental education. The results might potentially be different if SES were measured by relative educational level within countries. In the current study population, the proportion of children with two highly educated parents was 10% or lower in three out of six countries from Central and Western Asia (Tajikistan, Turkey, and Turkmenistan), whereas the proportion was 20% in pooled estimates. Less variation between European macro-regions and those of the Central and Western Asia was seen with regard to perceived wealth. Food habits may also be influenced by a number of other factors, such as ethnicity and grade of urbanization. A systematic review of low- and middle-income countries reported that dietary disparities were more consistently associated with the level of urbanization than with education and income.[39] Another study suggests that SES differences in food habits are moderated by ethnicity.[40] It is worthwhile to explore relative differences as well as the interplay between social and socioeconomic determinants in future studies of social inequality in children's food habits.

4.2 | Differences across SES indicators

In many countries, education is a determinant of family wealth, which is reflected in studies reporting education and income to be closely related indicators of SES.[41] However, although closely related, education and income are not interchangeable indicators[14] and may effect children's food habits through different pathways. While education is linked to parent's ability to put health and nutritional information into action,[42] financial resources influence parents' freedom of choice concerning food habits,[43] in particular the accessibility of fruit and vegetables.[30] The impact of socioeconomic variables on nutrition and obesity may be mediated in part by the low cost of energy-dense foods. Taste and convenience of added sugars and added fats can also lead to consumption of prepared and prepacked foods, and attempting to reduce dietary costs may paradoxically lead to the selection of energy-dense foods, increased energy intakes, and overweight.[44] Furthermore, parents who have to worry about having enough money to feed their children may be more likely to choose foods they know their children will accept, rather than "waste" money on unfamiliar or less highly palatable foods that children might reject.[45,46]

In the current study, low parental educational level was significantly associated with low consumption of fruit and vegetables and high consumption of sugar-containing soft drinks. Low perceived family wealth was consistently associated with low fruit and vegetable consumption but not with high soft drink consumption, which might indicate that financial considerations are not significant determinants of soft drink consumption among children. Exceptions were children in Kazakhstan and Georgia, in which lower likelihood of frequent soft drink consumption was associated with lower perceived family wealth. The findings may indicate that soft drinks are more expensive relative to income in these countries. This underscores the importance of exploring the pathways of different socioeconomic dimensions in light of relevant contexts and underlines the need for comparative studies when aiming to understand the nature of educational and financial socioeconomic determinants. It should be noted however that perceived wealth is a subjective indicator of the family's economic situation, and we do not know if applying objective measurements, such as total family income, would have produced different results. In the majority of the countries examined, parental employment status was not significantly associated with children's food habits. This finding might be related to lack of time for food preparation in families with employed parents, particularly those working full time, which may result in greater use of convenient food,[47,48] thus canceling out potential beneficial SES effects that could originally be expected from families where both parents work.

The present study underlines the need for further surveillance studies of children's food habits and their associations with SES. National and international strategies and policy actions addressing children's food habits should be reviewed from a comparative perspective to explain intercountry differences in trends and prevalence of dietary inequalities. Our findings suggest that, overall, variation in educational and economic resources are important determinants of children's food habits, and initiatives aiming to reduce social inequalities should address mechanisms behind such differences. However, policy makers should be aware that interventions addressing healthy food habits through increased knowledge may have greater benefit for children in high SES groups and could subsequently increase social inequalities in eating habits. A systematic review[49] reported that whereas individual-based initiatives like information and dietary counseling increased inequalities, a combination of taxes and subsidies preferentially improved healthy eating outcomes for people of lower SES, which could potentially reduce socioeconomic inequalities. Recognition of the specific pathways is important when aiming to develop effective interventions and initiatives targeting children's food habits, and policy actions aimed at improving population health should be routinely evaluated for differential socioeconomic impact. Our findings underline the need to address both the generic perspective, in terms of improved food habits in the younger population as a whole, as well as particularly targeting children living in families characterized by low SES.

4.3 | Strengths and limitations

An important strength of the current study is the large dataset based on nationally representative sampling for recruitment of children and their families, as well as standardization of instrumentation and measurement of children from WHO European region countries. Thus, the present results can be used to generate and compare national prevalence levels of selected children's food habits and their association with three indicators of family SES. However, the study also has some

limitations. Cross-national variation in the number of included children, as well as in family participation rates, may have resulted in selection bias. Some of the country-specific results had wide CIs, particularly when analyzing the association between parental education and consumption of sugar-containing soft drinks. This observation most likely reflects sample size limitations related to the low prevalence of children consuming sugar-containing soft drinks more than 3 days a week. As we did not have information concerning family structures, for example, single-parent families, only children with available information on both parents' SES were included in the study. The exclusion of different kind of families, such as caregivers who were related to children in different ways or single-parent families, is a limitation of the study. Single-parent families are generally more likely to be characterized with low SES,[50] and the relationship between family structure and young people's food habits may be mediated by SES.[38] Hence, the presented associations might be underestimated. However, loss of nuance is unfortunately unavoidable when comparing data at the population level. The use of standardized SES measurements and instrumentations challenge the study's validity, as there are most likely cross-national variations in the relative importance of the various SES indicators for children's food habits. Cross-country comparison of socioeconomic differences in food habits should therefore be conducted with caution.

One limitation of this study is that it does not provide information on portions of foods consumed per day. Rather, it provides information on the frequency of consuming various foods. Future work is needed to validate the dietary indicators in the COSI study and to identify possible ways to improve the questions so that responses can be measured against WHO recommendations. Further, children's food habits were assessed by parents' report. This may challenge the study's validity, as parents may not be aware of the child's food intake outside the family context (e.g., school meals). However, this consideration would most likely not affect SES groups differently. Finally, all included data were self-reported and may therefore be subject to reporting bias if parents felt pressure to report the more socially desirable outcome. This may be particularly relevant in terms of family perceived wealth, as financial hardship is often stigmatized.

5 | CONCLUSIONS

This paper provides valuable new insights into socioeconomic differences in children's food habits by comparing a large set of cross-national data. The present results can serve as a benchmark to evaluate national and international initiatives addressing social inequalities in children's diets. Furthermore, they illuminate areas amenable to further intervention in specific countries. Overall, our findings report that relative SES differences in children's food habits exist in the majority of European and some Asian countries studied. Continued surveillance is vital to monitor projected increases in socioeconomic inequalities and the impact this is likely to have on children's healthier and less healthy eating habits.

ACKNOWLEDGMENTS

We gratefully acknowledge all participating children, their parents, and school 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.

CONFLICT OF INTEREST

The authors declare no conflict of interest. The funders played no role in the design of the COSI protocol, the decision to write this paper or its content.

DISCLAIMER

JB, IR, and JW are staff members of WHO, and MB is a consultant with WHO. 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. The European Commission is not liable for any use that may be made of the information it contains.

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 from Albania: WHO 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, WHO Regional Office for Europe; Croatia: Ministry of Health, Croatian Institute of Public Health and WHO Regional Office for Europe; Czechia: Ministry of Health of the Czech Republic, grant nr. AZV MZČR 17-31670 A and MZČ–VO EÚ 00023761; Denmark: Danish Ministry of Health; Georgia: WHO; Ireland: Health Service Executive; Italy: Ministry of Health and Italian National Institute of Health; Kazakhstan: Ministry of Health of the Republic of Kazakhstan and WHO Country Office; Kyrgyzstan: World Health Organization; Latvia: Ministry of Health, Centre for Disease Prevention and Control; Lithuania: Science Foundation of Lithuanian University of Health Sciences and Lithuanian Science Council and WHO; Malta: Ministry of Health; Montenegro: WHO and Institute of Public Health of Montenegro; Norway: Ministry of Health and Norwegian Institute of Public Health; 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 from the Center for Studies and Research on Social Dynamics and Health (CEIDSS); Romania: Ministry of Health; Russian Federation: WHO; San Marino: Health Ministry, Educational Ministry; Serbia: This study was supported by the World Health Organization (Ref. File 2015-540940); Spain: Spanish Agency for Food Safety and Nutrition (AESAN); Tajikistan: WHO Country Office in Tajikistan and Ministry

of Health and Social Protection; Turkmenistan: WHO Country Office in Turkmenistan and Ministry of Health; Turkey: Turkish Ministry of Health and World Bank.

The CO-CREATE project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 774210.

ETHICS STATEMENT

The COSI study follows the International Ethical Guidelines for Biomedical Research Involving Human Subjects. Local ethics approval was also granted.

ORCID

Anne-Siri Fismen https://orcid.org/0000-0001-6711-5767
Marta Buoncristiano https://orcid.org/0000-0002-3978-8435
Arnfinn Helleve https://orcid.org/0000-0003-0650-6531
Sanja Musić Milanović https://orcid.org/0000-0003-4643-1052
Ivo Rakovac https://orcid.org/0000-0002-6815-5274
Angela Spinelli https://orcid.org/0000-0002-4068-3569

REFERENCES

1. WHO. Global Strategy on Diet. *Physical Activity and Health*. Copenhagen: WHO; 2004.
2. Glei DA, Goldman N, Weinstein M. A growing socioeconomic divide: effects of the Great Recession on perceived economic distress in the United States. *PLoS ONE*. 2019;14(4):e0214947.
3. Bauer UE, Briss PA, Goodman RA, Bowman BA. Prevention of chronic disease in the 21st century: elimination of the leading preventable causes of premature death and disability in the USA. *Lancet*. 2014; 384(9937):45-52.
4. Marmot M, Bell R. Social inequalities in health: a proper concern of epidemiology. *Ann Epidemiol*. 2016;26(4):238-240.
5. OECD. *Health for Everyone?: Social Inequalities in Health and Health Systems*. Paris: OECD Health Policy Studies,OECD Publishing; 2019.
6. 2014 Nordic Council of Ministers. Nordic Nutrition Recommendations 2012 Integrating nutrition and physical activity. 2014.
7. OECD. Understanding the socio-economic divide in Europe http://oe.cd/cope-divide-europe-2017; 2017.
8. ADB. Framework of Inclusive Growth Indicators 2013. https://www.adb.org/publications/framework-inclusive-growth-indicators-2013-key-indicators-asia-and-pacific; 2013
9. Chung A, Backholer K, Wong E, Palermo C, Keating C, Peeters A. Trends in child and adolescent obesity prevalence in economically advanced countries according to socioeconomic position: a systematic review. *Obes Rev*. 2016;17(3):276-295.
10. Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. *Soc Sci Med*. 1997;44(6): 757-771.
11. Giskes K, Avendano M, Brug J, Kunst AE. A systematic review of studies on socioeconomic inequalities in dietary intakes associated with weight gain and overweight/obesity conducted among European adults. *Obes Rev*. 2010;11(6):413-429.
12. Inchley J CD, Jewell J, Breda B, Barnekow V. Adolescent obesity and related behaviours: trends and inequalities in the WHO European Region, 2002–2014. Copenhagen, Denmark WHO Regional Office for Europe UN City.
13. Lissner L, Wijnhoven TM, Mehlig K, et al. Socioeconomic inequalities in childhood overweight: heterogeneity across five countries in the WHO European Childhood Obesity Surveillance Initiative (COSI-2008). *Int J Obes (Lond)*. 2016;40(5):796-802. https://doi.org/10.1038/ijo.2016.12
14. Fismen AS, Samdal O, Torsheim T. Family affluence and cultural capital as indicators of social inequalities in adolescent's eating behaviours: a population-based survey. *BMC Public Health*. 2012;12:1036. https://doi.org/10.1186/1471-2458-12-1036
15. De Clercq B, Abel T, Moor I, et al. Social inequality in adolescents' healthy food intake: the interplay between economic, social and cultural capital. *Eur J Public Health*. 2017;27(2):279-286.
16. WHO. Childhood Obesity Surveillance Initiative (COSI) Data collection procedures; 2016.
17. WHO. Childhood Obesity Surveillance Initiative (COSI) protocol WHO regional office for Europe 2016.
18. Breda J, McColl K, Buoncristiano M, et al. Methodology and implementation of the WHO European Childhood Obesity Surveillance Initiative (COSI). *Obes Rev*. 2021;e13215. https://doi.org/10.1111/obr.13215
19. Whiting S, Buoncristiano M, Gelius P, et al. Physical activity, screen time, and sleep duration of children aged 6–9 years in 25 countries: an analysis within the WHO European Childhood Obesity Surveillance Initiative (COSI) 2015–2017. *Obes Facts*. 2020;13(6):1-13.
20. Aune D, Giovannucci E, Boffetta P, et al. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-a systematic review and dose–response meta-analysis of prospective studies. *Int J Epidemiol*. 2017;46(3):1029-1056.
21. Evans CEL. Sugars and health: a review of current evidence and future policy. *Proc Nutr Soc*. 2017;76(3):400-407.
22. Narain A, Kwok CS, Mamas MA. Soft drinks and sweetened beverages and the risk of cardiovascular disease and mortality: a systematic review and meta-analysis. *Int J Clin Pract*. 2016;70(10):791-805.
23. Petrovic D, de Mestral C, Bochud M, et al. The contribution of health behaviors to socioeconomic inequalities in health: a systematic review. *Prev Med*. 2018;113:15-31.
24. Williams J, Buoncristiano M, Nardone P, et al. A snapshot of European children's eating habits: results from the fourth round of the WHO European Childhood Obesity Surveillance Initiative (COSI). *Nutrients*. 2020;12(8):2481. https://doi.org/10.3390/nu12082481
25. Musić Milanović S, Buoncristiano M, Križan H, et al. Socioeconomic disparities in physical activity, sedentary behavior and sleep patterns among 6- to 9-year-old children from 24 countries in the WHO European region, 2021. *Obes Rev*. 2021;e13209. https://doi.org/10.1111/obr.13209
26. Nations U. United Nations Standard Country Code, Series M: Miscellaneous Statistical Papers, No. 49 [cited 2020 Oct 4]. New York: United Nations. ST/ESA/STAT/SER.M/49. Available from: https://unstats.un.org/unsd/methodology/m49/2020
27. https://millenniumindicators.un.org/unsd/mi/worldbank.htm
28. Novakovic R, Cavelaars A, Geelen A, et al. Socio-economic determinants of micronutrient intake and status in Europe: a systematic review. *Public Health Nutr*. 2014;17(5):1031-1045.
29. Cameron AJ, Spence AC, Laws R, Hesketh KD, Lioret S, Campbell KJ. A review of the relationship between socioeconomic position and the early-life predictors of obesity. *Curr Obes Rep*. 2015;4(3): 350-362.
30. Desbouys L, Mejean C, De Henauw S, Castetbon K. Socio-economic and cultural disparities in diet among adolescents and young adults: a systematic review. *Public Health Nutr*. 2020;23(5):843-860.
31. Mackenbach JP, Bopp M, Deboosere P, et al. Determinants of the magnitude of socioeconomic inequalities in mortality: a study of 17 European countries. *Health Place*. 2017;47:44-53.
32. Vereecken CA, Inchley J, Subramanian SV, Hublet A, Maes L. The relative influence of individual and contextual socio-economic status on consumption of fruit and soft drinks among adolescents in Europe. *Eur J Public Health*. 2005;15(3):224-232.

33. Ahluwalia N, Dalmasso P, Rasmussen M, et al. Trends in overweight prevalence among 11-, 13- and 15-year-olds in 25 countries in Europe, Canada and USA from 2002 to 2010. *Eur J Public Health*. 2015;25(Suppl 2):28-32.
34. Rokholm B, Baker JL, Sorensen TI. The levelling off of the obesity epidemic since the year 1999—a review of evidence and perspectives. *Obes Rev*. 2010;11(12):835-846.
35. Cash Versus CB. Services: 'worlds of welfare' and the decommodification of cash benefits and health care services. *J Soc Policy*. 2005;34:195-213.
36. Nordic Council of Ministers. A better life through diet and physical activity. Nordic Plan of Action on better health and quality of life through diet and physical activity. Copenhagen 2006.
37. Mackenbach JP, Stirbu I, Roskam AJ, et al. Socioeconomic inequalities in health in 22 European countries. *N Engl J Med*. 2008;358(23):2468-2481.
38. Zaborskis A, Grincaite M, Kavaliauskiene A, Tesler R. Family structure and affluence in adolescent eating behaviour: a cross-national study in forty-one countries. *Public Health Nutr*. 2020;1-12. https://doi.org/10.1017/S1368980020003584
39. Mayen AL, Marques-Vidal P, Paccaud F, Bovet P, Stringhini S. Socioeconomic determinants of dietary patterns in low- and middle-income countries: a systematic review. *Am J Clin Nutr*. 2014;100(6):1520-1531.
40. Lee J, Allen J. Mother's educational attainment and their young adult daughters' fast food intake: the role of race/ethnicity. *Health Care Women Int*. 2020;41(2):169-187.
41. Uher R, Dragomirecka E, Papezova H, Pavlova B. Use of socioeconomic status in health research. *JAMA*. 2006;295(15):1770. https://doi.org/10.1001/jama.295.15.1770-a
42. Lehto E, Ray C, Te Velde S, et al. Mediation of parental educational level on fruit and vegetable intake among schoolchildren in ten European countries. *Public Health Nutr*. 2015;18(1):89-99.
43. Rao M, Afshin A, Singh G, Mozaffarian D. Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ Open*. 2013;3(12):e004277.
44. Drewnowski A. Obesity and the food environment: dietary energy density and diet costs. *Am J Prev Med*. 2004;27(3 Suppl):154-162.
45. London Child Obesity Taskforce. What makes it harder for London's children to be healthier?; 2019.
46. Birch LL, Ventura AK. Preventing childhood obesity: what works? *Int J Obes (Lond)*. 2009;33(Suppl 1):S74-S81.
47. Horning ML, Fulkerson JA, Friend SE, Story M. Reasons parents buy prepackaged, processed meals: it is more complicated than "I don't have time". *J Nutr Educ Behav*. 2017;49(1):60-66.e1
48. Fernandez MA, Marquis M, Desroches S, Turcotte M, Provencher V. Full-time employment, diet quality, and food skills of Canadian parents. *Can J Diet Pract Res*. 2019;80(2):63-71.
49. McGill R, Anwar E, Orton L, et al. Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact. *BMC Public Health*. 2015;15:457. https://doi.org/10.1186/s12889-015-1781-7
50. Williams K, Sassler S, Frech A, Addo F, Cooksey E. Does nonmarital childbearing and mother's later marriage influence child health in adolescence? Policy brief. *J Health Soc Behav*. 2013;54(3):277. https://doi.org/10.1177/0022146513501993

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Fismen A-S, Buoncristiano M, Williams J, et al. Socioeconomic differences in food habits among 6- to 9-year-old children from 23 countries—WHO European Childhood Obesity Surveillance Initiative (COSI 2015/2017). *Obesity Reviews*. 2021;e13211. https://doi.org/10.1111/obr.13211