Original Article

Why is there gender disparity in the body mass index trends among adults in the 1997-2011 China health and nutrition surveys?

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Background and Objective: Over the past three decades, the prevalence of overweight and obesity in China has increased greatly. Chinese body mass index (BMI) dynamics have shown much greater rates of changes among men, aged 18-45 years, than among women. This study examined the gender difference in the BMI trends and related factors. **Methods and Study Design:** We used longitudinal data from the China Health and Nutrition Survey collected in 1997, 2000, 2004, 2006, 2009 and 2011. A total of 10,982 participants (N=5339 men and 5643 women) aged 18-45 years were included in the final analysis. Lambda mu sigma method (LMS) was used to describe changes of BMI distribution. Separate sex-stratified multilevel random intercept-slope growth models were applied to examine effects of individual and community variables on BMI trends of Chinese adults. **Results:** Male BMI increased by 0.21 kg/m^2 overtime, which was larger than female BMI at 0.16 kg/m^2. Higher income, drinking and away-from-home food consumption were associated with higher BMI, and these variables were only significant among men. Physical activity (PA) had a negative association for both genders. **Conclusions:** Since different variables resulted in gender disparity in BMI trends among Chinese adults, separate health policies should be developed for men and for women.

Key Words: body mass index, obesity, overweight, gender disparity, China

INTRODUCTION

Though obesity is traditionally associated with developed countries, it has now become a pandemic health concern that includes developing countries such as China, as well.[1-3] The prevalence of overweight and obesity of Chinese adults rose rapidly in the most recent decade, reaching at 30.6% and 12.0% in 2010, respectively.[4] Researchers have reported that the prevalence of overweight and obesity has been increasing faster in men than in women since the 1990s, especially in the middle-aged Chinese population.[5,6] Researches from other countries have also found a similar phenomenon. Data from Canadian surveys showed that the distribution of BMI has shifted to the right since the 1970s, especially among men, and that men were more likely to be overweight than women.[7] Findings from the Korea National Health and Nutrition Examination Surveys also indicated gender differences in obesity trends.[8]

China has experienced dramatic economic and social changes in the past decades that have affected people's lifestyles, especially the way they eat, drink and move. The Chinese people have rapidly increased their consumption of edible oils, animal source foods, snacks and fried food and have adopted many other unhealthy behaviors.[9] At present, eating away from home is playing a larger part in the Chinese diet, due to rapid urbanization and income growth. These changing conditions are promoting significant gender disparities in BMI trends. As a result of all these factors, China's history of undernutrition has been followed by a rapid increase in obesity and obesity-related diseases, with differential rates across rural and urban areas.[10-11]

On the PA side, urbanization worldwide has provided many benefits in living, transportation, health service and other facilitative community aspects. However, rapid urbanization has had certain deleterious impacts on the eating habits, lifestyles and the overall health of individuals within developing communities, causing a significant nutritional transition in Africa, China and India, for instance.[12] A recent study has demonstrated that rapid changes in mechanized transportation, home production and market production have led to a dramatic reduction of total PA in China.[13] It is, therefore, essential to consider community-level effects as one of the most important var-

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iables in the growing obesity epidemic.

Several analyses have investigated a number of individual-level effects on overweight in Chinese adults. As attained education is typically an indicator of socioeconomic status, Jones Smith found that low socioeconomic status has become associated with higher BMI and increased odds of overweight among Chinese women, while higher socioeconomic status remains a risk factor for overweight among Chinese men,[14] which demonstrates the education attainment disparities. There are also regional differences, as women living in communities with different initial urban scores have different odds of becoming overweight/obese.[3] To our knowledge, few researchers have examined both the individual- and the community-level effects on Chinese BMI trends that may result in gender differences in the prevalence of overweight and obesity. In this multi-level study, we examined the association of these variables with different changes in BMI trends among men and women in China.

MATERIALS AND METHODS

Study population

Data were derived from the China Health and Nutrition Surveys (CHNS), a prospective household-based study conducted between 1989 and 2011 that included individuals of multiple ages across nine rounds of surveys from nine diverse provinces (Heilongjiang, Liaoning, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi and Guizhou) and three mega-cities (only in 2011). A multistage, stratified sampling design was used to ensure that CHNS provided a fair representation of urban and rural areas. Using sampling strategy, two cities and four counties per province were selected based on income. Within cities, two urban and two suburban communities were randomly selected based on urbanicity. Within counties, one community in the capital city and three rural villages were randomly chosen also based on urbanicity. Twenty households per community were then randomly selected for participation. The data were collected by trained and certified health workers. Survey protocols, instruments and the process for obtaining informed consent for this study were approved by the institutional review committees of the University of North Carolina at Chapel Hill as well as the National Institute for Nutrition and Health, which is affiliated with Chinese Center for Disease Control and Prevention. Participants provided their written, informed consent. Additional details regarding the CHNS data are provided elsewhere.[15]

Our samples included the six most recent rounds of CHNS, which were collected in 1997, 2000, 2004, 2006, 2009 and 2011. We limited the sample to participants between 18 and 45 years old who were not disabled, pregnant or lactating during a particular wave and had complete data. This meant the exclusion of all observations from the three megacities (Beijing Shanghai and Chongqing), as data were collected in those areas in 2011 only. Our final analysis sample included 11,963 male-wave observations and 12,161 female-wave observations.

Dependent variables

Anthropometry

Weight and height were measured following standardized protocols from the Word Health Organization (WHO) by trained field staff. Weight was measured without shoes and in light clothing to the nearest 0.1 kg on a calibrated beam scale; height was measured without shoes to the nearest 0.1 cm using a portable stadio-meter. BMI was calculated as weight (in kg) divided by height (in m) squared. According to the Chinese definitions, overweight and obesity were defined using BMI (weight in kilograms/height meters^2) cutoff points of 24 and 28, respectively. We used BMI as a continuous variable.

Individual-level variables

All analyses were stratified by gender in order to determine differences between men and women in China. There are two kinds of variables in this analysis. The first is categorical variables. For example, time was defined as six waves (0=1997; 1=2000; 2=2004; 3=2006; 4=2009; 5=2011). Age was categorized into five groups (0=18-24; 1=25-29; 2=30-34; 3=35-39; 4=40-45). Marital status was dichotomous (0=others; 1=currently married). Education was categorized into three groups (0=a primary school education or less; 1=a middle school education; 2=a high school or college education). Smoking status was dichotomous (0=not current smoking; 1=current smoking), as were drinking status (0=not current drinking; 1=current drinking) and eating away from home (0=no; 1=yes).

The second kind of variable is continuous. Individual income was based on reported gross annual per capita household income, which was inflated to 2011 values.[16] The average metabolic equivalent hours per day was used to indicate the PA level, which included four domains: occupational, domestic, leisure and travel. A unit of MET is defined as the ratio of a person's working metabolic rate relative to his/her resting metabolic rate. How these values were calculated is described in previous papers.[17,18] Detailed dietary consumption data was estimated from three consecutive 24-h recalls for each individual, supplemented with a daily inventory of all available foods in the household.[19] We used the 3-day mean percentage of energy intake from fat in this study.

Community-level variable

A multidimensional index was developed specifically for the CHNS to capture the urbanization level in Chinese communities.[3] This method, which measures various dimensions of urbanization, has been previously used in papers.[17,20,21] In this study, the urbanization index was divided into tertiles (0=low urbanization, 1=middle urbanization and 2=high urbanization) and was included as a categorical variable in statistical models.

Statistical analysis

First, we calculated descriptive statistics on individual demographic variables stratified by gender in each survey wave. Continuous variables were presented as means and standard deviations (SD). Categorical variables were expressed as percentages. We used trend Chi-square tests for categorical variables and Kruskal-Wallis tests for continuous variables to examine the changes over time and note when there were statistically significant differences in means (or percentages) among the selected years when $p<0.01$. Since the age distributions across the six study

periods were greatly different, all survey data were standardized to the age distribution of the China Census population in 2010.[22]

Second, we used the LMS method from the VGAM package (R version 3.0.3) to present figures for the distribution of BMI in 1997 and 2011, which reveals shifts in obesity measures (Figure 1).

Finally, separate sex-stratified multilevel random intercept-slope growth models were used to investigate the outcome effects of covariates measured at different levels of a hierarchy on the outcome. Model 1 controlled for time only to examine the time effects on BMI growth. The individual-level variables were then added into the equation to estimate Model 2. These consisted of age, marital status, education level, smoking, drinking, per capital family annual income, eating away-from home, PA and percentage of energy take from fat. For Model 3, the community-level variable was added onto Model 2. Interaction terms were included in Model 4 only if they improved the model fit significantly. Models were compared using the difference between the deviances as a negative twice likelihood ratio (-2 LL) statistic to indicate whether one model was a significant improvement over the other. Descriptive analyses and multilevel random intercept-slope growth models were conducted using SAS 9.2 (SAS Institute, Cary, NC).

RESULTS

Table 1 shows the characteristics of the study sample.

Trends of BMI distribution curves among men and women

Figure 1 shows the smoothed distribution curves using LMS methods of BMI shifted over time among men and women aged 18-45 years, for selected years. For both genders, the main characteristic of the changes was the shift to the right in the curves, with the distributions becoming wider and a higher proportion of the samples having a higher BMI. During the entire period, the distribution curve moved a lot for men but moved only a little for women.

The association between different level factors based on multilevel longitudinal models

Individual-level fixed effects in multilevel random intercept-slope growth models are interpreted as the average effect of the variable across communities.[21] We found a positive association between survey year and BMI for both genders (Tables 2 and 3). However, male BMI increased by 0.21 kg/m^2 overtime, which was larger than for females, whose BMI increased by 0.16 kg/m^2. Among individual-level factors for men, older age, being currently married, having a higher education level, drinking, having a higher income and away-from-home food consumption were significantly positively associated with BMI increase, while smoking and PA were significantly negatively associated. For women, older age, being currently married and their percentage of energy intake from fat were positive predictors for BMI. However, having PA was significantly associated with lower BMI for them as well.

Tables 2 and 3 also show the fixed-effects results for community-level urbanization. After adjustment for individual predictors, urbanization was significantly associated with the increase of BMI for men and women. For men, an increase of urbanization tertiles resulted in a 0.10 kg/m^2 increase in BMI; it resulted in a 0.36 kg/m^2 increase in BMI for women.

Finally, we tested cross-level interactions between urbanization and all individual-level variables to determine whether the effects of urbanization differed by individual-level characteristics. We found no evidence of significant interaction between any individual-level variable and urbanization for men. However, for women there was a significant interaction between urbanization and wave, suggesting that for women the relationship between urbanization and BMI differs by wave. There were also significantly interactions between urbanization and education level and between urbanization and percentage of energy intake from fat, which indicated that the relation-

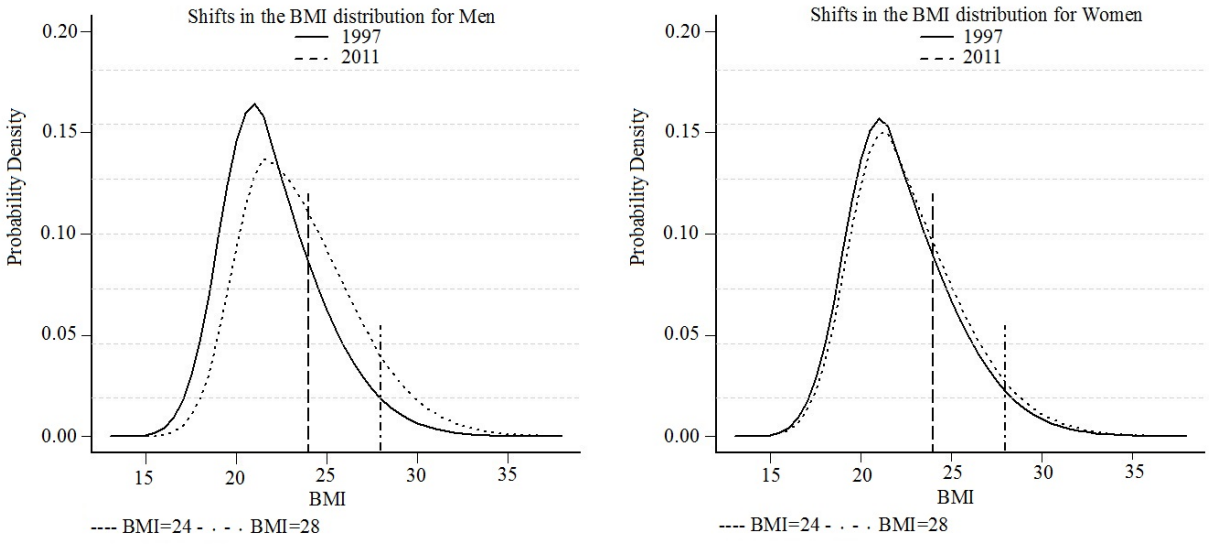

Figure 1. Shift in distribution of BMI in Chinese adults aged 18-45 years old, 1997-2011

Table 1. Characteristics of the sample

Wave	Men						Women					
	1997	2000	2004	2006	2009	2011	1997	2000	2004	2006	2009	2011
Sample size (N)	2474	2465	1967	1804	1801	1452	2270	2402	2023	1999	1888	1579
Age groups (%)*												
18-24 y	22.5	19.3	15.1	14.5	15.7	14.5	17.4	14.6	11.2	10.4	11.9	11.0
25-29 y	18.8	15.9	15.2	11.0	10.7	12.7	13.6	13.6	12.5	10.9	11.2	10.5
30-34 y	19.3	17.7	19.5	18.5	15.9	14.9	21.7	19.4	20.1	18.8	14.8	15.1
35-39 y	15.6	22.8	22.1	23.3	23.8	21.1	17.9	24.7	25.0	24.5	25.0	23.2
40-45 y	23.8	24.3	28.3	32.6	33.8	36.9	29.3	27.6	31.2	35.5	37.1	40.2
Currently married (%)*	72.3	74.3	76.0	78.0	77.2	78.0	80.2	81.8	85.4	86.6	87.0	87.0
Education level (%)*												
Illiteracy/primary	26.0	18.8	15.9	15.8	18.3	17.5	41.9	32.4	29.3	25.8	27.9	25.1
Middle school	44.9	47.1	47.9	44.0	48.7	45.7	34.2	39.7	41.2	42.7	42.9	43.7
High school and above	29.1	34.1	36.2	40.1	33.0	36.8	24.0	27.9	29.5	31.4	29.2	31.2
Smoking (%)*	61.9	60.8	61.3	58.5	60.5	58.1	2.72	2.06	2.08	1.15	1.32	1.27
Drinking (%)*	65.6	63.2	61.2	61.2	62.9	62.3	10.9	9.4	9.5	8.9	10.7	10.6
Per capital income (1000 RMB/year)*	4.27	5.47	7.37	8.77	12.0	14.9	4.30	5.59	7.26	8.50	11.7	13.9
	(3.49)	(5.73)	(7.40)	(10.2)	(14.2)	(18.5)	(3.62)	(5.66)	(7.31)	(10.8)	(12.6)	(15.8)
Away from home consumption (%)*	41.4	50.9	53.2	55.5	64.1	66.8	35.8	45.6	49.1	54.9	60.4	62.2
Total physical activity (METs/d)*	49.5	44.0	37.5	37.6	38.4	36.8	54.2	46.8	39.9	40.2	38.6	36.9
	(30.4)	(28.7)	(27.8)	(28.7)	(27.0)	(24.7)	(35.2)	(33.4)	(31.6)	(31.7)	(30.0)	(27.9)
Percentage of energy take from fat*	26.0	28.3	27.3	30.4	31.0	33.6	25.7	28.8	27.9	30.7	31.8	34.6
Urbanization index tertiles (score)*												
Low urbanization	31.8	38.2	40.6	41.2	45.0	48.4	31.6	38.1	39.9	41.4	45.0	48.2
	(5.65)	(5.84)	(5.73)	(6.13)	(6.10)	(6.30)	(5.56)	(5.89)	(6.20)	(5.97)	(6.20)	(6.25)
Middle urbanization	52.5	57.6	61.2	63.8	64.4	69.7	52.5	57.4	60.8	63.4	64.2	70.3
	(6.55)	(7.55)	(8.67)	(8.16)	(7.4)	(7.55)	(6.45)	(7.66)	(8.84)	(8.26)	(7.56)	(7.59)
High urbanization	73.5	80.2	85.6	87.3	89.5	91.3	73.7	80.4	85.7	87.1	89.3	91.4
	(5.98)	(4.68)	(5.33)	(6.03)	(6.00)	(4.89)	(5.97)	(4.61)	(5.29)	(5.88)	(5.70)	(4.81)
BMI (kg/m^2)*	22.0	22.6	22.9	23.2	23.2	23.7	22.2	22.6	22.5	22.6	22.6	22.7
	(2.74)	(3.05)	(3.17)	(3.24)	(3.46)	(3.51)	(2.82)	(3.06)	(3.17)	(3.16)	(3.32)	(3.39)

*$p<0.01$, trend Chi-square tests for categorical variables and Kruskal-Wallis tests for continuous variables.

Table 2. Coefficients from multilevel random intercept-slope growth models for men predicting changes of BMI, 1997-2011

Fixed effects	Model 1	Model 2	Model 3
Intercept	21.9 (0.046)*	20.7 (0.090)*	20.6 (0.095)*
Wave (ref=1997)	0.389 (0.014)*	0.209 (0.017)*	0.213 (0.017)*
Individual level			
Age (ref=18-24)		0.326 (0.024)*	0.324 (0.024)*
Current married (ref=no)		0.630 (0.067)*	0.629 (0.067)*
Education level (ref=no/primary)		0.267 (0.044)*	0.244 (0.045)*
Smoking (ref=no)		-0.109 (0.044)*	-0.110 (0.044)*
Drinking (ref=no)		0.128 (0.039)*	0.127 (0.039)*
Per capita family annual income		0.005 (0.002)*	0.004 (0.002)*
Eating away from home (ref=no)		0.178 (0.042)*	0.165 (0.042)*
Physical activity		-0.003 (0.001)*	-0.003 (0.001)*
Percentage of energy take from fat		0.003 (0.002)	0.002 (0.002)
Community level			
Urbanization index (ref=low)			0.104 (0.041)*
Random effects			
Intercept	7.12 (0.210)*	6.29 (0.207)*	6.26 (0.207)*
Wave	0.224 (0.016)*	0.220 (0.016)*	0.220 (0.016)*
Residual	1.69 (0.036)*	1.66 (0.039)*	1.66 (0.039)*
Model fit			
-2 likelihood ratio	53878	47110	47103

*$p<0.01$

Table 3. Coefficients from multilevel random intercept-slope growth models for women predicting changes of BMI, 1997-2011

Fixed effects	Model 1	Model 2	Model 3	Model 4
Intercept	21.9 (0.046)*	21.0 (0.094)*	21.0 (0.098)*	20.8 (0.108)*
Wave (ref=1997)	0.226 (0.014)*	0.057 (0.017)*	0.057 (0.017)*	0.156 (0.023)*
Individual level				
Age (ref=18-24)		0.489 (0.024)*	0.489 (0.024)*	0.482 (0.024)*
Current married (ref=no)		0.496 (0.084)*	0.496 (0.084)*	0.499 (0.083)*
Education level (ref=no/primary)		-0.260 (0.042)*	-0.259 (0.043)*	-0.125 (0.061)*
Smoking (ref=no)		-0.036 (0.081)	-0.036 (0.081)	-0.033 (0.081)
Drinking (ref=no)		0.004 (0.054)	0.004 (0.054)	0.007 (0.054)
Per capita family annual income		-0.003 (0.002)	-0.003 (0.002)	-0.002 (0.002)
Eating away from home (ref=no)		0.017 (0.039)	0.017 (0.040)	0.013 (0.039)
Physical activity		-0.003 (0.001)*	-0.003 (0.001)*	-0.003 (0.001)*
Percentage of energy take from fat		0.002 (0.002)	0.002 (0.130)	0.006 (0.002)*
Community level				
Urbanization index (ref=low)			-0.003 (0.039)	0.358 (0.066)*
Interaction terms				
Wave* Urbanization				-0.100 (0.016)*
Education level* Urbanization				-0.144 (0.043)*
Percentage of energy take from fat* Urbanization				-0.004 (0.002)*
Random effects				
Intercept	7.32 (0.210)*	6.57 (0.207)*	6.57 (0.207)*	6.53 (0.205)*
Wave	0.196 (0.015)*	0.180 (0.016)*	0.180 (0.016)*	0.169 (0.015)*
Residual	1.54 (0.032)*	1.48 (0.034)*	1.48 (0.034)*	1.48 (0.034)*
Model fit				
-2 likelihood ratio	54300	47444	47444	47379

*$p<0.01$

ship between urbanization and BMI also differs by education level and energy intake from fat among women.

DISCUSSION

Our longitudinal data provide evidence of an upward trend in BMI distribution among Chinese adults aged 18-45 years over the 23 years of the study. Both male and female BMI shifted to the right year by year. Although shifts to the right in the distribution of BMI between 1997 and 2011 were found among both genders, the shift in women was less evident than in men. Previous studies have documented similar increases in overweight and obesity as well as gender differences in BMI trends.[1,4-6]

Our results from multilevel longitudinal models show the association between different level factors and gender disparity in BMI trends among Chinese adults. The study identified that time had a positive association with men and women in all models. Male BMI increased by 0.21

kg/m^2 over time, which was larger than female BMI, which increased by 0.16 kg/m^2. Age was also a significant predictor between men and women; the elderly of both genders had a higher BMI. When comparing all individual-level variables, only the influence of age for women is greater than for men. For example, both genders who were currently married had higher BMI values than unmarried individuals, with a 0.63 kg/m^2 increase in male BMI and a 0.50 kg/m^2 increase in female BMI. However, higher income, drinking and engaging in away-from-home food consumption were associated with higher BMI, and these were only significant among men. What's more, the level of education had opposite effects on BMI for men and women, with a positive association for men and a negative association for women. This finding has been reported by other research.[1,14]

The obesity epidemic can be attributed to a widespread imbalance between energy intake and energy expenditure.[23] Researchers have carefully documented dietary and PA changes and their effects on obesity patterns and have shown that both are equally important in explaining these trends.[1,24,25] Chinese modernization over the decades has been resulting in rapid economic, social and cultural changes that have led to these male-female differences. For example, highly educated men often get higher incomes and have more social activities and opportunities for eating out than women.[14] When eating out, people tend to eat larger sizes, consume more energy-dense foods and increase their alcohol intake as compared with eating at home.[26,27] Yet women with a higher education level did not experience concomitant BMI changes, presumably because of either improved health knowledge or a preference for a thinner body size.[14] Some evidence indicates that desired body size among Chinese women had been tall and thin since the 1970s.[28]

For another example, people's lifestyle is influenced by age-related employment and occupational patterns. Men with a higher level of education have substantially more sedentary jobs or get less total PA than highly educated women. A nationally representative Chinese survey showed that male adults spent more time on sedentary behaviours (2.9 h/d) than female adults (2.6 h/d) in 2010.[29] Nowadays, Chinese women have not only taken on some of the responsibility to support the family together with men, but also still have to undertake the bulk of the housework in the home.

In this study, we also found that the significant negative association between urbanization and BMI differed for women by wave, education level and percentage of energy intake from fat. These findings provide more insight into how the level of education had a negative association for women, as Jones Smith reported.[14] Urbanization, while generally tending to increase BMI, had less a negative effect on women who had higher education levels. As time went by, urbanization had less effect on female BMI, though this differed depending on the percentage of energy intake from fat.

Since urbanization will continue unabated in China, it will continue to spur changes in dietary behaviour, with an increasing intake of edible oils, fried foods and animal-source foods and declines in PA due to less occupational, domestic and travel activity and more sedentary time. This phenomenon seems unlikely to reverse itself. Thus, it is urgent to conduct health promotion projects in order to educate people on how to live a more healthy life in an urban setting. For example, to encourage people to decrease the frequency of away-from-home food consumption, choosing fewer animal-source foods, eating less fast food and consuming more vegetables and fruits, in accordance with the Dietary guidelines. Additionally, policies are necessary to support the production of healthy and nutritious foods and to label all foods with relevant nutritional facts. Consumers have the right to know what nutrients their foods have. Finally, there is also a need to invest in interventions and policies that promote active leisure-time activities among all adults in China. Most recent work has shown that total PA in the CHNS, including each of the four domains of PA, has decreased for both genders.[13] Because declines in PA have occurred mostly at worksites, people have little control over increasing their PA in this domain. Technology development has created conditions of employment that reduce the amount of physical labour involved, and technological change is unavoidable. Hence, measures should be taken to encourage people to participate in leisure time PA, such as providing easy access to public spaces (build more parks and open school stadiums to the public on weekends), improving public and traffic safety to encourage active commuting (extend paths for bicycling and penalize road occupation).

This study has several strengths. First, the evidence for both the individual and the community level was added into the models. Thus, an array of variables (for instance, age, marriage status, dietary habits, education level, income, PA and urbanization) were able to be considered. This provided for a deeper and fuller analysis. Second, we used large-scale, longitudinal samples that enable us to examine the gender disparity in BMI trends among the middle aged population in China.

The study also has limitations. We did not consider the role of sex hormones that may respond to obeso-genic environmental changes and thus play a role in BMI. Hints about the possible importance of this variable lie in previous research that have indicated that the prevalence of overweight and obesity were higher among male adults than among female adults in China.[1,4-6] However, total PA had decreased more for women over time than for men, which would lead one to expect more overweight and obesity among women. Hormonal differences between the genders should be considered as a possible factor in this outcome.

In conclusion, our analysis shows that there were increases in BMI among adults in China over the past decade, and increase in BMI at the upper percentiles was larger than at the lower percentiles among both genders, but especially for men. Future work could be directed at applying quartile regression to figure out what factors have influenced people's BMI at different statuses. Intervention efforts are needed to control the increase in obesity in China.

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AUTHOR DISCLOSURES

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Original Article

Why is there gender disparity in the body mass index trends among adults in the 1997-2011 China health and nutrition surveys?

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1997-2011 年中国成人健康与营养调查中，为何体质指数变化趋势存在性别差异？

背景与目的：过去三十年间，中国成人的超重肥胖率大幅增加。有研究表明，18-45 岁中国人体质指数呈现逐年增加趋势，特别是男性。本研究主要探讨该年龄组人群体质指数变化的男女性别差异及影响因素。**方法与研究设计：**利用“中国居民健康与营养调查”的纵向数据，提取 1997、2000、2004、2006、2009 和 2011 年调查中 18-45 岁健康成年居民作为研究对象。样本共计 10892 人，其中男性 5339 人，女性 5643 人。应用偏度系数-中位数-变异系数法来拟合体质指数的分布曲线。应用多水平随机截距发展模型从个体和社区水平来研究男性和女性体质指数变化的影响因素。**结果：**中国成年人体质指数随时间变化呈上升趋势，男性每年增加 0.21 kg/m^2，女性每年增加 0.16 kg/m^2。较高的收入、饮酒和在外就餐都会导致体质指数的增加，但这些因素仅在男性有统计学意义。无论男女，增加身体活动都会降低体质指数。**结论：**鉴于影响中国成年男性和女性体质指数增加的原因不同，应该针对不同性别，采取不同的干预措施。

关键词：体质指数、肥胖、超重、性别差异、中国