Original Article

Changes in Waist Circumference and Abdominal Obesity among Chinese Adults over a Ten-year Period*

ZHAI Yi[1], FANG Hong Yun[2], YU Wen Tao[2], YU Dong Mei[2], ZHAO Li Yun[2], LIANG Xiao Feng[1], and ZHAO Wen Hua[2,#]

1. Chinese Center for Disease Control and Prevention, Beijing 102206, China; 2. National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing 100050, China

Abstract

Objective The aim of this study was to describe changes in waist circumference (WC) and prevalence of abdominal obesity over a period of 10 years among Chinese adults in different socio-economic status (SES).

Methods Data derived from the China Nutrition and Health Surveillance during 2002 and 2010-2012. We calculated the mean WC and the prevalence of abdominal obesity by gender, place of residence, SES indicators (education, income, and marital status), and body mass index (BMI) categoriesand used pooled *t*-tests to assess the differences between the two time periods.

Results 26.0% of men and 25.3% of women had abdominal obesity in 2010-2012. The age-adjusted mean WC increased by 2.7 cm among men and 2.1 cm among women; the age-adjusted prevalence of abdominal obesity increased by 7.7% among men and 5.3% among women. The rising trends were observed in all subgroups except for a negative growth in high-income women. People living in rural areas with low education and income and with a BMI of 18.5 to 23.9 kg/m^2 had a greater absolute and relative increase in WC. People living in rural areas with low income had a greater relative increase in abdominal obesity.

Conclusion The mean WC and prevalence of abdominal obesity among Chinese adults have increased during the past 10 years. Gender differences were noted using various SES indicators.

Key words: Waist circumference; Abdominal obesity; Socio-economic indicators; Trends; China

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INTRODUCTION

Obesity as a major health issue is closely associated with morbidity and mortality from chronic disease[1]. Normally, we used the body mass index (BMI) to evaluate obesity in the population. Waist circumference (WC) provides a complementary measure of excess bodyweight. Accumulating evidence showed that measurement of abdominal obesity was strongly and positively associated with all-cause CVD and cancer mortality[2-3] independently of general obesity and may be a better predictor for the risk of myocardial infarction[4], type 2 diabetes[5], and metabolic syndrome[6]. The increase in WC in the population has been greater than expected from the observed increases in BMI among US adults. Adverse health consequences associated with obesity may be

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#Correspondence should be addressed to Dr. ZHAO Wen Hua, E-mail: zhaowh@chinacdc.cn, Tel: 86-10-66237120.

Biographical note of the first author: ZHAI Yi, female, born in 1978, PhD candidate, majoring in non-communicable diseases control and prevention.

increasingly underestimated by trends in BMI alone. Since WC is closely linked to adverse cardiovascular outcomes, it is important to know the prevailing trends in both of these parameters[7].

In addition to genetic and lifestyle factors, many socio-demographic and socio-economic indices are closely associated with obesity[8]. Obesity may affect men and women with different socio-economic status to a different degree[9]. Some studies reported large and persistent social inequalities in obesity and overweight by age, gender, educational level, and socio-economic status[10-11]. However, there has been a limited report on the secular trends in abdominal obesity, especially in changes of WC and abdominal obesity according to various socio-economic indicators, which are worth investigating. Here we analyzed the recent secular trends in mean WC and the prevalence of abdominal obesity among Chinese adults by gender and socio-economic status between 2002 and 2010-2012 using comparable and nationally representative cross-sectional data from China Nutrition and Health Surveillance (CNHS).

METHODS

Study Design and Subjects

This study examined data from two cross-sectional surveillance programs of China: China Nutrition and Health Surveillance conducted in 2002 and 2010-2012. Participants were selected using a multi-stage and proportional to population size sampling design, which included 132 monitoring sites in 2002 and 150 sites during 2010-2012. The National Bureau of Statistics (NBS) and the Chinese Center for Disease Control and Prevention (China CDC) assisted in the sampling of each county (city and region) and village (neighborhood) committees. Project teams at county (district) levels selected sample households for the principle of uniform sampling. The selected sample was representative of China from urban and rural areas. The physical examinations response rates were 87.9% in 2002[12] and 76.5% in 2010-2012[13]. A total of 142,240 subjects in 2002 and 119,856 subjects in 2010-2012 were analyzed. Pregnant women were excluded. Ethics approval was obtained from the Ethics Committee of the National Institute for Nutrition and Food Safety, China CDC (IRB code: 2013-018). Informed consent forms were signed by the participating subjects.

Measurements and Definitions

The survey included inquiries and medical physical examinations. The inquiring survey covered basic information such as age, nationality, marital status, education, occupation, and financial income of the family members. Education, household income, and marital status were used as socio-economic indicators. Education was divided into three categories: (1) ≤ 6 years of schooling (elementary school or lower); (2) 7-12 years of schooling (high school); and (3) ≥ 13 years of schooling (junior college or higher). Taking into account the increase in income level, different options were used in the two programs. Household annual per capita income was grouped into three categories. In CNHS 2002: (1) low level: ≤ 1,999 Yuan (1 US dollar = 8.28 Yuan RMB in 2001); (2) medium level: 2,000-9,999 Yuan; (3) high level: ≥ 10,000 Yuan. In CNHS 2010-2012: (1) low level: < 10,000 Yuan (1 US dollar = 6.83 Yuan RMB in 2011); (2) medium level: 10,000-24,999 Yuan; (3) high level: ≥ 25,000 Yuan. Marital status was categorized as: (1) unmarried, including single, widowed or separated; (2) married.

Physical examinations were performed by health professionals from the local county CDCs. Body height and weight were measured using standard protocols (without shoes and outerwear). Height was measured to the nearest 0.1 cm on a column stadiometer and weight to the nearest 0.1 kg on a lever weight scale. WC was measured to the nearest 0.1 cm by a non-elastic flexible tape. We used the method recommended by the World Health Organization (WHO), which consists measuring midway between the lowest rib margin and the iliac crest at the mid-axillary line[14]. BMI was calculated as weight (kg)/height squared (m^2). BMI was categorized as: (1) low BMI: < 18.5 kg/m^2; (2) normal BMI: 18.5-23.9 kg/m^2; (3) overweight: 24.0-27.9 Kg/m^2; and (4) obesity: ≥ 28 kg/m^2. Pre-abdominal obesity was defined as WC of 85-89.9 cm for men and 80-84.9 cm for women while abdominal obesity was defined as WC ≥ 90 cm for men and ≥ 85 cm for women[15].

Statistical Analysis

This study analyzed the mean and standard error (SE) of WC and the prevalence of abdominal obesity and 95% confidence interval (*CI*) in men and non-pregnant women ≥ 18 years old for subgroups defined by age, place of residence, education,