

Original Article



Vegetable and Fruit Consumption among Chinese Adults and Associated Factors: A Nationally Representative Study of 170,847 Adults *

LI Yi Chong^{1,2,^}, JIANG Bo^{3,^}, ZHANG Mei¹, HUANG Zheng Jing¹, DENG Qian¹,
ZHOU Mai Geng¹, ZHAO Zhen Ping¹, WANG You Fa^{4,5,#}, and WANG Li Min^{1,#}

1. National Center for Chronic Non-communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing 100050, China; 2. Peking University Clinical Research Institute, Beijing 100191, China; 3. Beijing Center for Disease Prevention and Control, Beijing 100191, China; 4. Global Health Institute, Health Science Center, Xi'an Jiaotong University, Xi'an 710049, Shanxi, China; 5. Fisher Institute of Health and Well-being, Systems-Oriented Global Childhood Obesity Intervention Program, Department of Nutrition and Health Sciences, College of Health, Ball State University, Muncie, IN 47306, USA

Abstract

Objective This study examined vegetable and fruit (VF) consumption rate and its associated factors among Chinese adults.

Methods Nationally representative data from the 2013 China Chronic Disease Surveillance survey were used. Dietary intake data, including VF consumption during the last 12 months, were collected. All analyses were weighted to obtain nationally representative estimates. Associations between VF consumption and other factors (e.g., meal frequency and physical activity) were examined through logistic regression analysis.

Results The average fruit consumption was 102.3 g/day (95% CI: 97.0-107.6) and the average vegetable consumption was 350.6 g/day (95% CI: 339.3-361.8). Over half (53.2%, 95% CI: 50.9-55.4) of Chinese adults met the VF consumption of 400 g/day recommended by the World Health Organization (WHO). Rural residents had a higher prevalence of low VF consumption rate than urban residents [49.20% (95% CI: 46.2%-52.2%) vs. 44.0% (95% CI: 41.7%-46.3%) $P < 0.01$]. Old age ($OR = 1.01$, 95% CI: 1.00-1.01), low educational level, low income, minority ethnicity ($OR = 1.41$, 95% CI: 1.15-1.74), underweight ($OR = 1.17$, 95% CI: 1.03-1.33), single marital status ($OR = 1.20$, 95% CI: 1.08-1.33), low health literacy, irregular breakfast ($OR = 1.20$, 95% CI: 1.04-1.38) or lunch ($OR = 1.58$, 95% CI: 1.26-1.99) habits, and no leisure-time physical activity were associated with low VF consumption.

Conclusion Only half of Chinese adults met the VF consumption recommended by the WHO. Low socio-economic status, irregular diet, and poor health literacy were likely associated with low VF consumption. National efforts and programs are needed to promote VF consumption.

Key words: Fruit; Vegetables; China Noncommunicable and Chronic Disease Surveillance survey; China

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[^]These authors contributed equally to this work.

[#]Correspondence should be addressed to WANG You Fa, E-mail: youfawan@buffalo.edu or youfawang@gmail.com; WANG Li Min, E-mail: wlm65@126.com

Biographical notes of the first authors: LI Yi Chong, male, born in 1982, PhD, majoring in epidemiology; JIANG Bo, male, born in 1989, MMed, majoring in epidemiology.

INTRODUCTION

Disease patterns have changed rapidly in China over the past three decades. Specifically, the occurrence of noncommunicable diseases (NCDs) has increased^[1-2]. Shifts in people's dietary patterns may have contributed to this change^[3]. The adequate consumption of vegetables and fruits (VF) is necessary for a healthy lifestyle. VF consumption is associated with the low risk of chronic diseases^[4], and high VF consumption is related with the low risk of mortality from all causes^[5]. The 2015 Global Burden of Disease study showed that worldwide, the total number of deaths attributable to low VF consumption was 2.0 million and 2.9 million, respectively. The global disability adjusted of life years (DALYs) attributed to low vegetable consumption was 44.6 million and that to low fruit consumption was 72.6 million. In China, low fruit consumption ranked ninth among the 15 leading level-3 risk factors for DALYs^[2].

The dietary guidelines of different countries recommend a certain level of VF consumption. VF consumption was a key target of some nationwide health-promotion programs, including that in China. The Chinese Dietary Guidelines for adults recommend consuming 200-400 g/day of fruits and 300-500 g/day of vegetables^[6]. The Korean recommendation was 80-240 g/day for fruits and 400-560 g/day for vegetables in accordance with age-sex groups^[7]. The US Healthy People 2010 program aimed to increase the proportion of Americans who eat ≥ 160 g of fruit per day to 75% and those who eat ≥ 240 g of vegetables per day to 50%. The France Programme National Nutrition Santé for 2001-2010 aimed to reduce the low French VF consumption rate (< 280 g/day) by 25%^[8]. The WHO recommended total VF consumption of at least 400 g/day for an adult.

Given the importance of adequate VF consumption in maintaining a healthy diet, we used nationally representative data to examine VF consumption among Chinese adults and the disparities in VF consumption across Chinese subpopulations. We also identified the association of factors, such as meal frequency and physical activity, with VF consumption.

METHODS

Data Source and Survey

Data were originally collected in the 2013 China

Chronic Disease and Risk Factors Surveillance survey, which included 298 survey sites (districts/counties) in all 31 provinces, autonomous regions, and municipalities of mainland China. The surveillance was administered by the National Center for Chronic and Non-communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention. Previous research had demonstrated that the surveillance was nationally representative^[9].

Participants were selected from each study site using a multistage sampling design. In the first stage, four townships were selected from each study site using the method of probability proportional to size. Then, three villages were selected from each sampled township by the same method used in the previous stage. All households were listed within each selected village, from which 50 households were randomly selected. Finally, an adult aged 18 years or older was randomly selected from each household using the Kish grid method^[10]. If a sampled individual refused to participate, the household was replaced by a neighboring family with a similar member structure. This replacement strategy guaranteed a sufficient sample size for each survey area.

Data were collected by trained interviewers using a questionnaire, which included demographic information, food consumption frequency, and lifestyle-related factors. Height and weight were measured with standardized tools. All data collectors were trained to follow standardized study protocols, and only qualified staff performed data collection. Data were double-entered and double-checked.

A total of 177,305 participants completed the interviews. The replacement families were selected from the same residential area, and the overall replacement rate was 6.3%. A subsample of 565 observations from one survey site was deleted given data quality concerns, and 5,893 observations were excluded because of missing VF consumption data. The final analysis for estimating VF consumption and for studying factors associated with VF consumption included 170,847 and 160,897 individuals with complete data, respectively.

Dependent Variables

The quantity and frequency of VF consumption were measured with the food consumption frequency questionnaire. To assess fruit consumption, each respondent was asked: 'In the last 12 months, did you eat fruit?' If he/she responded yes, the respondent was further asked

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