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Prevalence of overweight and obesity and associated risk factors among adult residents of northwest China: a cross-sectional study

Ning Song,[1,2] Fen Liu,[1,2] Min Han,[1,2] Qiang Zhao,[1,2] Qian Zhao,[1,2] Hui Zhai,[1,2] Xiang-Mei Li,[1,2] Guo-Li Du,[1,2] Xiao-Mei Li,[1,2] Yi-Ning Yang[1,2]

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NS and FL contributed equally.

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[1]Department of Cardiology, Xinjiang Medical University Affiliated First Hospital, Urumqi, China
[2]Xinjiang Key Laboratory of Cardiovascular Disease Research, Clinical Medicine Institute, The First Affiliated Hospital of Xinjiang Medical University, Urumqi, China

Correspondence to
Professor Yi-Ning Yang; yangyn5126@163.com

Professor Xiao-Mei Li; lixm505@163.com

ABSTRACT

Objective Overweight and obesity have been shown to be related to multiple chronic conditions, leading to a heavy economic burden on society throughout the world. This study aims to estimate the prevalence of overweight and obesity and determine potential influencing factors among adults in Xinjiang, northwest China.

Design A community-based observational study.

Setting The First Affiliated Hospital of Xinjiang Medical University.

Methods In total, 14 618 adult participants (7799 males; 6819 females) aged over 35 years were recruited from the Cardiovascular Risk Survey conducted in 2010. Data were obtained from face-to-face interviews and physical examinations. The sample was used to estimate the prevalence of overweight (body mass index (BMI) 24–28 kg/m^2) and obesity (BMI ≥28 kg/m^2) in Xinjiang Province. Influencing factors were analysed based on statistical methods.

Results In Xinjiang Province, the overall prevalence of overweight was 36.5% (male 40.1%; female 33.4%), and the prevalence of obesity was 26.5% (male 27.2%; female 25.8%). The prevalence of both overweight and obesity were higher in women than in men (p<0.001). The main influencing factors for overweight and obesity were sex, age, race, marital status, education level, occupation, smoking, drinking, hypertension, diabetes and dyslipidaemia (p<0.05).

Conclusions This study estimated that the prevalence of overweight and obesity among adult residents of Xinjiang Province, northwest China, was high. These data suggest that efforts related to the prevention and control of overweight and obesity should be a public health priority in northwest China.

Strengths and limitations of this study

- The survey sample was demographically representative of Uyghur adults with obesity who are aged 35–80 years and reside in Xinjiang.
- The main strengths of our study are its large sample size and precise physical measurements, which increase the validity of our results.
- Due to the cross-sectional nature of the study and the self-designed questionnaire, indicators and experience could have been affected by bias.
- Moreover, other indicators of adiposity, such as body-fat percentage and waist circumference, were not obtained in our study.
- The results were from Xinjiang only and therefore cannot be generalised to all of China.

INTRODUCTION

Obesity is a complex chronic global disease affecting people worldwide across all ages, sexes, ethnicities and nationalities, and it is the fifth leading cause of mortality globally.[1 2] According to WHO, the prevalence of worldwide obesity has doubled in >70 countries since 1980.[3] Moreover, this trend has continuously increased in most other countries. In 2013, in order to draw physicians' attention to the condition, the American Medical Association classified obesity as a disease.[4]

Body mass index (BMI), which is calculated as weight/height squared (kg/m^2), is a common and accepted measure that is used to report obesity rates. While BMI is not a true measure of adiposity, it is simple to use in health screenings and epidemiological surveys.[5] According to WHO, obesity is defined as a BMI ≥30 kg/m^2, and overweight as a BMI of 25–30 kg/m^2.[6] For Chinese people, a BMI ≥28 kg/m^2 suggests obesity and a BMI of 24–28 kg/m^2 indicates overweight.[7]

China is the largest low-income and middle-income country and has the largest population in the world. With rapid economic growth and changes in lifestyle, such as dietary habits and physical activity,[8] the epidemiological data indicate that individuals with overweight and obesity have a higher prevalence of traditional diseases, including dyslipidaemia, hypertension, cardiovascular disease, insulin resistance or diabetes, fatty liver disease and psychosocial complications

and some cancers.[5 9] Located in northwest China, Xinjiang is an autonomous minority ethnic region within the People's Republic of China, and one of the fastest developing regions in China. It is the largest Chinese administrative division and spans over 1.66 million km^2, which represents approximately one-sixth of the country's territory. A few studies had reported the prevalence of overweight among adults in Xinjiang.[10] Nevertheless, the samples in the above-mentioned studies were small, and those results cannot accurately represent the status of overweight and obesity in the whole region of Xinjiang.

In the present study, we estimated the prevalence of overweight and obesity in Xinjiang, northwestern part of China. Furthermore, we investigated the associated factors of overweight and obesity, which will be regarded as a reference for policy makers to make informed decisions.

MATERIALS AND METHODS

Ethics approval

Written informed consent was acquired from each participant prior to enrolment.

Study design and population

This survey is a population-based cross-sectional programme and the Cardiovascular Risk Survey (CRS) study was conducted in Xinjiang Province of China in 2010. Previously, several studies had described in details.[11–14] The CRS was a prospective, multiple-ethnicity and community-based observational study designed to investigate the prevalence and risk factors for cardiovascular disease (CVD) in the Han, Uygur and Kazakh populations in Xinjiang Province.[11] All participants we recruited had lived in Xinjiang for >1 year. In short, a total of 16 460 adults aged ≥35 years joined the CRS, 14 618 subjects (5757 Han, 4767 Uygur and 4094 Kazakh Chinese) of them completed the investigation. We adopt the method of multistage stratified sampling to randomly select the representative sample from six different administrative regions, including Urumqi, Yili, Hetian, Kelamayi, Fukang and Turpan.

Data collection

The standard survey mainly consisted of two aspects,[15] one is the face-to-face interview, the other is the physical examination. Before launching the regular survey, it is necessary to carry out a presurvey to ensure the accuracy and feasibility of the questionnaire. At the investigation stage, two independent investigators ensured the validity of every survey questionnaire. In the questionnaire processing stage, we used parallel double method to handle data, and carried out three validations to verify the self-contradictory responses. The questionnaire provided demographics, general personal information and medical histories.[16] Height and weight were measured adopting the standards. Height was measured to the nearest 0.1 cm, and weight was measured with a standard scale in the upright position to the nearest 0.1 kg.[15] Smoking and drinking habits were self-reported.

Blood samples were collected in examination centres at local hospitals in the participants' residential area. The collected and detected methods have also been described in detail previously.[13 14] At the time of the in-person interview, a 5 mL fasting venous blood was collected into EDTA tubes and separated to acquire plasma within 4 hours. Finally, all samples after processing were stored at −80°C immediately. We measured the biochemical markers in plasma using the equipment for chemical analysis (Dimension AR/AVL Clinical Chemistry System, Newark, New Jersey, USA), operated by the Clinical Laboratory Department of the First Affiliated Hospital of Xinjiang Medical University. Relevant markers in plasma, which contained total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C), were measured.

Definition of variables

Overweight and obesity were defined by the Chinese standards mentioned in the 'Introduction' section. Obesity was defined as BMI ≥28 kg/m^2 and overweight was defined as a BMI of 24–28 kg/m^2.

Education was classified into four levels: primary school and below (including never having attended school and elementary schooling only); junior middle school; senior middle school (including secondary vocational schooling); undergraduate and above (including postsecondary vocational schooling, master's degree and doctoral degree). The occupations consist of three parts: manual labour (including farmers, production and service workers), white-collar occupations (including office and other technical employment) and other occupations (including unemployed, retiree, student and full-time homemaker).[17] Smoking-status classifications included current smokers (who had smoked at least one cigarette a day over the past 30 days) and never-smokers. Drinking-status classifications included current drinkers (who had consumed more than one alcoholic drink a week) and never-drinkers. Hypertension was defined as mean systolic blood pressure (BP) ≥140 mm Hg, mean diastolic BP ≥90 mm Hg and/or current use of antihypertensive medications.[14 18] Diabetes was defined as fasting plasma glucose ≥126 mg/dL (≥7.0 mmol/L), self-reported history of diabetes and/or current use of insulin or antidiabetic medications.[14 19] Hypercholesterolaemia was defined as serum TC level >6.22 mmol/L (240 mg/dL) and hypertriglyceridaemia was defined as serum TG level >2.26 mmol/L (200 mg/dL). A serum LDL-C level of >4.14 mmol/L (160 mg/dL) was defined as high LDL-C, and a serum HDL-C level of <1.04 mmol/L (40 mg/dL) was defined as low HDL-C. In total, dyslipidaemia was defined as the existence of at least one of the four abnormal lipid concentrations mentioned above or self-reported use of lipid-lowering drugs.[13 20]

Statistical analysis

Data were entered and corrected by two staff members using EpiData 3.02 software (EpiData, Association, Odense, Denmark). The subjects' continuous variables were expressed by frequency distributions, meanwhile, the prevalence rates were shown through the percentage; χ^2 test was used to compare the prevalence of overweight and obesity in different groups. To analyse the factors associated with obesity and adjust for potential confounding effects, multivariable logistic regression analyses were carried out to explain independent factors associated with overweight and obesity. ORs with 95% CIs were used for the risk analysis. All statistical analyses were conducted using the complex sampling function of Social Sciences SPSS for Windows V.22.0 (SPSS, Chicago, Illinois, USA), with a p<0.05 indicating statistical significance.

Patient and public involvement

This survey is a population-based cross-sectional programme and the CRS study was conducted in Xinjiang Province of China in 2010. The study was designed to investigate the prevalence of overweight and obesity among adult residents in Xinjiang in northwest China. However, no patients or members of the public were included in the design, recruitment or conduct of the study. The results were to be disseminated to participants after the study was completed by the study team. The burden of intervention would not be assessed by the patients themselves.

RESULTS

In this survey, we interviewed 14618 residents aged 35–101 years (mean age: 50.8±12.6 years), including 6819 (46.6%) men and 7799 (53.4%) women. Among these participants, 5757 (39.4%) were Han, with a mean age of 52.5±12.7 years; 4767 (32.6%) were Uygur, with a mean age of 50.7±13.0 years and 4094 (28.0%) were Kazakh, with a mean age of 48.6±11.7 years. According to the BMI classification for Chinese people, the overall prevalence of overweight was 36.5% (male 40.1%; female 33.4%), and the prevalence of obesity was 26.5% (male 27.2%; female 25.8%) in Xinjiang Province (table 1). There were differences in age, area, race, occupation, education, marriage, drinking habits, hypertension history and plasma levels of TG and TC between the overweight and obesity groups, while there were no significant differences in sex, smoking, diabetes history and the level of LDL-C and HDL-C between the two groups.

From the age-stratified and gender-stratified results in table 2, for men, the prevalence of both overweight and obesity peaked at 45–54 years, while a significant trend indicating an increase in the prevalence of overweight with age was not demonstrated. For women, the prevalence of overweight and obesity increased with age, peaking at 55–64 years, although there was a slight decrease at ≥65 years. In addition, a higher proportion of enrolled males were overweight than females. Interestingly, the proportion of females who were obese was higher than that of males.

From the age-stratified and race-stratified results in table 3, as a whole, obesity prevalence was found to be the highest among the Kazakh participants and the lowest among Han participants. The differences among the three ethnic groups were statistically significant (p<0.001). Furthermore, overweight prevalence was also significantly different among the three ethnicities, with the highest rate among Han participants and the lowest among Kazakh participants.

We divided the participants into two groups: normal weight and overweight/obese. Table 1 shows that the following factors all had a significant effect on overweight/obese: age, area, race, education, marital status, occupation, drinking, hypertension and dyslipidaemia (p<0.05). We applied multivariable unconditional logistic regression analysis to all of the identified risk factors and attempted to identify any existing differences in these risk factors that could explain the difference in overweight and obesity prevalence. Table 4 shows the results of logistic regression models comparing the prevalence of the potential risk factors: sex, age, area, marriage status, occupation, smoking, drinking, hypertension, diabetes and level of dyslipidaemia, including hypercholesterolaemia, hypertriglyceridaemia and low HDL-C. The multivariable logistic regression results reveal that female adults were more likely to become overweight and obese than male adults (OR 0.8, 95% CI 0.7 to 0.8). We categorised age into four groups, which clearly showed that increasing age was a risk factor for overweight/obesity, especially age 45–54 years (OR 1.5, 95% CI 1.3 to 1.6). Among the three ethnic groups, the Kazakh participants (OR 1.7, 95% CI 1.5 to 1.8) and Uygur participants (OR 1.4, 95% CI 1.3 to 1.6) were at higher risk of becoming overweight and obese. Participants who were married (OR 1.8, 95% CI 1.4 to 2.5) or widowed (OR 1.8, 95% CI 1.3 to 2.5) were more likely to be overweight/obese than those who were unmarried. In addition, smokers (OR 0.9, 95% CI 0.8 to 0.9) were less likely to become overweight and obese than non-smokers. Participants who drank were more likely to become overweight or obese than those who never or rarely drank (OR 1.5, 95% CI 1.3 to 1.6). Overweight and obesity were more common among those who had hypertension (OR 2.1, 95% CI 2.0 to 2.3) and diabetes (OR 1.3, 95% CI 1.1 to 1.6) compared with those who had no hypertension and diabetes history. In the overweight and obese group, hypertriglyceridaemia (OR 2.4, 95% CI 2.2 to 2.7), hypercholesterolaemia (OR 1.2, 95% CI 1.1 to 1.3) and low HDL-C (OR 1.1, 95% CI 1.0 to 1.2) remained risk factors.

Discussion

The epidemic of obesity is one of the most important health problems worldwide and is estimated to be the

Table 1 Prevalence of overweight and obesity according to demographic characteristics

Characteristic	N	Overweight			Obesity		
		n (%)	χ^2	P value	n (%)	χ^2	P value
Sex							
Male	6819	2735 (40.1)	71.1	<0.001*	1856 (27.2)	3.7	0.05
Female	7799	2603 (33.4)			2013 (25.8)		
Age (years)							
35–44	5425	1866 (34.4)	20.3	<0.001*	1146 (21.1)	149.8	<0.001*
45–54	3759	1441 (38.3)			1153 (30.7)		
55–64	2932	1067 (36.4)			919 (31.3)		
≥65	2502	964 (38.5)			651 (26.0)		
Area							
Urban	7974	3163 (39.7)	75.1	<0.001*	1956 (24.5)	33.9	<0.001*
Rural	6644	2175 (32.7)			1913 (28.8)		
Ethnicity							
Han	5757	2380 (16.3)	99.1	<0.001*	1082 (7.4)	331.9	<0.001*
Uygur	4767	1635 (11.2)			1361 (9.3)		
Kazakh	4094	1323 (9.1)			1426 (9.8)		
Occupation							
Manual labour	4583	1760 (12.0)	12.1	0.002*	1095 (7.5)	32.1	<0.001*
White collar	7751	2736 (18.7)			2086 (14.3)		
Other	2284	842 (5.8)			688 (4.7)		
Education							
Primary school and below	5805	1993 (13.6)	26.9	<0.001*	1589 (10.87)	21.2	<0.001*
Junior middle school	3094	1196 (8.2)			844 (5.8)		
Senior middle school	4556	1676 (11.5)			1191 (8.2)		
Undergraduate and above	1163	473 (3.2)			245 (1.7)		
Marriage							
Unmarried	192	59 (0.4)	14.1	<0.001*	27 (0.2)	23.1	<0.001*
Married	12 988	4795 (32.8)			3427 (23.4)		
Divorced	201	53 (0.4)			47 (0.2)		
Widowed	1237	431 (3.0)			368 (2.5)		
Drinking							
Yes	4169	923 (6.3)	44.5	<0.001*	663 (4.5)	24.6	<0.001*
No	10 449	4415 (30.2)			3206 (21.9)		
Smoking							
Yes	2151	1688 (11.6)	39.7	<0.001*	1101 (7.5)	0.01	0.92
No	12 467	3650 (25.0)			2768 (18.9)		
Hypertension							
Yes	5701	2138 (14.6)	3.9	0.05	2155 (14.7)	616.8	<0.001*
No	8917	3200 (21.9)			1714 (11.7)		
Diabetes							
Yes	859	335 (2.3)	2.4	0.1	317 (2.2)	51.0	<0.001*
No	13 759	5003 (34.2)			3552 (24.3)		
Dyslipidaemia							
Hypertriglyceridaemia							
Yes	4113	1724 (11.8)	72.0	<0.001*	1497 (10.2)	289.9	<0.001*

Continued

Table 1 Continued

Characteristic	N	Overweight n (%)	χ^2	P value	Obesity n (%)	χ^2	P value
No	10505	3614 (24.7)			2372 (16.2)		
Hypercholesterolaemia							
Yes	3787	1469 (10.1)	11.4	0.001*	1267 (8.7)	128.3	<0.001*
No	10831	3869 (26.5)			2602 (17.8)		
High LDL-C							
Yes	5251	1921 (13.1)	0.02	0.9	1334 (9.1)	4.8	0.03*
No	9367	3417 (23.4)			2535 (17.3)		
Low HDL-C							
Yes	4437	1704 (11.7)	9.8	0.002*	1215 (8.3)	2.8	0.09
No	10831	3634 (24.9)			2654 (18.2)		

Categorical variables are presented as counts and percentages. Data were compared by χ^2 tests.
*P<0.05, statistically significant.
HDL-C, high-density lipoprotein-cholesterol; LDL-C, low-density lipoprotein-cholesterol.

second leading cause of preventable death in high-income countries, behind cigarette smoking.[21 22] The prevalence of overweight and obesity continues to increase around the world, as have associated comorbidities and healthcare costs.[23] In the USA, the prevalence of obesity accounts for one-third of the general population, and another one-third is overweight.[24] The China Chronic Disease Survey conducted by the Chinese Centre for Disease Control and Prevention demonstrated that the prevalence of overweight among Chinese adults (aged 18–64 years) in 2007 and 2010 was 26.6% and 30.6%, respectively (males, 27.4% and 32.1%; females, 25.7% and 29.1%), and the prevalence of obesity was 7.7% and 12.1%, respectively (males, 6.7% and 12.5%; females, 8.7% and 11.1%).[15] We found that the prevalence of both overweight and obesity was high. Our cross-sectional study indicates that the prevalence of overweight and obesity among adults in northwest China was 36.5% (males, 40.1%; females, 33.4%) and 26.5% (males, 27.2%; females, 25.8%), respectively. In the Russian population,[25] the prevalence of overweight was 64.6% (males, 42.3%; females, 28.7%), and approximately one-third of the participants (30.3%) were obese (males, 27.5%; females, 31.4%). Contrary to what was observed in our research, the prevalence of overweight was higher than obesity in that study. This implies that overweight and obesity have a higher prevalence in both sexes and are more common in northwest China and Russia than in other areas, although effective actions might have been taken to control the upward trend.[26] The prevalence of underweight (according to Chinese standards, underweight reflects <18.5 kg/m^2) was significantly different among the ethnic groups (p<0.05) (online supplementary table 1). However, due to the special dietary habits (high-sugar and high-fat diet) and living habits in Xinjiang, the number of low-weight people was too small to reliably detect differences.

In this study, we found that the prevalence of both overweight and obesity was high in middle age (45–64 years). Similarly, age gradients in the prevalence of obesity have been found in Russia.[26] It is worth noting that more than half of all women aged 55–64 years were obese, and nearly 80% of men in the group aged 45–54 years were overweight or obese, which is consistent with our age gradients. Chinese people are more likely to have positive perceptions of obesity because it is considered good fortune to become fat during middle age in traditional Chinese culture.[27] Moreover, a large segment of

Table 2 Prevalence of overweight and obesity in men and women according to age group

Age (years)	Overweight Male (%)	Overweight Female (%)	P value	Obesity Male (%)	Obesity Female (%)	P value
35–44	994 (40.2)	872 (29.5)	<0.001	631 (25.5)	515 (17.4)	<0.001
45–54	735 (43.1)	706 (34.4)		517 (30.3)	636 (31.0)	
55–64	476 (35.8)	591 (36.8)		389 (29.3)	531 (33.0)	
≥65	530 (40.3)	434 (36.5)		319 (24.3)	332 (27.9)	

Date were compared by χ^2 tests.
*P<0.05, statistically significant.

Table 3 Prevalence of overweight and obesity in Han, Uyghur and Kazakh according to age group

Age (years)	Overweight				Obesity			
	Han (%)	Uygur (%)	Kazakh (%)	P value	Han (%)	Uygur (%)	Kazakh (%)	P value
35–44	712 (35.0)	573 (34.6)	581 (33.6)	<0.001	273 (13.4)	422 (25.5)	451 (26.1)	<0.001
45–54	599 (43.9)	481 (38.1)	361 (31.9)		246 (18.0)	436 (34.5)	471 (41.6)	
55–64	497 (45.9)	354 (32.6)	216 (28.3)		268 (24.7)	318 (29.3)	333 (43.6)	
≥65	572 (45.0)	227 (29.9)	165 (35.1)		295 (23.2)	185 (24.3)	171 (36.4)	

Date were compared by χ^2 tests.
*P<0.05, statistically significant.

the middle-aged and older adult population will be living with overweight and obesity, which is associated with additional health impairments.[28]

Through the present study, we found a very high prevalence of overweight and obesity in three ethnicities in Xinjiang, and there is no doubt that this result is similar to those observed in the previous study conducted in Xinjiang.[10] In addition, the prevalence rate of obesity was significantly different among Han, Uygur and Kazakh groups, as the prevalence in the Kazakh group was significantly higher compared with the Han and Uygur groups. Overall, our findings indicate that 16.3% of Han, 11.2% of Uygur and 9.1% of Kazakh people >35 years of age in Xinjiang were overweight and that 7.4% of Han, 9.3% of Uygur and 9.8% of Kazakh people were obese. Xinjiang is a multiethnic co-populated area in China. The national census showed that there are 47 ethnicities in Xinjiang, and 13 of them are confirmed to be native ethnicities, such as the Uygur and Kazakh. Explanations for this increase in prevalence are as follows: first, Kazakh people live in the grasslands and forests, and their dietary habits are characterised by eating more animals and consuming fewer fresh vegetables. Second, the Kazakh group is a nomadic ethnicity, the members of which usually live in hypoxic areas and at high altitude where the climate is cold and dry. Third, differences in genetic background may be an important factor underlying the differences in the prevalence of obesity.[29]

Multivariable logistic regression analysis showed that the prevalence of overweight and obesity was related to several factors. A previous review revealed that various marital transitions are related with changes in body weight: transition into marriage appears to be associated with weight gain, whereas transition out of marriage is associated with weight loss.[30] Our study found a similar result, namely, that marriage-related transitions, including marrying, divorcing and being widowed, are risk factors for becoming overweight and obese. A plausible explanation is that behaviours and lifestyles differ among married and unmarried individuals, but the exact mechanism underlying this association with marriage status is not clear. In our study, we also found that different educational levels, occupations and areas of residence are closely related to body weight. We observed that a low education level is a risk factor because of insufficient levels of cognition. Urban populations, especially the unemployed, retirees, students and full-time housewives, are more likely to become overweight and obese, which may be attributable to urban working conditions, for example, sitting in an office and living a fast-paced life as well as supermarket or fast-food restaurant availability.[31]

The 2015 Global Burden of Disease Study, representing 195 countries and territories, estimated that 25.0% of men and 5.4% of women worldwide smoked daily, which is the leading preventable cause of death worldwide.[32] In this study, we found a lower prevalence of overweight and obesity in smokers than in non-smokers, which is consistent with studies conducted in Switzerland, India and Jilin, China.[15 33 34] In addition, reasonable explanations illustrate the issue based on two different criteria. Using tobacco is associated with the function of multiple systems, especially that of cardiovascular and digestive systems.[35] In terms of the organism itself, smoking has been considered to be a method of relieving stress and anxiety. In northwest China in particular, it is generally believed that the more you drink, the more weight you gain. Wang *et al*[15] found results consistent with this belief.

To the best of our knowledge, obesity is an independent risk factor for both CVD and death.[36–38] We explored whether the prevalence of overweight and obesity is higher among subjects with hypertension or diabetes or dyslipidaemia. The results provide a compelling reason why the occurrence of obesity is combined with cardiovascular risk factors such as hypertension, diabetes and dyslipidaemia. Previous studies reported that the benefits of weight loss are well established, with a 5%–10% reduction in weight associated with improvements in health and quality of life and a 3% reduction being positive for health improvement when maintained.[39]

Relevant departments should heed the high prevalence of overweight and obesity in Xinjiang Province and provide effective guidelines to help to reverse the trend. The main strengths of our study are its large sample size and precise physical measurements, which increase the validity of our results. However, the present study has several limitations. First, the main limitation is the cross-sectional design, which prohibits inferring a causal link between overweight and obesity and risk factors. As in cross-sectional studies, data on exposure and outcome are gathered simultaneously at a specific time point.

Table 4 Multivariable regression analysis of correlates of overweight and obesity in residents of Xinjiang Province

Characteristic	B	SE	Wald	df	P value	OR	95% CI
Area	−0.1	0.04	10.4	1	0.001*	0.9	0.8 to 0.9
Sex	−0.3	0.05	32.5	1	<0.001*	0.8	0.7 to 0.8
Ethnicity			94.4	2	<0.001*		
Han	–	–	–	–	–	1	–
Uygur	0.4	0.05	50.0	1	<0.001*	1.4	1.3 to 1.6
Kazakh	0.50	0.05	86.2	1	<0.001*	1.7	1.5 to 1.8
Age (years)			71.2	3	<0.001*		
35–44	–	–	–	–	–	1	–
45–54	0.4	0.05	62.8	1	<0.001*	1.5	1.3 to 1.6
55–64	0.3	0.05	24.6	1	<0.001*	1.3	1.2 to 1.5
≥65	0.1	0.06	3.1	1	0.08	1.11	1.0 to 1.3
Education			17.9	3	<0.001*		
Primary school and below	–	–	–	–	–	1	–
Junior middle school	0.2	0.05	15.6	1	<0.001*	1.2	1.1 to 1.4
Senior middle school	0.2	0.06	7.0	1	0.008*	1.2	1.0 to 1.3
Undergraduate and above	0.2	0.08	6.8	1	0.009*	1.3	1.1 to 1.5
Occupation			10.4	2	0.006*		
Manual labour	–	–	–	–	–	1	–
White collar	0.01	0.05	0.04	1	0.8	1.0	0.9 to 1.1
Other	0.2	0.06	7.9	1	0.005*	1.2	1.1 to 1.4
Marriage			26.5	3	<0.001		
Unmarried	–	–	–	–	–	1	–
Married	0.6	0.2	15.5	1	<0.001*	1.8	1.4 to 2.5
Divorced	0.1	0.2	0.2	1	0.7	1.1	0.7 to 1.7
Widowed	0.6	0.2	12.4	1	<0.001*	1.8	1.3 to 2.5
Smoking	−0.2	0.05	9.0	1	0.003*	0.9	0.8 to 0.9
Drinking	0.4	0.06	34.8	1	<0.001*	1.5	1.3 to 1.6
Hypertension	0.8	0.04	340.4	1	<0.001*	2.1	2.0 to 2.3
Diabetes	0.3	0.09	10.4	1	0.001*	1.3	1.1 to 1.6
Dyslipidaemia							
Hypertriglyceridaemia	0.9	0.05	371.4	1	<0.001*	2.4	2.2 to 2.7
Hypercholesterolaemia	0.2	0.05	20.9	1	<0.001*	1.2	1.1 to 1.3
Low HDL-C	0.1	0.04	6.4	1	0.01*	1.1	1.0 to 1.2
High LDL-C	0.02	0.04	0.16	1	0.69	1.0	0.9 to 1.1
Constant	−1.0	0.2	35.3	1	<0.001	–	–

*P<0.05, statistically significant.

Prospective studies are necessary to confirm our findings. In addition, self-reported data and the nature of cross-sectional data may lead to recall and reporting biases, which may be the reason for the non-significant difference in the causes of obesity. Finally, other indicators of adiposity, such as body-fat percentage and waist circumference, which many studies have noted reflect the prevalence of overweight, obesity and body-fat distribution, were not obtained in our study.[40 41]

CONCLUSIONS

In conclusion, the present study indicates that the prevalence of overweight and obesity among adult residents in Xinjiang in northwest China has been very high during the past years. Furthermore, the main influencing factors for overweight and obesity are sex, age, race, marital status, education level, occupation, smoking, drinking, hypertension, diabetes and dyslipidaemia. These data suggest that efforts related to the prevention and control

of overweight and obesity should be a public health priority in the northwest of China. These findings will be submitted to relevant departments as a reference for efforts to reverse these trends.

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Competing interests None declared.

Patient consent for publication Obtained.

Ethics approval This study was carried out in accordance with the Declaration of Helsinki and the study protocol was approved by the Ethics Committee of the First Affiliated Hospital of Xinjiang Medical University (Xinjiang, China) (approval ID:20100116-01).

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