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Trends of Childhood Obesity in China and Associated Factors

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Abstract

Childhood obesity is worsening at dramatic rates and has become a public health crisis. This study investigated these trends in childhood obesity and examined parental factors that may contribute to overweight and obesity. Body mass index (BMI) was calculated from height and weight measurements taken annually from 2004 to 2007 in a subsample of 136 children (2–4 years old), from the Jintan Child Health Project in China. Parental factors were assessed through a self-administered questionnaire. Prevalence rates of overweight and obesity rose from 6.6% and 2.2% in 2004 to 15.4% and 6.6% in 2007 ($p < .05$). Overweight was significantly associated with maternal employment ($p < .05$), but not with parental education level, maternal age at birth, or breast-feeding. To counter this rapid increase of obesity and overweight prevalence, nurses should regularly monitor children's weight and advise parents, especially working mothers, on the nutritional benefits of home-cooked meals.

Keywords

overweight; obesity; preschool children; maternal employment

Background

In almost all reports throughout the world, the increasing prevalence of childhood overweight and obesity has become a public health crisis in both developed and developing countries. In many countries the problem of childhood obesity is worsening at a dramatic rate. It was reported that 65%, 19%, and 16% of preschool children were normal, overweight, and obese, respectively, in 2005 in Newfoundland and Labrador, Canada (Twells & Newhook, 2010). A total of 23% (3085) of children were overweight at the age of

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3 years in the United Kingdom (Hawkins, Cole, & Law, 2008). Meanwhile, the combined prevalence of childhood overweight and obesity increased from less than 12% in 1985 to over 23% in 2008 in Australia (Olds, Tomkinson, Ferrar, & Maher, 2010). In addition, 21.5% of children were overweight and 10.3% were obese in a sample of Portuguese children aged 3 to 10 years (Ferrao et al., 2013). In the United States, the prevalence of childhood overweight increased from 14.0% among boys and 13.8% among girls in 1999 to 2000 to 18.2% and 16.0% in 2003 to 2004 (Ogden et al., 2006). A more recent study reported that in 2007 to 2008, 32% of children in the United States aged 2 to 19 years were classified as overweight, including 17% that were obese, and 12% severely obese (Ogden et al., 2010).

While overweight and obesity are common among affluent individuals in developing or underdeveloped countries (Pampel, Denney, & Krueger, 2012; Patel et al., 2011), they are more common among poor individuals in developed countries (Pampel et al., 2012; Shrewsbury & Wardle, 2008). Although China is a developing country, its rapid economic growth within the past decades has led to an increased prevalence of overweight and obesity. According to the Chinese National Surveys on Students Constitution Health (CNSSCH), the overweight prevalence of children aged 7 to 18 years nearly doubled from 4.1% in 2000 to 8.1% in 2010 (Song, Wang, Ma, & Wang, 2013). Meanwhile, Shanghai CDC indicated that the obesity prevalence of children was 3.76% in 1991 and increased to 13.53% in 2009 (Lu et al., 2013).

Many risk factors have been identified for childhood obesity. Studies have cited dietary habits, physical inactivity (Aeberli, Kaspar, & Zimmermann, 2007; Thibault et al., 2013; Trinh, Campbell, Ukoumunne, Gerner, & Wake, 2013), breast-feeding patterns (Feig, Lipscombe, Tomlinson, & Blumer, 2010; Hawkins, Cole, & Law, 2009; Twells & Newhook, 2010), parental occupational status (Brown, Broom, Nicholson, & Bittman, 2010; Farajian et al., 2013; Hawkins et al., 2009), and parental education level (Grydeland et al., 2012; Maddah & Nikooyeh, 2010; Veugelers & Fitzgerald, 2005) as common factors associated with childhood obesity. In addition, factors such as excessive TV-watching have been correlated with increased childhood obesity, perhaps due to the lack of parental supervision or increased total energy intake during this activity (Lazarou & Soteriades, 2010; Manios et al., 2009). The recent influx of Western fast foods has contributed to the rise in obesity in China as well as other countries around the world (Amin, Al-Sultan, & Ali, 2008; Rouhani, Mirseifinezhad, Omrani, Esmailzadeh, & Azadbakht, 2012; Shan et al., 2010; Wu, Huxley, Li, & Ma, 2009; Zhang, van der Lans, & Dagevos, 2011). Childhood obesity has many serious health consequences. For instance, obese children are more likely to become obese adults (Stovitz et al., 2010), and obese children have reported significantly lower health-related quality of life (HRQOL) in physical, social, and school domains (Pinhas-Hamiel et al., 2006). In addition, there is a significant likelihood for some obese children to have multiple risk factors for Type 2 diabetes, heart disease, asthma, and a variety of other comorbidities before or during early adulthood (Reilly et al., 2003). In light of such adverse health consequences known to stem from childhood overweight and obesity, it is essential to extend our knowledge regarding the factors contributing to childhood obesity as well as clinical interventions to help reduce the prevalence of these conditions.

Studies have been conducted on overweight and obesity among preschool children, but few have employed a cohort study design, which allows for the analysis of the effects of earlier factors since participants can be followed from infancy. In addition, past research in China has focused on comparing urban and rural areas and has reported higher rates of obesity and overweight in urban areas (Yu et al., 2012; Zhang & Wang, 2013). Research on obesity and overweight prevalence in smaller Chinese cities, however, is limited. Therefore, this study investigated the prevalence, changing trends, and associated parental factors of overweight and obesity in a subsample of children (2–4 years old in 2004) participating in the Jintan Child Health Project in the small city of Jintan from 2004 to 2007. Furthermore, because past studies have shown that parental characteristics, especially maternal factors, influence children's obesity and overweight prevalence (Biribilis, Moschonis, Mougios, Manios, & group HGS, 2013; Wang et al. 2013), we examined the relationship between the prevalence of childhood overweight and obesity in 2007 with parental factors such as maternal and paternal occupational status and education level, mother's breast feeding patterns, and mother's age at the time of giving birth.

Method (Participants, Instruments, Procedure, Data Analysis)

Participants

Jintan is a middle sized city located in the south-eastern coastal region of China, with both well-developed agriculture and industry as compared with the northern parts of the country. Data analyzed for this study were originally collected as part of the "Jintan Child Health Project," which is a longitudinal study that aims to assess the early health factors related to children's physical and mental health development. The study surveyed and measured a portion of a cohort that consisted of 136 children across three preschools in 2004. The three preschools were chosen to be representative of the geographic, social, and economic profile of the whole city. The Jintan Child Health Project consists of a preschool cohort of 1656 children accounting for 24.3% of all children in this age range in Jintan city. Height and weight data from 2004 to 2007 were available for 136 children. For details on sampling procedure, refer to a previous study (Liu, McCauley, Zhao, Zhang, & Pinto-Martin, 2010). The mean ages of the studied cohort children were 3.5 ± 0.4 and 5.9 ± 0.4 years in 2004 and 2007, respectively. Prior to recruitment, children's guardians were fully informed of the objectives and methods of the study. Written informed assent was obtained from the children, and written consent was obtained from the parents. IRB approval and corresponding ethical committee for research approval were obtained.

Instruments and Procedure

Child Measures—Child anthropometric measures, including height and weight, were collected by school nurses during a routine physical examination at the beginning of the new preschool year in September 2004 to 2007. Body mass index (BMI) was calculated as weight/height^2 (kg/m^2). Overweight was defined using World Health Organization (WHO) age- and sex-specific standards (WHO, 2006). Overweight and obesity were defined by the actual BMI >1 SD and >2 SD, respectively, based on WHO reference data.

Parental Factors (Sociodemographic Information)—Parents completed a questionnaire during their meeting at the preschools at the end of the school year, when children were 6 years old. Family demographic information that was obtained included: parental socioeconomic status, parental and grandparental educational level, and maternal factors such as breast-feeding and mother's age at time of giving birth. The educational level of parents was classified into one of three categories: lower than middle school, high school, and college or higher. The parental occupation was classified as follows: with a job or without job for at least 1 year. The parents reported the occupation they held for the longest period of time in their lives. Maternal age at the time of giving birth was coded as three groups: 24 years and younger, 25 to 29 years old, and 30 years and older. Breast-feeding practice in the first 4 to 6 months was classified as: breast-feeding only or mostly, bottle feeding only or mostly, or half and half.

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 11.5). Means, frequencies, and percentages were used to describe data. Chi square test was used to evaluate associations between the categorical variables. Fisher's exact test was used for those variables where the minimum expected count was $n < 5$. Multivariate analysis using binary logistic regression was conducted to determine factors associated with overweight and obesity. A p -value of less than .05 was considered statistically significant. Because of the small sample size, cases with missing values were retained in the preliminary analysis, and only when doing the analysis on obesity and overweight and the associated factors, were they deleted. The percentage of cases with missing values was 8.8% ($N = 12$).

Results

The sample size was 136 (56% boys, 44% girls) in this study. The prevalence rates of overweight were 6.6%, 12.5%, 12.5%, and 15.4% in 2004, 2005, 2006, and 2007, respectively. The prevalence rates of obesity were 2.2%, 2.9%, 4.4%, and 6.6% in 2004, 2005, 2006, and 2007, respectively (Figure 1). In our sample from Jintan, 23.7% of the boys were overweight or obese, and 20% of the girls were overweight or obese in 2007. The prevalence of overweight increased by approximately 133% and the prevalence of obesity tripled over the time period from 2004 to 2007.

The prevalence of overweight and obesity among children with employed mothers was higher than that among children with unemployed mothers ($\chi^2 = 5.533$, $p < .05$; Table 1), while no significant association was found with fathers' employment status ($\chi^2 = 0.403$). Parental education levels were not associated with children's overweight or obesity in our sample of children, using χ^2 analysis.

Maternal factors, including maternal age at time of giving birth and breast-feeding practice in the first 4 to 6 months, were not found to be associated with children overweight and obesity (Table 2). Multivariable analysis that took into account parental employment, mother's age at the time of giving birth, and breast-feeding practice in the first 4 to 6 months is shown in Table 3. Consistent with the single factor analysis, our results indicated that children of employed mothers were more likely to be overweight or obese (Odds Ratio [OR]

= 17.76, $i < .05$). However, no association was found between paternal employment, breast-feeding practice in the first 4 to 6 months, or maternal age at the time of giving birth and the prevalence of overweight and obesity in our study sample.

Discussion

This article estimated the prevalence of overweight and obesity in preschool children and examined its relationship with parental factors. Estimations were based on WHO recommendations for the evaluation of overweight and obesity in order to ensure that results would be comparable to similar surveys. The prevalence rates reported in this study are consistent with Liu's report that the overall prevalence rate of overweight and obesity was 7.4% among children aged 4 to 6 years across 26 counties/cities in China (Liu et al., 2007). From 2004 to 2007, the prevalence of overweight had risen from 6.6% to 15.4% among our cohort children, an approximate increase of 133%. This trend is similar to the national trend in China (Wang, Mi, Tao, & Chen, 2011) and indicative of the immense importance of obesity prevention. Previous studies in China have largely focused on larger cities such as Shanghai and Jinan (Zhang et al., 2012; Zhang & Wang, 2013). In addition, research has shown that inland cities tend to have lower rates of obesity than their coastal counterparts (Ji & Cheng, 2008). Our findings also extend this previous research by studying prevalence rates in a small Chinese inland city like Jintan and including an examination of a number of associated factors.

No significant variation in this study was identified in relation to parental education level, maternal age at the time of giving birth, or breast-feeding practice in the first 4 to 6 months. However, we found the prevalence of overweight and obesity to be significantly associated with maternal employment status. Our study showed that the prevalence of overweight and obesity increased when mothers were employed. A relationship between childhood overweight and obesity and fathers' employment status was not observed. Our results were consistent with other studies (Anderson, Butcher, & Levine, 2003; Hawkins et al., 2008). Maddah (Maddah & Nikooyeh, 2010) recently reported that children with more educated mothers had a higher prevalence of overweight than children with less educated mothers in Iran. While it could be hypothesized that more educated mothers are more likely to be employed, maternal education level was not significantly associated with childhood obesity in our study. In addition, other literature has consistently demonstrated a positive relationship between maternal employment and children's overweight status. For instance, Kang (Kang et al., 2006) also reported a high prevalence rate of obesity among the children of employed mothers in Korea. Anderson and Hawkins reported that maternal employment was associated with an increased prevalence of childhood obesity, which was particularly observed in families of a high socioeconomic level or high annual family income. Studies have shown that a child is more likely to be overweight if his/her mother worked more hours per week over the course of the child's life (Anderson et al., 2003; Anderson, 2012). Hawkins also reported that maternal employment of 21 hr/week or more was associated with early childhood overweight status (adjusted odds ratio was 1.23, 95% CI, 1.10 to 1.37) as compared to those mothers who had never worked (Hawkins et al., 2009). This finding may be due to the possibility that working mothers spend less time preparing meals for their children, as studies have shown that eating dinner at home is associated with a lower risk for

being overweight (Veugelers & Fitzgerald, 2005). Brown and colleagues (Brown et al., 2010) recently investigated the factors affecting children's weight at ages 4 to 5 years and 6 to 7 years. The results in a cross-sectional survey indicated that long work hours for mothers increased risk for their child's overweight at age 4 to 5 years, but did not predict children's weight status 2 years later (Brown et al., 2010). Other factors could contribute to the noted trends in overweight and obesity. When mothers spend more time away from home, their children may either remain unsupervised or spend time under the care of others. Without parental supervision, children may be more likely to stay indoors (watching TV or playing video games), as opposed to engaging in physical activity. While we do not have data about family income, it is also possible that having both parents working may result in greater family income and higher SES, which are factors that have been linked with obesity in rapidly developing countries. Further research is needed to explore the relationships among unsupervised time or time supervised by nonparent guardians, children's dietary intake and physical activity, and childhood obesity.

It has been reported that breast-feeding protects against overweight and obesity among preschool children (Armstrong & Reilly, 2002; Bergmann et al., 2003; Hawkins et al., 2009; Liese et al., 2001; Poulton & Williams, 2001; Twells & Newhook, 2010). Other studies have provided no support for a protective effect of breast-feeding on obesity (Vafa, Moslehi, Afshari, Hossini, & Eshraghian, 2012; Li, Parsons, & Power, 2003). Indeed several meta-analyses have evaluated this relationship, yielding conflicting conclusions (Arenz, Ruckerl, Koletzko, & von Kries, 2004; Harder, Bergmann, Kallischnigg, & Plagemann, 2005; Owen et al., 2005; Owen, Martin, Whincup, Smith, & Cook, 2005). Our results did not suggest a protective effect of breast-feeding on overweight and obesity. Possible explanatory reasons include the small sample size, and the fact that most of the investigated children were breast-fed (the percentage of only or mostly breast-fed was 78.3%), thereby making it difficult to identify the effect of breast-feeding on the overweight and obesity of children.

While China is not unique in its increasing Westernization in recent years, these findings may be culturally specific. The beginning of this millennium marked a time of Westernization in China, even in smaller cities like Jintan. This period was accompanied by an influx of fast-food restaurants in the community and the media, which may have contributed to an increase in the consumption of fast food rather than traditional, home-cooked meals, and, consequently, contributed to the increased prevalence of overweight and obesity (Shan et al., 2010; Wu et al., 2009; Zhang et al., 2011). Also, this study is limited by the sample size of this cohort study ($n = 136$), which is relatively small for extracting accurate information on the factors associated with prevalence of overweight and obesity. Studies among larger cohorts are needed to clarify the factors affecting childhood overweight and obesity in the future. Additionally, data on other variables that may help explain the trends in overweight and obesity, such as genetic risk, dietary energy intake, dietary fat intake, and other unmeasured socioeconomic factors (e.g., income) were not accounted for. Data collection on this same set of subjects is ongoing, given the nature of the longitudinal cohort design, and long-term evaluation can possibly address these limitations.

Nursing Implications

The current study highlights parental factors, particularly maternal employment status that increase the likelihood of developing childhood obesity among preschool children. Children whose mothers work outside the home may be at a greater risk for becoming overweight and obese. This may be due to a lack of dietary and physical activity supervision. It is thus important that in the absence of direct parental supervision, children are provided with healthy food choices and activities and thus adopt healthy behaviors from a young age.

In light of the adverse health consequences that are known to stem from childhood overweight and obesity, both clinical and nonclinical interventions are necessary to help reduce the prevalence of these conditions. In primary care, pediatric nurses can provide parents with important information and strategies for preventing childhood obesity. Possible actions include an assessment of parents' and children's food knowledge, providing healthy food choices at home, and advising parents on nutritional home-cooked meals especially for working mothers, encouraging physical activity or participation in group sports, and monitoring children's weight on a regular basis.

Schools could work to provide after-school care programs which are attentive to improving children's dietary habits and reducing sedentary behaviors. Furthermore, schools should make sure that these programs are available and accessible to all children, and to encourage parents to enroll their children in these or related programs. Moreover, since children in China are not routinely examined unless ill, school nurses are essential providers for monitoring children's weight on a regular basis. School nurses also play a critical role in educating children during school about healthy habits to adopt even when they are outside the school and potentially home alone. In addition, interventions can focus on providing students with healthy lunches and snacks, promoting physical activities such as after-school team sports, and educating students on the importance of healthy eating and physical activity. This education and engagement could also directly or indirectly involve the parents, for example by promoting school projects in which parents can be involved and gain awareness of the diet and ideal growth and development of their children.

In conclusion, this study evaluated the changing rates of childhood overweight and obesity in our sample and examined the associated factors. The prevalence of overweight and obesity has been increasing at a dramatic rate, and the prevalence of overweight in children with employed mothers was found to be higher than that among children with stay-at-home mothers.

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Figure 1.

The prevalence of overweight and obesity in the investigated children in Jintan City from 2004 to 2007.

Table 1

The Prevalence Distribution of Overweight and Obesity Associated With Parental Education and Occupation in the Investigated Children.

Factorss	<i>n</i> ^a	Overweight(%)	Obesity(%)	Overweight + obesity (%)
Father education				
Lower than middle school	35	5 (14.3)	2 (5.7)	7 (20.0)
High school	42	4 (9.5)	4 (9.5)	8 (19.0)
College or higher	59	12 (20.3)	3 (5.1)	15 (25.4)
χ^2		2.246	0.911	0.696
<i>p</i>		.325	.681 ^b	.706
Mother education				
Lower than middle school	42	7 (16.7)	4 (9.5)	11 (26.2)
High school	47	5 (10.6)	2 (4.3)	7 (14.9)
College or higher	47	9 (19.1)	3 (6.4)	12 (25.5)
χ^2		1.374	1.040	2.15
<i>p</i>		.503	.629 ^b	.341
Father				
Having a job	114	19 (16.7)	7 (6.1)	26 (22.8)
Without a job for at least one year	13	1 (7.7)	1 (7.7)	2 (15.4)
χ^2		0.830	0.045	0.403
<i>p</i>		.690 ^b	.589 ^b	.732 ^b
Mother				
Having a job	103	19 (18.4)	7 (6.8)	26 (25.0)
Without a job for at least one year	21	0 (0.0)	1 (4.8)	1 (4.8)
χ^2		7.721	0.129	5.533
<i>p</i>		.041 ^b	1.000 ^b	.043 ^b

Note:

^aThe sample size for some variables is different from the overall sample size due to missing information.

^bFisher's exact test, the minimum expected count is < 5.

Table 2

The Prevalence Distribution of Overweight and Obesity in the Investigated Children Associated With Maternal Factors.

Maternal age at birth	<i>n</i> ^a	Overweight(%)	Obesity(%)	Overweight + obesity(%)
24	30	4 (13.3)	1 (3.3)	5 (16.7)
25–29	94	15 (16.0)	7 (7.4)	22 (23.4)
30	12	2 (16.7)	1 (8.3)	3 (25.0)
χ^2		.236	.788	.710
<i>p</i>		1.000	.740	.750 ^b
Breast-feeding practice				
Breast-feeding only or mostly	83	16 (19.3)	5 (6.0)	21 (25.3)
Bottle feeding only or mostly	10	1 (10.0)	1 (10.0)	2 (20)
Half and half	13	0 (0.0)	0 (0.0)	0 (0.0)
Fisher's exact test		<i>p</i> = .683	<i>p</i> = .505	<i>p</i> = 1.000

Note:

^aThe sample size for some variables is different from the overall sample size due to missing information.

^b χ^2 -test.

Table 3

Multiple Logistic Regression for Factors Associated With Overweight or Obesity in Children.

	OR	95% CI
Father employment		
Without a job for at least 1 year	1	—
Having a job	0.424	0.05–3.30
Mother employment		
Without a job for at least 1 year	1	—
Having a job	17.76*	1.69–187.08
Breast-feeding practice		
Mostly breast	1	—
Mostly Nonbreast	0.893	0.12–6.86
Half and half	0.000	
Maternal age at birth		
24	1	—
25–29	1.89	0.37–9.60
30	3.43	0.29–40.71

Note:

*
 $p < .05$.

CI = confidence interval. OR = odds ratio.