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Abstract

Background: Among low- and middle-income nations, the highest prevalence of child overweight and associated metabolic disorders has been found in Middle Eastern and Eastern European countries. Obesity has been on the rise in Turkey and past research has shown regional variations among adults. However, the prevalence of childhood obesity in different socioeconomic groups in the largest metropolitan areas in the country has not been reported.

Aims: This study aimed to investigate the prevalence of child obesity with a population-representative, SES-stratified random sample with objective measures of body mass index (BMI) in the capital city of Turkey.

Methods: Weight status was measured by the WHO growth curve and analyzed by

socioeconomic status (SES), sex, and parental factors in a population-representative sample of 2066 parent-child dyads. Chi-square and logistic regression were conducted.

Results: Rates of overweight and obesity were 21.2% and 14.6% (35.8% combined) but significantly higher in high (24.5% and 18.9%) vs. low SES (20.1% and 13.8%) (P = 0.02). Boys were at higher risk for obesity than girls, especially in high vs. low SES (Odds Ratio [OR] = 3.0 [95% CI: 1.4–6.5] vs. 1.7 [95% CI: 1.2–2.5]). Having both parents being overweight or obese increased the risk for obesity, particularly in medium and high SES (OR = 5.8 [95% CI: 2.3–14.1]) and 6.3 (95% CI: 1.5–26.2).

Conclusions: Higher maternal education was a risk factor in low-to-medium but not high SES. In Ankara, child overweight and obesity appears to be 1.5 times more prevalent than national estimates. Higher SES may signify greater exposure to an obesogenic environment and greater obesity risk.

Keywords: Turkey, childhood obesity, socioeconomic status, parent, school

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Introduction

The prevalence of chronic diseases is now increasing at a faster pace in low- and middle-income countries than in high-income countries and obesity is a significant factor in this

trend worldwide (1,2). In Turkey, the prevalence of adult obesity has doubled between 1990 and 2000 (3), with recent estimates indicating that 24% of adults are overweight and another 16% are obese (4). Among low- and middle-income nations, the highest prevalence of child overweight and associated metabolic disorders has been found in Middle Eastern and Eastern European countries (5). In a cross-sectional study of obesity among primary school children in seven European countries, Olaya et al. (6) showed that Turkey was second only after Romania in terms of the prevalence of obesity. Recent studies suggest between 20–25% of youths aged 6–19 years are overweight or obese in Turkey (7–9), but numbers in the largest metropolitan areas of Turkey are not clear. There could be significant variations in the prevalence of child obesity in Turkey, as regional eating habits and the physical activity environment differ across the country (10).

Previous studies revealed that common risk factors associated with obesity among Turkish children and adolescents include low physical activity, lack of sleep, living in a large city, having obese parents, having high birth weight, eating while watching TV, eating fast food, skipping breakfast, consuming sugar-sweetened beverages (fruit juice, soft drinks), and time spent more than 2–3 h/day in front of TV and personal computer (11). In addition, research has found significant but varying associations of body weight and socioeconomic status (SES) in Turkey. Several studies, including those aforementioned, have indicated higher obesity rates among children with higher SES while the reverse may be the case among adults (9,12–14). There is also some evidence to suggest that the relationship between SES and obesity may differ by region within Turkey, at least in adults (15). Overall, the association between obesity and SES in Turkey remains unclear.

Ankara is the capital and second largest city in Turkey, with a diverse mix of populations with varying SES backgrounds. The Child Obesity Study of Ankara (COSA) is a unique international collaboration between public health researchers in Turkey and in the United States of America. The current study stemmed from this collaboration and aimed to investigate the prevalence of child obesity with a population-representative, SES-stratified random sample with objective measures of body mass index (BMI) in the capital city of Turkey. Children’s BMI was examined in association with selected parental factors across three different SES strata. Specifically, this article reports on the overall childhood obesity prevalence by SES, parental education, parental occupational status, and parental weight status.

Methods

Study sample

The metropolitan area of Ankara consists of 25 counties. It is possible to rank these counties according to their SES by using available indicators, including: number of primary school students per teacher, number of primary school students per classroom, average consumption of natural gas per household (m3), percentage of poor households (%), and unit price of new

apartment (16). Also, Yucesahin and Tuysuz classified a total 338 of wards in Ankara city into six social structures (17). In child obesity studies, SES has been measured by a variety of indicators. Each indicator measures a different aspect of SES. It is not possible to use traditional SES markers based on income, education and occupation directly with children; therefore, family-, community- or school-level SES measures are typically preferred (18). By using Yucesahin and Tuysuz's classification and the available socio-economic indicators, the central metropolitan counties were ranked to form a SES spectrum, with all private schools forming the sampling frame for the high SES stratum. Public schools of Cankaya and Yenimahalle counties, both at the top of the ranked list, formed the middle SES, and public schools from Altındağ, Mamak and Sincan counties from the bottom of the list formed the low SES stratum sampling frames.

Considering child obesity prevalence in the existing literature and also requiring 6 to 10 observations for any variable in a multiple regression model, sample size was calculated as 1000 students for each SES stratum to provide 80% power to detect differences between SES groups with an alpha of 0.05. Accounting for non-response rates, a sample size of 1200 to 1500 students was targeted for each stratum. To reach this sample size, 15 schools were initially targeted from each of the high, middle and low SES strata by using probability proportional-to-size (PPS) methodology. Also, two replacement schools were identified for each sampled school for a potential case of refusal. Where possible, 80–100 students from each school were recruited in the study via a random selection of two to five classrooms by taking into account density of classrooms of the school. All classes were included in some schools if the number of students in Grade 4 was less than 80.

Ultimately, surveys were rolled out to Grade 4 children (ages 9–11 years) and their parents in 46 schools (15 schools from lower SES, 17 schools from medium SES and 14 schools from higher SES strata). The total number of questionnaires delivered to families was 4022. Of these, 3003 families returned the questionnaires (70.8% responded by mothers and 26.9% by fathers). From this number, 2382 were accepted as eligible for the study; in 1640 questionnaires, more than 90% of items were not filled out by the respondents and were thus discarded. For the child component, 3580 students were present in the school on the survey date, but 3518 of them were available to be measured. The parent and child surveys resulted in 2082 dyads (Figure 1) . Response rates were analyzed for each school separately. In three private schools, questionnaires received were mostly from families in which children were affected by obesity, resulting in very low participation overall and selection bias. This created problems in the weighting procedure that could cause subsequent statistics to be biased. Therefore, these three schools were excluded and sample weights were recalculated by taking into account the dropped schools. In the end, the response rate of the final dyad sample was 51% (2066/4022).

Data collection and measures

Surveys were administered with the assistance of individual school administrations. Each school sent information about the study, informed consent, and parent questionnaires to parents of selected children. Passive student assent was sought. Field teams consisting of trained researchers administered the student survey. Students completed the surveys in their regular classrooms with oral instructions provided by the field team members. Survey administration took place over a three-week period in first quarter 2015. Child anthropometric measurements were collected by trained field research staff at the time of the student survey. Female healthcare personnel collected weight and height measurements with another female interviewer in a separate room to respect children's privacy. Field team members used SECA 813 weight scales (Hamburg, Germany) and portable SECA 213 height boards (Hamburg, Germany) to collect weight and height for each student. Height boards were mounted where a level ground and a vertical plane intersected to form a right triangle, and the mobile part was used as a head rod. Weights were recorded at the closest 0.1 kg and heights were recorded at the closest 0.1 cm.

The questionnaires included standard demographic characteristics of parents and children (e.g., date of birth, sex, school code, class code, child code, school code according to SES, family income, parental education, parental employment). Parent height and weight (mothers and fathers) were self-reported. BMI was calculated as weight (kg) divided by height squared (m2). For children, overweight and obesity status was estimated using the WHO cutoff points, where BMI-for-age z-score values were calculated using WHO Anthro-Plus software program. Based on the BMI z-score value, underweight was defined as +1 and ≤ +2, and obesity > +2 standard deviation units (19). The study was approved by the Institutional Review Board of Hacettepe University, Ankara, Turkey.

Statistical Analysis

Descriptive statistics were generated by SES group and obesity status of students. Child BMI status was analysed by sex, SES, parental age, parental education, parental employment, and parental BMI status. Chi-square tests were first conducted in bivariate analyses to test differences in the proportion of children with overweight or obesity by levels of these categorical variables. Subsequently, multinomial logistic regression models were used to examine the relationship of child BMI status with gender and multiple parental determinants. For overcoming multicollinearity problems, parental age and father's educational status were removed from the models. SES, sex, maternal educational status, maternal employment status and parental obesity status were included in the models. These regression models were performed in the full sample as well as in SES-stratified groups. The estimates for the parameters in the multinomial logistic regression model were computed and compared to a referent category. Having normal BMI value was specified as referent category. A small number of underweight children (n=43) were removed in the regression analysis.

Multiple imputation (MI) method was used to address missing data. The MI procedure creates imputed data sets for incomplete multi-dimensional multivariate data. For independent variables of interest, missing data were imputed based on other correlated variables but without the dependent variable of interest (20). PROC MI in SAS 9.4 (Cary, NC, USA) was used in the MI process and nine imputed data sets were created. Additionally, for calculating chi-square statistics of pooled imputed data sets, the MICEADDS package in R was used. SPSS 23.0 (Armonk, NY, USA) was used for multinomial regression analyses, which gave us pooled results for the nine imputed data sets. Normalized sample weights were taken into account in all calculations. Findings are shown for both raw and imputed data sets. Description of findings in this paper is based on imputed results. For significance testing, α was set at 0.05.

Results

The prevalence rates of child overweight and obesity in Ankara were 21.2% and 14.6%, respectively, with a combined rate of 35.8% (95% CI: 33.9–38.2) (Table 1 , raw data set included complete anthropometric data). There were no differences between the estimates from all participating children vs. the final dyad sample used in this paper.

Table 2 shows the BMI and sociodemographic characteristics of the study population by SES for original and imputed data. We describe all results henceforth using the imputed results. The low-SES group made up 53.2% of the study population, medium-SES was 34.6%, and the high-SES group accounted for 12.2% (data not shown). The prevalence rates of child overweight and obesity were significantly higher in high vs. low SES groups (24.5% vs. 21.1% for overweight and 18.9% vs. 13.8% for obesity, P = 0.02). The combined overweight and obesity rate in high SES children was 43.4%. Parental age and educational status were significantly related to SES (P < 0.001). For mothers, there was a significant difference in employment status between low and high-SES (18.8% vs. 62.4%, P < 0.001). Students in high SES were more likely to have overweight fathers but less likely to have overweight mothers than other SES groups (P < 0.001). The proportion of both parents being overweight or obese was 40.7%, 37.1% and 35.5% in low, medium, and high SES groups, respectively.

Multinomial logistic analyses with imputed data

Three models were tested in multinomial logistic regression, comparing children with overweight or obesity to children who had normal weight (Table 3). In Model I, child obesity was significantly associated with high-SES (OR = 1.56, P < 0.01), consistent with the chi-square findings earlier. Although there was still a positive trend of an SES gradient, child overweight was only marginally associated with high-SES in this model (P < 0.10). In Model II, the association between child obesity and SES was attenuated and became insignificant when maternal education was entered into the model. Secondary and tertiary educational status of mothers tended to increase child obesity risk by two-fold compared to the reference category of primary or lower educational level (OR = 2.07, P < 0.01). Higher education of mothers was also

generally associated with an increased risk of child overweight (OR = 1.6–1.7, P < 0.01) but not at the tertiary education level. The significant role of maternal education (OR = 1.87–2.25, P < 0.05) in explaining the relationship between SES and child obesity remained in Model III, when the child's sex (OR = 1.96, P < 0.01), maternal employment (OR = 1.56, P < 0.05) and parental weight status (OR = 1.94–3.80, P < 0.05) were added to the model.

Multinomial logistic analysis by SES group

Table 4 shows the results of SES-stratified analyses in full logistic regression models. Boys were more likely than girls to suffer from obesity, especially as SES increases (OR = 1.73–3.04, P < 0.01). Maternal education was most significantly associated with increased risks for child overweight/obesity in low and medium SES groups (OR = 1.59–2.66, P < 0.05) but not in the high SES group. Maternal employment was significantly associated with child obesity risk only in the medium SES group (OR = 1.79, P < 0.05), although the magnitude of ORs was similar across all three SES strata. Having both parents as overweight or obese was a significant factors in the risk of child obesity across all three SES strata, though the risk gradient increased as SES increased (OR = 2.64–6.26, P < 0.05).

Discussion

This study is one of the first randomly sampled family- and population-based studies on child obesity in Turkey, with a particular focus on three distinct SES groups. It addresses several gaps in obesity research in Turkey, including having objective measures of BMI in children and linking these to parental factors across different SES groups in a major metropolitan area. To date, obesity data from Turkey's biggest cities such as Istanbul and Ankara have been limited. We found the prevalence of child overweight/obesity among 10-year-old children to be exceptionally high in Ankara across all SES levels. One-third of low and medium-SES children and almost half of high-SES children were overweight or obese. Previous reports generally pegged the combined overweight and obesity prevalence in Turkish children at 20–25% (11). Our estimates are more than 1.5 times the prevalence figures documented in the European Childhood Obesity Surveillance Initiative (COSI) or other prevalence studies from Turkey in the past few years, and may indicate regional differences in Turkey. The growing epidemic of child overweight/obesity is alarming and warrants the attention of public health and educational authorities as well as society as a whole in Turkey.

It is possible that our data are picking up on an increased pace of social and nutritional shift in Turkey, which may be contributing to the growing and accelerating prevalence of child overweight/obesity. This is also supported by a recent study in high school students in the city centre and rural areas of Eskisehir, i.e., a smaller, neighbouring metropolitan city of Ankara, that found a narrowing of the urban–rural divide often seen in low- and middle-income countries in the prevalence of overweight/obesity (21). In that study, the prevalence of overweight and obesity in rural areas was 10.4% and 7.9%, respectively, whereas the prevalence in urban

areas was 12.2% and 11.3% respectively. This represented a difference of only about 5% in the combined prevalence of overweight/obesity between rural and urban areas.

We found that obesity was more prevalent in the high SES group compared to low and medium-SES groups. This finding was consistent with another recent report from Mardin in southeastern Turkey (10). Similarly, in a review of childhood obesity across Middle Eastern countries, Mirmiran et al. (22) concluded that the relationship between SES and obesity was complex and varied across different cultures; they found obesity to be more prevalent in urban areas and higher SES in some countries such as Egypt, while it is more prevalent in medium SES in countries such as Pakistan, suggesting perhaps different stages of the nutrition transition across countries. Of note, one study among Turkish women of reproductive age (15–49 years) from different regions of Turkey found that obesity was concentrated among wealthier women in Eastern Turkey whereas in Western Turkey, it was more concentrated among poorer women (23). This suggests that contextual variations within a country are important to consider and warrants further research. It is not entirely clear if such regional variations in the association between SES and obesity also exist in Turkish children, though our study points to this likelihood.

A recent review from Western high-income countries found inconsistent results for the role of gender in the relationship between SES and child obesity (24). Our findings showed that boys were more likely than girls to experience obesity and that this gender effect was most pronounced in the higher SES group. This is consistent with reports from other Middle Eastern countries but contrasts with findings from certain Western countries (22). One explanation for our finding might be the increased likelihood of exposure among boys to the obesogenic environment (25). In Turkish culture, it is more acceptable for a 10-year-old boy than the same-age girl to go out with his friends. Thus, this may particularly increase boys' access to energy-dense, nutrient-poor foods. We can also speculate that boys belonging to higher SES have more discretionary money to spend (26).

The effect of maternal education on child obesity remains controversial. In a systematic review, El-Sayed et al. (27) found that four of seven studies indicated a positive relationship, one showed a negative relationship, and two did not find any relationship. In addition, the first wave of COSI showed that there were significant variations in the relationship between parental education and child BMI across European countries (28). For example, Sweden, and to a lesser extent, Portugal and the Czech Republic, reported that lower parental education was associated with higher child BMI. In contrast, Bulgaria (a neighbouring country of Turkey), and to some extent Lithuania, showed higher parental education was associated with higher child BMI.

In our study, we found that maternal education was significantly and positively associated with child obesity and this mostly (but not entirely) explained the effect of SES on child obesity. The effect of maternal education was strongest in low and medium-SES groups. Our finding is consistent with results of a recently published review of studies from 12 low- and middle-income countries (29). In Nairobi (Kenya) and Bogota (Colombia), maternal education was found to also be positively related to child BMI. The fact that the rate of child obesity was highest nonetheless in the high-SES group in our study suggests that other variables (e.g., higher exposure to the obesogenic environment among high-SES children) besides maternal education may also playing important roles. Given the complexity of SES and obesity, more research is warranted, taking into account the diversity of social, political and economic contexts of different countries or regions.

In OECD countries, maternal employment has been shown to be related to pre-school child BMI (30). A similar relationship has been noted in Japanese pre-school children (31). Our result corroborates with these findings among primary school children in the capital city of Turkey, though notably this was only significant in the medium-SES group. It is possible that medium SES working mothers in Ankara are more likely to have time limitations and their children might receive more non-parental care compared to the other two SES groups (32,33). More research is warranted to better understand the interaction between maternal employment and SES.

Previous research in several countries has found parental weight to be the most influential factor driving the childhood obesity epidemic across SES groups (29,34–36). However, some studies have noted a more prominent role of parental obesity in child BMI status in lower SES families (18,24). On the contrary, our finding suggests that parental overweight status has a much larger effect in higher SES groups in Ankara. The gradient of effect from low to high SES is striking.

Limitations

Lower than desired response rate could be seen as a limitation of our study; however, this concern was due to lower response rate of family questionnaires and we calculated that BMI values showed no difference between the children of responding and non-responding families. Relying on these results, we concluded that our findings could be generalized for the same age group of residents of Ankara. In addition, although BMI is considered a good predictor of adiposity in the healthy paediatric population (37), we recognize that other measures of adiposity such as waist circumference may be more strongly correlated with obesity-related co-morbidities (38). Future analyses will examine this issue more specifically. Due to missing

data, the MI procedure is an increasingly used tool in public health research to provide greater statistical power and to increase the robustness of parameter estimates (39).

Conclusion

Collectively, our findings show that Ankara may be in an accelerated stage of nutritional transition. In early stages, overweight/obesity tends to accrue in higher SES groups. In further stages, lower SES groups begin to be affected by the obesity burden (18). Although the SES gradient remains, even lower SES groups are now catching up to the overweight/obesity rates seen in high-income countries. Results from the study will contribute to the national and regional public and political discourse on obesity prevention and treatment, and add urgency to the development of multipronged interventions in Turkey.

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Competing interests: None declared.

Prévalence de l’obésité de l’enfant et facteurs parentaux associés à travers les strates socio-économiques à Ankara (Turquie)

Résumé

Contexte : Parmi les pays à revenu faible et intermédiaire, c’est dans les pays du Moyen-Orient et de l’Europe de l’est que la plus haute prévalence du surpoids chez l’enfant et de troubles métaboliques associés a été observée. L’obésité est en augmentation en Turquie et les travaux de recherche menés dans le passé ont montré des variations régionales parmi les adultes. Cependant, la prévalence de l’obésité de l’enfant dans différents groupes socio-économiques dans les plus grandes zones métropolitaines du pays n’a pas fait l’objet de rapports.

Objectifs : La présente étude avait pour objectif d'étudier la prévalence de l'obésité de l'enfant dans un échantillon de population représentatif aléatoire stratifié sur le statut socio-économique, et à l'aide de mesures objectives de l'indice de masse corporelle (IMC) dans la capitale turque.

Méthodes : Le statut pondéral a été mesuré à l'aide la courbe de croissance de l'OMS et analysé en fonction du statut socio-économique, du sexe, et de facteurs parentaux dans un échantillon de population représentatif de 2066 dyades parent-enfant. Le test du khi-carré et la régression logistique ont été utilisés.

Résultats : Les taux de surpoids et d'obésité étaient de 21,2 % et 14,6 % (35,8 % combinés), et étaient significativement plus élevés parmi les statuts socio-économiques élevés (24, 5 % et 18,9 %) et les statuts socio-économiques inférieurs (20,1 % et 13,8 %) (p = 0,02). Les garçons étaient exposés à un risque plus élevé d'obésité que les filles, notamment ceux bénéficiant d'un statut socio-économique plus élevé (Odds ratio [OR] = 3,0 [IC à 95 % : 1.4-6,5] contre 1,7 [IC à 95 % : 1,2-2,5]). Le fait d'avoir les deux parents en surpoids ou obèses augmentait le risque d'obésité, particulièrement pour ceux ayant un statut socio-économique intermédiaire et élevé (OR= 5,8 [IC à 95 % : 2,3-14,1] et 6,3 [IC à 95 % : 1,5-26,2]).

Conclusions : Un niveau d'éducation maternel plus élevé était un facteur de risque dans les cas de statut socio-économique faible à intermédiaire, mais pas dans les cas de statut socio-économique élevé. À Ankara, le surpoids et l'obésité de l'enfant semblent être 1,5 fois plus fréquents que les estimations nationales, et un statut socio-économique élevé peut signifier une plus grande exposition à un environnement obésogène et un risque accru d'obésité.

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