Original Article

The Influence of Secular Trends in Body Height and Weight on the Prevalence of Overweight and Obesity among Chinese Children and Adolescents*

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Abstract

Objective To explore the influence of secular trends in body height and weight on the prevalence of overweight and obesity among Chinese children and adolescents.

Methods The data were obtained from five cross-sectional Chinese National Surveys on Students' Constitution and Health. Overweight/obesity was defined as BMI-for-age *Z*-score of per the Wold Health Organization (WHO) reference values. Body height and weight for each sex and age were standardized to those reported in 1985 (standardized height: SHY; standardized weight: SWY) and for each sex and year at age 7 (standardized height: SHA; standardized weight: SWA) using the *Z*-score method.

Results The prevalence of overweight/obesity in Chinese children was 20.2% among boys and 10.7% among girls in 2010 and increased continuously from 1985 to 2010. Among boys and girls of normal weight, SHY and SHA were significantly greater than SWY and SWA, respectively ($P < 0.001$). Among boys and girls with overweight/obesity, SHY was significantly lower than SWY ($P < 0.001$), and showed an obvious decreasing trend after age 12. SHA was lower than SWA among overweight boys aged 7-8 years and girls aged 7-9 years. SHY/SHW and SHA/SWA among normal-weight groups were greater than among overweight and obese groups ($P < 0.001$).

Conclusion The continuous increase in the prevalence of overweight/obesity among Chinese children may be related to a rapid increase in body weight before age 9 and lack of secular increase in body height after age 12.

Key words: Obesity; Children; Secular trends; Body height; Body weight

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INTRODUCTION

Obesity/overweight is associated with a number of health risks, including cardiovascular diseases, type 2 diabetes mellitus, respiratory and skeletal muscle problems, and psychological problems[1-4] and has become an important global health challenge. Over the past few decades, the prevalence of overweight and obesity among children and adolescents has been increasing

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in both developed and developing countries. Hossain reported that there were at least 155 million overweight or obese children all over the world[5]. In European countries, the number of children with obesity in the 2000s was 10 times higher than in the 1970s[6]. In the United States, 16.9% of children and adolescents aged 2-19 years were obese[7]. Ji and Ma reported that the prevalence of childhood overweight/obesity increased from 1.62% and 0.93% in 1985 to 7.8% and 16.0% in 2005, and to 10.6% and 18.5% in 2010, among girls and boys, respectively[8-9].

It is well known that body mass index (BMI, weight in kilograms divided by the square of height in meters) is one of the most highly recommended and widely used tools for defining childhood overweight and obesity[10-11]. The prominent secular trends in child body height and weight have been shown since the 1980s, especially in developed countries such as European countries and the United Sates[12-17]. In Chinese children, increasing secular trends in body height and weight in the second half of the 20th century has been well documented[18-20]. However, it remains unknown whether the increase in the prevalence of child overweight/obesity over the years is caused by a too fast secular increase in body weight or the lack of a secular increase in body height among Chinese children and adolescents.

The purposes of the study are to explore the influence of secular trends in body height and weight on the prevalence of childhood overweight or obesity.

METHODS

Study Population and Data Sources

The study used data from the Chinese National Surveys on Students' Constitution and Health (CNSSCH) from 1985, 1995, 2000, 2005, and 2010. The CNSSCH was jointly launched by the Ministry of Education, the National Health and Family Planning Commission, the Ministry of Science and Technology, the State of National Affairs, and the State Sports General Administration in China in 1985 and has been conducted every 5 years since 1995[19,21-24]. The participants in the CNSSCH were selected by stratified cluster random sampling from 30 of 31 provinces in China. The detailed sampling procedure has been published elsewhere[21-24]. In the present study, the participants only included children and adolescents aged 7-18 years of the Han nationality. The sample sizes were 409,946 (205,100 boys and 204,846 girls) in 1985, 204,894 (103,084 boys and 101,810 girls) in 1995, 207,397 (103,804 boys and 103,593 girls) in 2000, 232,138 (116,676 boys and 115,462 girls) in 2005, and 215,280 (107,651 boys and 107,629 girls) in 2010. The project was approved by the Medical Research Ethics Committee of Peking University Health Science Center (IRB00001052-13082).

Measures

Body height and weight measurements were obtained from the five CNSSCH surveys. The same types of instruments were used to measure body height (cm) and weight (kg) as per standard procedures over the five CNSSCH surveys[19,21-24]. The participants were required to wear only light clothes and to stand straight, barefoot, and at ease when being measured. Body weight was measured to the nearest 0.1 kg using level scales. Body height was measured to the nearest 0.1 cm with metal column height measuring stands. Both instruments were routinely calibrated before daily use to reduce daily biases. The measurements were conducted by professional technicians who passed a training course for anthropometric measurements. Overweight was defined as BMI-for-age *Z*-score at or above +1 standard deviation (SD), but lower than +2 SD; obesity was defined as BMI-for-age *Z*-score at or above +2 SD; and normal weight was defined as BMI-for-age *Z*-score at or above −2 SD, but lower than +1 SD, according to the WHO reference for children aged 5-19 years[25-26].

Statistical Analysis

Data were analyzed using IBM SPSS data statistics 20.0 software. The prevalence rates of overweight and obesity in different survey years were calculated for each sex and age group (7-18 years). The secular trends in child body height and weight over survey years (from 1985 to 2010) and ages (from 7 to 18) were demonstrated using standardized body height and weight to reveal the changes in prevalence of childhood overweight/obesity. Body height and weight were standardized by two approaches: one by data in the 1985 survey year and the other by data at age 7. Standardized body height (SHY) and weight (SWY) based on data from 1985 were calculated using the *Z*-score method[27] (Formula 1).

$$x'_y = \frac{X - \bar{X}_{1985}}{s} \quad (1)$$