Citation: Nutrition and Diabetes (2012) **2**, e35; doi:10.1038/nutd.2012.8

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SHORT COMMUNICATION

Overweight in singletons compared to children with siblings: the IDEFICS study

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The aim of this study was to compare the prevalence of overweight in only children to those with siblings and to explore potential behavioral mediating factors. This study relies upon cross-sectional data collected at survey centers in eight European countries participating in Identification and prevention of Dietary- and lifestyle-induced health EFfects In Children and infantS (IDEFICS). The present analysis is based on measured anthropometry and parent or guardian-reported socio-demographic characteristics. Subjects include 12 720 children aged 2–9 years for whom number of siblings was known. Singletons were more likely (odds ratio 1.52, 95% confidence interval (CI):1.34–1.72) to be overweight than their peers with siblings when controlling for factors related to childhood overweight, including survey country, parental education, parental weight, maternal age, child's age, birth weight and gender. The three southernmost countries have over threefold risk of overweight, dominated by Italy, compared with the north-central countries, which is not explained by the prevalence of singleton children. The excess risk of overweight among children without siblings was robustly observed even when considering behavioral mediating factors (playtime, screen time per day, dietary propensities for sugar or fat, parental attitudes towards food rewards and television in the child's bedroom). Among singletons aged 6–9 years, the excess risk of overweight was 1.70 (95% CI: 1.44–2.01) compared with 1.32 (95% CI: 1.10–1.60) in younger singletons.

Nutrition and Diabetes (2012) **2,** e35; doi:10.1038/nutd.2012.8; published online 2 July 2012

Keywords: singleton; only child; overweight; siblings

INTRODUCTION

In European countries, ~22 million children are overweight.[1] Genetic, environmental, and social factors have been proposed as potential causal factors, and recent studies have suggested a possible role for family structure.[2–9] However, little is known about the impact of family structure on childhood obesity in Europe. Singleton status was recently identified as a risk factor for obesity in one Norwegian population study,[10] and other researchers have suggested that first-born children receive more 'quality time' per day than later-born children.[11] It is not fully understood how this aspect of family composition influences obesity or whether the association is present across diverse European countries. Given the known variation in birthrates across European regions, only child may in part explain the ecological gradient currently observed. Overweight prevalence estimates are highest in the southern countries and are lowest in the northern areas.[12] To our knowledge, singleton status and overweight has not been examined in a large, international survey of European children. The aim of this study was to compare the prevalence of overweight in only children to those with siblings and to explore potential behavioral mediating factors.

MATERIALS AND METHODS

Study design

Identification and prevention of Dietary- and lifestyle-induced health EFfects In Children and infantS (IDEFICS) is a multi-center European study involving eight countries. IDEFICS recruited 16 224 children aged 2–9 (response rate 51%) from September 2007–June 2008 at survey centers in Italy, Estonia, Cyprus, Belgium, Sweden, Hungary, Germany and Spain.[13] All centers obtained ethics approval from their respective authority. Parents or legal guardians provided written informed consent for data collection for their children and children gave oral consent. Detailed information about IDEFICS has previously been published.[13] The present analysis was limited to children for whom singleton status was reported on the parental questionnaire, resulting in a sample size of 12 720 children with numbers per survey center ranging from 1300 in Estonia to 2014 in Hungary.

Anthropometry

Anthropometric measurements were taken according to standardized procedures at all survey sites.[14,15] Body height was measured to the nearest 0.1 cm without shoes on by trained staff using a portable stadiometer (SECA 225, KWS Medical Supplies, LLC, North Bend, WA, USA). Weight was measured by means of an adapted version of electronic scale TANITA BC 420 SMA (Tanita Europe BV, Amsterdam, The Netherlands). Body mass index (BMI) was calculated based on these

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Received 8 May 2012; accepted 27 May 2012

measures and categorized using age and sex-specific cut points according to the criteria of International Obesity Task Force.[16] In this analysis, children were further classified as overweight, including obese, or not overweight.

Demographic characteristics and socioeconomic variables

Demographics and socioeconomic variables were assessed from a standardized parental questionnaire. Data are presented separately by country, although it must be noted that survey centers cannot be considered representative of the whole country. The north to south gradient in overweight was examined by comparing north and central countries (Sweden, Estonia, Belgium, Germany and Hungary) with the southernmost countries (Spain, Italy and Cyprus). Children were examined in two age groups, 2 to <6 years of age (46.2%) and 6 to 9 years of age. Child's birth weight was self-reported on the parental questionnaire and examined in kilograms as a continuous variable. Socioeconomic status indicators included highest education attained in the household. Parental overweight was assessed by self-reported height and weight. To facilitate cross-country comparisons, the educational level was categorized according to the International Standard Classification of Education (ISCED) into low, medium and high. The original ISCED levels 1 and 2 were considered low, 3 and 4 were considered medium, and 5 was considered high educational attainment.[17]

Potential behavioral mediating factors

Parents reported their child's play time outdoors in hours and minutes for weekdays and weekends, which was transformed into average hours per day. Average screen time in hours per day was calculated from reported weekday and weekend television viewing and computer usage. Consumption of high-fat and high-sugar foods and beverages was calculated based on parental responses to the Children's Eating Habits Questionnaire (CEHQ) developed for IDEFICS. The CEHQ assesses usual intake using a 43-item food frequency questionnaire (FFQ) in which parents are asked to characterize a typical week, excluding foods provided in school or daycare settings. This method captures those foods eaten under parental control. Reproducibility and validity for selected items have been reported.[18] When more than 21 (50%) of the FFQ answers were missing or not known the cases were excluded; resulting in an exclusion of 585 cases. To examine a tendency to consume high-fat or high-sugar foods, weekly consumption frequencies for items high in fat and high in sugar were calculated in relation to all foods consumed, as described previously.[19] Parents were also presented eight statements regarding food as a reward from validated instruments.[20,21] Parents were instructed to mark all the statements they agreed with, for example, 'a good way to get a child to finish a chore is to promise a snack when he/she is finished'. These eight statements were used to create a score ranging from 0–8 (no agreement (0) to complete agreement (8)). Television in the child's bedroom was derived from a question on the parental questionnaire, 'which of the following media devices are located in the bedroom your child is using?' with a number of devices listed.

Statistical analysis

Differences between only children and those with siblings were assessed with Student's *t*-tests for continuous variables and with χ^2 tests for categorical variables. Logistic regression produced adjusted odds ratios (OR) for overweight as a function of singleton status. In model 1 the analysis was adjusted only for survey country as a categorical dummy variable, in model 2 also for child characteristics, in model 3 also for potential confounders, and in model 4 the model was stratified by age groups (2 to <6 and 6 to 9). In additional logistic regression analyses, potential behavioral mediating factors were assessed individually and in combination, and the north to south ecological gradient was assessed. We further examined only children versus those with siblings considering sibling order in additional logistic regression models (only younger siblings or older siblings/twins). The criterion for statistical significance was set to $P \leqslant 0.05$. All statistical analyses were performed using StataIC 11 (StataCorp LP, College Station, TX, USA).

RESULTS

The basic characteristics of the study sample by participating survey center and by singleton status with a test of differences are shown in Table 1. Statistically significant differences were found for age; singletons were younger and their mothers were younger. Singletons less commonly had both parents overweight and singletons less commonly live in highly educated households but more commonly live in medium-level educated households.

Table 1. Characteristics of 12 720 children and distribution of covariates by eight country survey centers and singleton status

	Survey center overall (N = 12 720)									
	Italy	*Estonia*	*Cyprus*	*Belgium*	*Sweden*	*Germany*	*Hungary*	*Spain*	*Singleton*	*Sibling(s)*
N	1995	1300	1338	1594	1563	1589	2014	1327	2314	10 406
Overweight (%)	41.9	14.0	24.6	7.7	9.5	14.8	16.3	20.4	22.9	18.5**
Singleton child (%)	18.1	29.2	12.6	11.9	9.7	19.6	22.6	22.4	100	0
Age ± s.d.	6.1 ± 1.8	5.8 ± 2.1	6.2 ± 1.4	5.6 ± 1.6	5.7 ± 2.0	6.1 ± 1.8	6.2 ± 1.8	5.8 ± 1.8	5.5 ± 1.8	6.1 ± 1.8**
Age <6 (%)	43.6	52.4	35.13	55.6	51.6	43.7	41.9	46.9	56.0	44.0**
Boys (%)	51.9	48.6	50.5	52.1	52.3	50.2	50.9	52.0	50.9	51.2
Birth weight (mean kg)	3.2 ± 0.5	3.6 ± 0.6	3.2 ± 0.5	3.3 ± 0.6	3.5 ± 0.6	3.4 ± 0.6	3.4 ± 0.6	3.2 ± 0.5	3.3 ± 0.6	3.3 ± 0.6
Maternal age	30.0 ± 5.0	27.3 ± 5.0	28.4 ± 5.0	29.2 ± 4.2	31.0 ± 4.4	29.1 ± 5.4	28.3 ± 4.3	32.5 ± 4.0	28.5 ± 5.3	29.6 ± 4.8**
Parent overweight (%)										
Neither	23.0	33.8	29.8	38.2	35.0	25.2	24.3	31.3	30.2	29.4
Only mother	7.5	7.9	7.3	11.5	11.5	12.0	7.8	5.5	8.0	9.1
Only father	39.2	43.2	44.9	31.3	36.0	34.0	44.5	44.5	41.6	39.1
Both parents	30.4	15.1	18.0	19.0	17.5	28.9	23.4	18.8	20.1	22.4*
Education household (%)										
Low	20.1	1.9	3.8	2.9	1.2	30.8	2.5	8.7	9.3	9.3
Medium	60.9	83.4	38.1	48.4	28.5	51.2	52.4	38.0	59.0	48.1**
High	19.0	14.8	58.1	48.7	70.3	18.1	45.1	53.3	31.7	42.6**
Potential mediating factors										
Outdoor play (hours per day)	2.5 ± 1.7	2.1 ± 1.2	2.6 ± 1.3	2.2 ± 1.7	3.0 ± 1.5	2.9 ± 1.7	2.7 ± 1.4	2.5 ± 1.2	2.5 ± 1.4	2.6 ± 1.5*
Screen time <1 h per day (%)	83.8	77.7	84.9	88.8	88.8	87.6	88.5	90.7	86.3	86.7
Propensity sugar (%) ± s.d.	28.6 ± 12.8	25.0 ± 9.5	22.0 ± 9.7	31.7 ± 10.8	13.8 ± 7.5	29.3 ± 11.2	25.5 ± 11.1	25.4 ± 9.1	26.1 ± 11.5	25.2 ± 11.7*
Propensity fat (%) ± s.d.	23.6 ± 10.4	26.7 ± 8.2	24.3 ± 9.4	29.2 ± 9.3	22.2 ± 9.4	28.8 ± 9.0	26.9 ± 8.2	23.3 ± 8.3	25.5 ± 9.0	25.7 ± 9.5
Reward with food score	2.0 ± 1.2	2.4 ± 1.2	1.3 ± 1.7	1.9 ± 1.3	2.0 ± 1.1	2.0 ± 1.2	2.4 ± 1.2	1.6 ± 1.1	2.0 ± 1.3	1.9 ± 1.3**
TV in bedroom (%)	64.9	31.1	19.0	8.8	20.1	21.0	42.5	7.2	34.3	27.6**

*$P < 0.05$, **$P < 0.01$.

Table 2. Multiple logistic regression analysis of predictors for overweight and singleton status

Models	*OR (95% CI)*
M1: overweight and singleton adjusted for survey country	1.30 (1.16–1.45)
M2: + child characteristics (age, sex and birth weight)	1.45 (1.29–1.63)
M3: + potential confounders (parents education and parents body mass index ⩾25, mothers age)	1.52 (1.34–1.72)
M4: stratified by age group[a]	
Aged 2 to <6 singleton	1.32 (1.10–1.60)
Aged 6 to 9 singleton	1.70 (1.44–2.01)

Abbreviations: M, model; CI, confidence interval; OR, odds ratio. [a]Model includes: singleton status, survey country, sex and birth weight, highest household education, and parental overweight categorized as none, one or both and maternal age.

Fewer only children had two-parent households; they had less play time outdoors; a higher propensity to consume sugar; and were more likely to have parents supportive of food as a reward and television in the bedroom.

Table 2 shows the relationship between singleton status and overweight. In model 1, adjusted only for survey center, singletons were 1.30 times more likely to be overweight than their peers with at least one sibling. Adjusting further for child characteristics in model 2, (age, sex and birth weight) and additional confounding factors in model 3 (parental education, parental overweight and maternal age), singletons were 1.52 times more likely to be overweight. The association between only child and overweight was strengthened with age. In model 4, among older singletons, the association with overweight (OR 1.70, 95% confidence interval (CI):1.44–2.01) was greater than for younger singletons (OR 1.32, 95% CI: 1.10–1.60). Potential mediators, including playtime outdoors, screen time per day, propensity to consume sugar or fat, parental attitudes toward food rewards and television in the child's bedroom, did not attenuate the relationship between only child and overweight with associated ORs ranging from 1.51 to 1.58 when each mediator was explored individually and in combination. The north to south ecological obesity gradient was not explained by singleton status. We observed an over threefold excess risk for overweight in southern countries compared with the north/central countries (OR 3.10, 95% CI: 2.81–3.37) that was unattenuated by having siblings (not shown). Whether we include a north to south gradient or single countries in our analyses, the results are robust. Having a sibling was protective regardless of birth order (twins or those with older siblings versus only younger sibling) when only children were compared to those with siblings. Additional analyses (not shown) suggested that children who have always had a sibling were slightly more protected from overweight than those that were previously a singleton until the arrival of a younger sibling but not to a significant extent.

CONCLUSIONS

Being an only child was a risk for overweight after controlling for a number of factors that may present confounding. The longer the child remains a singleton in the household the stronger the association with overweight. Singleton status could not explain the ecological gradient observed in childhood overweight in eight European countries. The potential behavioral mediators examined did not attenuate the relationship between singleton status and overweight despite significant differences between singleton children and those with sibling(s) for a number of factors. Part of the reason may be due to reporting bias when overweight is involved. This paper is among the first to show that singleton status is a risk factor for childhood overweight; stressing the importance of family structure and related lifestyle behaviors.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

This study was conducted as part of the IDEFICS study (http://www.idefics.eu). We gratefully acknowledge the financial support of the European Community within the Sixth RTD Framework Programme Contract No. 016181(FOOD) and the grant support from the EU for the IDEFICS study. Additionally, MH received financial support from Gothenburg University, Department of Medicine and the Swedish Foundation for International Cooperation in Research and Higher Education (STINT).

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