# Epidemiological Characteristics of Overweight and Obesity Among Residents Aged 18-44 Years in Hebei Province, China, 2013 and 2020 [Post-print]

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## Abstract

**Background** In recent years, overweight and obesity have become increasingly prominent, constituting a major global public health challenge. China has also launched the "Weight Management Year" campaign, aiming to prevent and control chronic diseases associated with overweight/obesity at the source. However, due to regional differences in economic development levels and geographical conditions, the prevalence of overweight and obesity varies across areas. Specifically, what are the trends in overweight and obesity prevalence in Hebei Province in recent years, and what should be the focus of prevention and control efforts? These questions require urgent clarification.

**Objective** To investigate the trends and changes in overweight and obesity prevalence among residents aged 18-44 years in Hebei Province in 2013 and 2020, dynamically analyze their influencing factors, and provide evidence for the construction of "Healthy Hebei" and the formulation of weight management prevention and treatment strategies and measures.

**Methods** Data were collected from the Hebei Province Cardiovascular Disease Epidemiology Survey (May-September 2013) and the Hebei Province Residents' Cardiovascular Disease and Risk Factors Monitoring Project (April-December 2020). Various obesity indicators were employed to comprehensively assess changes in overweight and obesity prevalence among residents aged 18-44 years. Multivariate logistic regression models were used to explore influencing factors and interactions between factors, and to analyze their changes.

**Results** In 2020, the standardized detection rates of overweight, obesity, body fat percentage obesity, abdominal obesity, and high waist-to-height ratio (WHtR) among residents aged 18-44 years in Hebei Province were all higher

than those in 2013. The respective detection rates in 2013 were 32.24%, 11.49%, 24.86%, 27.03%, and 45.01%, while in 2020 they were 32.85%, 25.75%, 57.93%, 40.77%, and 59.73%. Multivariate logistic regression analysis revealed that, overall, older age groups (compared with the 18-20 age group), males, married individuals, and hypertensive patients had higher risks for all types of obesity (P<0.05). Additionally, education level of junior high school or below, being married, occupations as self-employed individual business owners and agricultural workers, insufficient physical activity, high-fat diet, fish and egg intake >1000g/week, sleep duration <6h/day, and hypertension also increased the risk of different obesity types (P<0.05). Multiplicative interaction analysis showed that married hypertensive patients had risks of obesity, body fat percentage obesity, and high WHtR that were 1.551 times (95%CI=1.400-1.758, P<0.05), 1.418 times (95%CI=1.170-1.720, P<0.05), and 1.652 times (95%CI=1.454-1.935, P<0.05) those of the reference group, respectively. Compared with the reference group, individuals with sleep duration <6h/day and high-fat diet had higher risk of abdominal obesity (OR=1.428, 95%CI=1.075-1.897, P<0.05). Hypertensive patients with occupations as self-employed individual business owners and agricultural workers had risks of high WHtR that were 3.248 times (95%CI=1.418-7.44, P<0.05) and 3.100 times (95%CI=1.606-5.984, P<0.05) those of the reference group, respectively. Compared with 2013, among the common influencing factors for various obesity types in 2020, the proportion of males decreased slightly in the overweight and body fat percentage obesity groups (P<0.05) but increased in the abdominal obesity group (P<0.05). The proportion of individuals with different obesity types in the 31-35 and 36-40 age groups all exceeded 20%. The proportion of married individuals decreased slightly in the two general obesity groups (P<0.05) but increased slightly in the two central obesity groups (P<0.05). The proportion of hypertensive patients in all obesity type groups increased significantly, more than doubling that of 2013 (P<0.05).

**Conclusion** In 2020, the detection rates of all obesity types among residents aged 18-44 years in Hebei Province were significantly higher than those in 2013. Attention should be paid to the dynamic trends of influencing factors for overweight and obesity among young and middle-aged populations in Hebei Province, with targeted preventive measures implemented to enhance residents' health awareness and improve weight management.

## Full Text

# Characterisation of the Prevalence of Overweight and Obesity Among Residents Aged 18–44 Years in Hebei Province in 2013 and 2020

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## Abstract

### Background
The problem of overweight and obesity has become increasingly prominent in recent years, representing a major global public health challenge. China has launched the "Weight Management Year"initiative to prevent and control chronic diseases related to overweight and obesity at their source. However, due to regional differences in economic development and geographic conditions, the prevalence of overweight and obesity varies across regions. The recent trends in overweight and obesity prevalence in Hebei Province, as well as the key priorities for prevention and control, urgently need to be clarified.

### Objective
To understand the trends and changes in overweight and obesity prevalence among residents aged 18–44 years in Hebei Province between 2013 and 2020, to dynamically analyze the influencing factors, and to provide evidence for the development of weight management strategies and measures for "Healthy Hebei."

### Methods
Data were collected from the 2013 Hebei Provincial Cardiovascular Disease Epidemiological Survey (May–September) and the 2020 Hebei Provincial Residents' Cardiovascular Disease and Risk Factor Surveillance Project (April–December). Different obesity indicators were used to comprehensively measure changes in overweight and obesity prevalence among residents aged 18–44 years. Multifactorial logistic regression models were employed to explore influencing factors and interactions, and changes over time were analyzed.

### Results
In 2020, the standardized detection rates of overweight, obesity, body fat percentage obesity, abdominal obesity, and high waist-to-height ratio (WHtR) among 18–44-year-old residents in Hebei Province were all higher than in 2013. The respective rates in 2013 were 32.24%, 11.49%, 24.86%, 27.03%, and 45.01%, while in 2020 they were 32.85%, 25.75%, 57.93%, 40.77%, and 59.73%. Multivariate logistic regression analysis showed that, overall, older age groups (compared with 18–20 years), males, married individuals, and hypertensive patients had higher risks of various types of obesity ($P<0.05$). Additionally, educational level of junior high school or below, being married, occupations as self-employed or agricultural workers, insufficient physical activity, high-fat diet, fish and egg intake >1,000 g/week, sleep duration <6 h/day, and hypertension all increased the risk of different obesity types ($P<0.05$). Multiplicative interaction analysis revealed that married hypertensive patients had 1.551 times

(95%CI=1.400–1.758, P<0.05), 1.418 times (95%CI=1.170–1.720, P<0.05), and 1.652 times (95%CI=1.454–1.935, P<0.05) higher risks of obesity, body fat percentage obesity, and high WHtR, respectively, compared with the reference group. Individuals with sleep duration <6 h/day and high-fat diet had higher risk of abdominal obesity (OR=1.428, 95%CI=1.075–1.897, P<0.05). Hypertensive patients who were self-employed or agricultural workers had 3.248 times (95%CI=1.418–7.44, P<0.05) and 3.100 times (95%CI=1.606–5.984, P<0.05) higher risks of high WHtR, respectively. Compared with 2013, the proportion of males in overweight and body fat percentage obesity groups slightly decreased in 2020 (P<0.05), while it increased in the abdominal obesity group (P<0.05). The proportion of different obesity types in the 31–35 and 36–40 age groups all exceeded 20%. The proportion of married individuals slightly decreased in generalized obesity groups (P<0.05) but slightly increased in central obesity groups (P<0.05). The proportion of hypertensive patients in all obesity types more than doubled compared with 2013 (P<0.05).

**Conclusion**
In 2020, the detection rates of all obesity types among 18–44-year-old residents in Hebei Province were significantly higher than in 2013. Attention should be paid to the dynamic trends of influencing factors related to overweight and obesity among young and middle-aged populations in Hebei Province, with targeted preventive measures implemented to enhance health awareness and improve weight management.

**Keywords:** Overweight; Obesity; Obesity, abdominal; Prevalence; Root cause analysis; Hebei

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## Introduction

With changes in socioeconomic conditions, lifestyles, and dietary patterns, overweight and obesity have become increasingly prominent problems that not only reduce quality of life but also increase disease burden, representing a major global public health challenge. Between 2000 and 2023, the prevalence of overweight, obesity, and central obesity among adult residents aged 18–44 in ten Chinese provinces showed rapid growth trends, while chronic diseases such as hypertension and diabetes have gradually shown a pattern of affecting younger populations. Obesity has been confirmed as a major risk factor for various chronic diseases including diabetes, hypertension, and cardiovascular disease. As a reversible risk factor, interventions targeting obesity are crucial for reducing the incidence of chronic diseases among young and middle-aged populations.

Both the "Healthy China Action (2019–2030)" and "Healthy Hebei Action (2020–2030)" have set goals to improve national awareness and skills in weight management and to prevent and control overweight and obesity. Young and middle-aged populations, as primary wealth creators for society and families, experience indirect impacts on work efficiency and productivity when overweight

and obesity emerge. Previous studies have shown that in 2019, the overweight rate among 18–44-year-old residents in coastal Fujian Province was 21.41% and the obesity rate was 7.40%. A study in Zhengzhou indicated that the body fat excess rate was relatively high among young and middle-aged individuals engaged in light physical labor, with the most significant increases in overweight and obesity rates occurring among men aged 20–39 and women aged 30–49. Currently, research on overweight and obesity prevalence among young and middle-aged populations is limited, with inconsistent findings across regions and a lack of dynamic analysis of influencing factors.

Based on this context, this study examined 18–44-year-old residents in Hebei Province in 2013 and 2020, applying different obesity measurement indicators to analyze the epidemic changes in overweight/obesity and central obesity in Hebei, and dynamically studying the changes in related influencing factors to provide a theoretical basis for developing prevention and treatment strategies for overweight/obesity and central obesity, early prevention of related chronic diseases, and reduction of disease burden in Hebei Province.

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## Methods

**Data Sources** Data were obtained from the Hebei Provincial Cardiovascular Disease Epidemiological Survey conducted from May to September 2013 and the Hebei Provincial Residents' Cardiovascular Disease and Risk Factor Surveillance Project conducted from April to December 2020. Both surveys used a multi-stage stratified random sampling method: ten counties (cities/districts) were selected as survey points in Hebei Province; from each point, two townships (streets) were selected using simple random sampling (SRS); from each township, three villages (neighborhood committees) were selected using SRS; and from each village, residents aged 18 years who had lived in the survey area for 6 months in the previous year were selected by SRS according to gender and age groups. This study extracted data for permanent residents aged 18–44 years. After data cleaning and excluding those with missing height, weight, waist circumference, or body fat percentage data, 9,535 residents were included from 2013 and 6,650 from 2020. The study was approved by the Ethics Review Committee of Fuwai Hospital (Approval No. 2020-1360), and all participants provided informed consent.

**Survey Methods Questionnaire Survey**
A standardized questionnaire developed by the National Cardiovascular Disease Center was administered through face-to-face interviews by trained and qualified surveyors. The questionnaire covered age, gender, residence, education level, marital status, occupation, physical activity, dietary habits, sleep duration, and chronic disease status.

**Physical Examination**

Measurements were conducted on-site by trained and qualified surveyors, including height, weight, body fat, and waist circumference (WC). Body mass index (BMI) and waist-to-height ratio (WHtR) were calculated. Body weight and composition were measured using an Inbody H20B body composition analyzer. Participants were required to wear light clothing, empty their bladder and bowels, and avoid vigorous exercise before measurement. During measurement, participants stood barefoot on the instrument with hands and feet properly aligned with electrodes, maintaining an upright posture with head straight and eyes looking forward, arms extended forward and downward without touching the torso until the measurement was completed.

**Quality Control**

To ensure reliability and comparability and to control for recall and reporting bias, the following measures were implemented: all survey personnel received unified training and passed qualification assessments before conducting surveys; standardized measurement and recording instruments were used uniformly; informed consent was obtained from all participants with strict confidentiality of survey information; questionnaires were designed with clear questions, using objective indicators whenever possible, and providing auxiliary information and images to aid recall; survey events were limited to recent time periods; and quality control officers randomly selected participants for repeat measurements and verification.

**Indicator Definitions Physical Activity**

Sufficient physical activity was defined as accumulating 150 minutes/week of moderate-intensity activity; otherwise, it was considered insufficient.

**High-Fat Diet**

Defined as average daily intake of livestock and poultry meat 75 g/day.

**Hypertension**

Defined as systolic blood pressure 140 mmHg (1 mmHg=0.133 kPa) and/or diastolic blood pressure 90 mmHg, or having been diagnosed with hypertension by a township (community) level or higher hospital, or having taken medication within the past two weeks.

**Obesity Criteria**

(1) Previous studies have shown that body fat percentage correlates well with BMI and can reflect changes in BMI, though BMI may underestimate obesity prevalence. Therefore, this study used both BMI and body fat percentage to assess generalized obesity. Overweight was defined as 24.0 kg/m² BMI < 28.0 kg/m², and obesity as BMI 28.0 kg/m². Body fat percentage obesity was defined as 25% for men and 35% for women. (2) WC and WHtR show high consistency in men with height 160-<180 cm and women with height 150-<170 cm, but poor consistency in other height groups, while WHtR is superior to WC in predicting clustering of cardiovascular disease risk factors. Therefore, this study used both WC and WHtR to assess central obesity. Abdominal

obesity was defined as WC 90.0 cm for men or 85 cm for women, and high WHtR as WHtR 0.5.

**Statistical Analysis** SPSS 22.0 software was used for data analysis. Categorical data were expressed as percentages, with inter-group comparisons using $^2$ tests and trend $^2$ tests. Multivariate unconditional logistic regression analysis was used to analyze influencing factors, with $P<0.05$ considered statistically significant. Using data from the 2010 National Sixth Population Census as the standard, survey results were standardized by age and gender. The standardized detection rate was calculated as the number of detected cases standardized to the 2010 national census population divided by the standard population count of individuals aged 18–44 from the 2010 census. To compare the proportion of influencing factors for different obesity types between 2013 and 2020, data were weighted accordingly.

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## Results

**Basic Characteristics of Included Residents in 2013 and 2020** In 2013, among the 9,539 included residents, the majority were aged 31–40 years [4,148 (43.49%)], with 4,810 males (50.42%) and 4,729 females (49.58%). Urban residents accounted for 3,824 (40.09%) and rural residents for 5,715 (59.91%). Most had junior high school education or below [6,129 (64.25%)], 7,247 (75.97%) were married, and the most common occupation was agricultural worker [4,326 (45.35%)]. Physical activity was insufficient in 8,213 (86.10%), high-fat diet was present in 4,696 (49.23%), fish and egg intake >1,000 g/week in 3,340 (35.02%), sleep duration <6 h/day in 3,258 (34.16%), and hypertension in 653 (6.85%).

In 2020, among the 6,653 included residents, the majority were aged 31–40 years [2,919 (43.87%)], with 3,299 males (49.59%) and 3,354 females (50.41%). Urban residents accounted for 2,697 (40.54%) and rural residents for 3,956 (59.46%). Most had junior high school education or below [3,155 (47.42%)], 4,617 (69.40%) were married, and the most common occupation was agricultural worker [2,531 (38.04%)]. Physical activity was insufficient in 4,798 (72.12%), high-fat diet was present in 3,109 (46.73%), fish and egg intake >1,000 g/week in 3,396 (51.05%), sleep duration <6 h/day in 2,415 (36.30%), and hypertension in 1,450 (21.79%).

Statistically significant differences were observed between 2013 and 2020 in age distribution, education level, marital status, occupation, physical activity, high-fat diet, fish and egg intake, sleep duration, and hypertension prevalence ($P<0.05$). No significant differences were found in gender or residence ($P>0.05$) .

**Prevalence of Various Obesity Types in 2013 and 2020** In 2020, the standardized detection rates of overweight, obesity, body fat percentage obesity, abdominal obesity, and high WHtR among 18–44-year-old residents in Hebei

Province were all higher than in 2013, with substantial increases. The respective standardized rates in 2013 were 32.24%, 11.49%, 24.86%, 27.03%, and 45.01%, while in 2020 they were 32.85%, 25.75%, 57.93%, 40.77%, and 59.73% .

Trend $^2$ tests showed that in both 2013 and 2020, the prevalence of overweight, obesity, body fat percentage obesity, abdominal obesity, and high WHtR among both men and women generally increased with age (P<0.001) .

**Influencing Factors for Various Obesity Types in 2020** Using overweight, obesity, body fat percentage obesity, abdominal obesity, and high WHtR as dependent variables (no=0, yes=1), and age, gender, residence, education level, marital status, occupation, physical activity, high-fat diet, fish and egg intake, sleep duration, and hypertension as independent variables, multivariate logistic regression models were established. Results showed that, overall, older age groups (compared with 18-20 years), males, married individuals, and hypertensive patients had higher risks of various obesity types (P<0.05). Specifically, education level of junior high school or below increased the risk of overweight and high WHtR compared with college/undergraduate or above (P<0.05). Married individuals had higher risks of obesity, body fat percentage obesity, abdominal obesity, and high WHtR compared with unmarried individuals (P<0.05). Self-employed individuals and agricultural workers had higher risks of high WHtR compared with managers in government/enterprises/institutions (P<0.05). Insufficient physical activity increased the risk of overweight compared with sufficient activity (P<0.05). High-fat diet increased the risk of abdominal obesity (P<0.05). Fish and egg intake >1,000 g/week increased the risks of abdominal obesity and high WHtR compared with intake of 600-1,000 g/week (P<0.05). Sleep duration <6 h/day increased the risks of abdominal obesity and high WHtR compared with 6-9 h/day (P<0.05). Hypertensive patients had higher risks of obesity, body fat percentage obesity, abdominal obesity, and high WHtR compared with non-hypertensive individuals (P<0.05) .

**Multiplicative Interaction of Influencing Factors** Logistic regression models with product terms were established to analyze interactions between influencing factors, adjusting for gender and age. Results showed that married hypertensive patients had 1.551 times (95%CI=1.400-1.758, P<0.05), 1.418 times (95%CI=1.170-1.720, P<0.05), and 1.652 times (95%CI=1.454-1.935, P<0.05) higher risks of obesity, body fat percentage obesity, and high WHtR, respectively, compared with the reference group. Individuals with sleep duration <6 h/day and high-fat diet had higher risk of abdominal obesity (OR=1.428, 95%CI=1.075-1.897, P<0.05). Hypertensive patients who were self-employed or agricultural workers had 3.248 times (95%CI=1.418-7.44, P<0.05) and 3.100 times (95%CI=1.606-5.984, P<0.05) higher risks of high WHtR, respectively. No other multiplicative interactions were found (P>0.05).

**Comparison of Influencing Factors Between 2013 and 2020** Comparing the composition of influencing factors for different obesity types between 2013 and 2020 with weighted data showed that among common influencing factors, the proportion of males slightly decreased in overweight and body fat percentage obesity groups (P<0.05) but increased in the abdominal obesity group (P<0.05) in 2020. The proportion of different obesity types in the 31–35 and 36–40 age groups all exceeded 20%. The proportion of married individuals slightly decreased in generalized obesity groups (P<0.05) but slightly increased in central obesity groups (P<0.05). The proportion of hypertensive patients in all obesity types more than doubled compared with 2013 (P<0.05). Additionally, in the overweight group, the proportion of individuals with junior high school education or below decreased (P<0.05), while the proportion with insufficient physical activity in 2020 was 1.76 times that of 2013 (P<0.05). In central obesity groups, the proportion of individuals with fish and egg intake >1,000 g/week exceeded 50%, while the proportion with sleep duration <6 h/day only slightly decreased (P<0.05). The proportion of high-fat diet individuals increased in the abdominal obesity group (P<0.05). In the high WHtR group, the proportion of individuals with junior high school education or below decreased (P<0.05), the proportion of agricultural workers decreased (P<0.05), while the proportion of self-employed individuals increased (P<0.05) [TABLE:5, TABLE:6].

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## Discussion

To understand the epidemic trends of overweight and obesity among young and middle-aged populations in Hebei Province, analyze the dynamic changes in influencing factors, and develop appropriate prevention strategies with region-specific priorities, this study analyzed the prevalence characteristics of overweight and obesity among 18–44-year-old residents in Hebei Province in 2013 and 2020.

Although BMI is commonly used to assess generalized obesity, it cannot reflect visceral fat distribution. Body fat percentage represents the proportion of body fat to total body weight, while abdominal fat accumulation is more strongly associated with obesity-related diseases. Both WC and WHtR can reflect abdominal fat distribution, with WHtR correcting for height and showing no gender differences, making it better for reflecting visceral fat distribution. Therefore, this study comprehensively used BMI, body fat percentage, WC, and WHtR to assess overweight and obesity in 18–44-year-old residents in Hebei Province in 2013 and 2020.

Results showed that compared with 2013, the rates of overweight, obesity, body fat percentage obesity, and central obesity all showed significant upward trends in 2020, consistent with findings from a study on overweight and obesity trends in ten Chinese provinces. The standardized rates of overweight, obesity, and abdominal obesity among Hebei residents in 2013 and 2020 ranged from 32.24%–

32.85%, 11.49%–25.75%, and 27.03%–40.77%, respectively. In 2013, the overweight and obesity rates among 18–44-year-old residents in Ningxia were similar to those in Hebei (32.2% and 12.1%), but the central obesity rate was much higher than in Hebei (40.8%). Compared with Hebei' s 2020 data, the standardized overweight rate among residents aged 20 and above in Shanxi in 2018 was slightly higher (39.6%), the obesity rate was slightly lower (20%), and the central obesity rate was higher (60.2%), possibly due to differences in population structure, regional economy, and lifestyle habits across different years and provinces.

Multivariate logistic regression analysis showed that age was the main factor affecting changes in obesity rates, consistent with Xing Xiuya' s findings. Xu Xingyan et al. suggested that men' s higher acceptance of obesity and less concern about appearance may contribute to higher male obesity rates, though other studies indicate that women' s higher body fat content is a risk factor. This study found that lower education level was associated with higher obesity risk, consistent with multiple domestic and international studies, though Wang Ru et al. suggested that higher education levels may be associated with more sedentary time and less physical activity. Married individuals had higher risks of all obesity types, possibly due to decreased self-care attention. Excessive fish and egg intake increased central obesity risk, possibly related to metabolic effects of excessive protein intake. Occupation also mattered: managers in government/enterprises/institutions may pay more attention to personal image and weight control, while self-employed individuals and agricultural workers may be less concerned. Short sleep duration was identified as an obesity risk factor, while long sleep duration was not, consistent with some studies, possibly because insufficient sleep reduces leptin levels and induces overeating. Hypertensive patients had higher risks of all obesity types, consistent with Zheng Xin et al.' s findings.

Given the rapid increase in obesity rates among 18–44-year-old residents in Hebei Province between 2013 and 2020, dynamically analyzing changes in the composition of related influencing factors is crucial for developing obesity prevention measures tailored to Hebei' s actual conditions. The study found that changes in gender, population structure, and marital status between 2013 and 2020 may have increased obesity risks: the proportion of males and married individuals only slightly decreased in some obesity groups but increased in others, with their influence persisting. Population structure showed a shift toward older age groups, with decreased proportions in the 21–25, 26–30, and 41–44 age groups and increased proportions in the 31–35 and 36–40 age groups, indicating an aging trend that increases overweight risk. In central obesity groups, insufficient sleep showed little improvement with only a slight decrease in proportion, while dietary imbalances became prominent, with increased proportions of excessive intake of high-protein foods (fish and eggs) and high-fat diets, possibly contributing to higher central obesity rates. Among occupations associated with high WHtR risk, the proportion of self-employed individuals also increased significantly. Additionally, interactions existed between influencing factors in

different obesity groups, such as between hypertension prevalence and marital status or occupation, and between high-fat diet and insufficient sleep. The combined changes in the composition of these factors and their interactions may also be associated with increased prevalence of various obesity types.

The main strengths of this study include using surveillance data from 2013 and 2020 to dynamically analyze trends in overweight/obesity and influencing factors in Hebei Province, providing baseline data for real-time adjustment of "Healthy Hebei" policies. The use of multiple obesity evaluation indicators provides a more comprehensive analytical perspective, and strict quality control throughout the study ensures reliable data. However, limitations exist: first, the cross-sectional design precludes inference of causal relationships between obesity and risk factors; second, changes in socioeconomic and technological levels, medical care, and health promotion environments between survey years may have affected lifestyle, dietary and exercise habits, and obesity awareness, influencing obesity prevalence—future studies should supplement investigation and analysis of these factors; finally, the study did not include obesity indicators such as body roundness index and waist-to-hip ratio, which could provide more comprehensive assessment of obesity prevalence in Hebei from multiple dimensions—body roundness index reflects overall body roundness and better reflects fat distribution considering height-adjusted waist circumference, while waist-to-hip ratio is typically used with WHtR to reflect central obesity.

Between 2013 and 2020, the overweight rate and prevalence of different obesity types among 18–44-year-old residents in Hebei Province showed upward trends, making obesity prevention and control a priority for "Healthy Hebei." Targeted prevention measures should be developed based on the actual situation in Hebei and changes in influencing factors for different obesity types. Health-supportive environments should be strengthened, residents encouraged to actively participate, and guidance provided on scientific diet and healthy sleep habits, with enhanced medical intervention for hypertensive patients to support weight management and improve residents' health.

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**Author Contributions:** TANG Lijuan proposed the main research objectives, designed and implemented the study, and wrote the manuscript. QI Qi and ZHANG Fan were responsible for data collection and collation. GAO Yifu and CAO Yajing collected and organized relevant literature. YUE Fujuan and GAO Jinchai revised the manuscript. LIU Xiaoli was responsible for quality control and review of the manuscript and provided overall supervision.

**Conflict of Interest:** The authors declare no conflict of interest.

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*Note: Figure translations are in progress. See original paper for figures.*