Letter to the Editor

Prevalence and Predictors of Hypertension in the Labor Force Population in China: Results from a Cross-sectional Survey in Xinjiang Uygur Autonomous Region*

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The objective of this study was to examine the prevalence of hypertension and identify its contributory factors in the labor force population in Karamay. A total of 2819 adults (55.9% male adults) were interviewed and examined. The overall crude prevalence of hypertension was 32.4%. Among 914 hypertensive patients, 34.8% were aware of their diagnosis, 22.1% received treatment, and 5.6% achieved blood pressure control. Hypertension was significantly correlated with age, overweight/obesity, central obesity, diabetes, and dyslipidemia in both men and women. In addition, less education, alcohol consumption, and less walking were risk factors for men. Effective hypertension prevention and control programs are urgently needed to decrease the burden of hypertension in this region.

Hypertension is a major public health problem worldwide because of high prevalence and various complications. Globally, hypertension has been identified as one of the leading risk factors for disease burden, responsible for 9.4 million deaths in 2010. Due to economic growth and urbanization, dietary patterns and lifestyles have changed in many developing countries. Additionally, because life expectancy has increased in developing nations, chronic diseases such as hypertension are receiving greater attention.

As an important developing country with the largest population in the world, in China, hypertension is increasing rapidly. A recent systematic review demonstrated that in China, the age-standardized prevalence of hypertension increased by 1.4% per year from 2002 to 2012[1]. Karamay is a famous oil city in the Xinjiang Uygur Autonomous Region of Northwest China. The labor force population plays an important role in family life and development of the social economy. To our knowledge, no study has investigated the epidemiological characteristics of hypertension in the labor force population in Karamay. Therefore, a cross-sectional survey of chronic diseases and life habits was conducted in 2012 among the population aged 18 to 60 years.

After a participant provided written informed consent, a self-administrated questionnaire was used to collect sociodemographic and life habits data. Dietary information was based on self-reported data. Physical examination was performed to measure pressure levels, height and weight, and other parameters. Blood was tested for fasting plasma glucose and serum lipid levels. Hypertension was defined as an average systolic blood pressure (BP) ≥140 mmHg, and/or an average diastolic BP ≥90 mmHg, and/or current use of antihypertensive medications.

Statistical analyses were carried out using SAS 9.4 (SAS Institute, Cary, NC, USA). The estimated prevalence of hypertension was adjusted for age using the 2000 Chinese census. Univariate and multivariate logistic regression analyses were performed to evaluate the association between potential factors and hypertension. All variables with $P<0.05$ in the univariate analysis were entered into the multivariate model; variables were selected by the stepwise method. A P-value <0.05 was considered statistically significant.

A total of 3000 adults were randomly selected

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from 180 work units (including about 90,000 people) that organized employee medical examinations. Finally, 2819 subjects were eligible for analysis.

The basic characteristics of the subjects are shown in Table 1. The average age of the subjects was 41±9.2 years for men and 40±9.2 for women. More than half of the subjects were men (55.9%). Men were more likely to have college or higher degrees, to eat more meat, eat less vegetables or fruit, and were less likely to know the recommended daily amount of salt or edible oil. They were also more likely to be current smokers or drinkers, to be overweight, to have obesity or central obesity, and to have diabetes, dyslipidemia, or hypertension.

Table 1. Characteristics of the Sample

Variables	Men (*n*=1575)		Women (*n*=1244)		*P*-Value
	N	%	*N*	%	
Age at recruitment (years)					0.172
18-29	230	14.6	197	15.8	
30-39	408	25.9	358	28.8	
40-49	688	43.7	512	41.2	
50-60	249	15.8	177	14.2	
Ethnicity (Han)	1375	87.3	1008	81.0	<0.001
Education level					<0.001
College or higher	995	63.2	708	56.9	
High school or lower	580	36.8	536	43.1	
Self-reported health condition*					<0.001
Good	413	26.3	239	19.2	
Fair	1090	69.3	958	77.1	
Poor	70	4.4	46	3.7	
Cigarette smoking (daily or occasional)	844	53.6	27	2.2	<0.001
Alcohol drinking, last year					<0.001
Never	232	14.7	677	54.4	
Less than monthly	321	20.4	368	29.6	
Monthly	357	22.7	104	8.4	
Weekly	299	19.0	39	3.1	
≥3 days per week	366	23.2	56	4.5	
Knew recommended daily salt intake <6 g	695	44.1	645	51.9	<0.001
Knew recommended daily edible oil intake <25-30 g	475	30.2	457	36.7	<0.001
Eating meat >50 g per day	482	30.6	184	14.8	<0.001
Eating vegetables <300 g per day	331	21.0	181	14.6	<0.001
Eating fruit <200 g per day	713	45.3	318	25.6	<0.001
Moderate and above intensity physical activity (≥5 days per week, ≥30 min per day)	335	21.3	294	23.6	0.135
Walking time (every day, >30 min per day)	221	14.0	163	13.1	0.475
Sedentary activity per day (hours)*					0.178
<3	209	13.3	196	15.8	
3-6	826	52.5	636	51.2	
≥6	537	34.2	411	33.1	
Body mass index (kg/m^2)*					<0.001
Normal (BMI<24)	494	31.3	816	65.7	
Overweight (24≤BMI<28)	754	47.9	331	26.6	
Obesity (BMI≥28)	327	20.8	96	7.7	
Central obesity*	1020	64.8	370	29.8	<0.001
Diabetes*	160	10.4	64	5.3	<0.001
Dyslipidemia	857	54.4	380	30.6	<0.001
Hypertension	632	40.1	282	22.7	<0.001

Note. *Values may not add up to totals due to missing data.

The overall crude prevalence of hypertension was 32.4% (age-standardized prevalence was 29.3%), with 40.1% for men (age-standardized prevalence was 36.5%) and 22.7% for women (age-standardized prevalence was 20.8%). The prevalence of hypertension was significantly higher in men than in women (*P*<0.001), which was possibly due to higher proportions of unhealthy lifestyle choices in men. The prevalence of hypertension in Karamay is much higher than that reported by other areas in Xinjiang[2] and other cities or provinces in China[3].

Compared with normotensive subjects, hypertensive subjects had significantly higher levels of blood pressure, fasting plasma glucose, total cholesterol, triglycerides, and low-density lipoprotein (LDL) cholesterol, and had lower levels of high-density lipoprotein (HDL) cholesterol, and HDL cholesterol/total cholesterol ratio (Table 2). Hypertensive subjects were more likely to smoke or drink, to eat more meat or less fruit, to walk less, and to have a higher BMI compared to normotensive subjects (*P*<0.05 for all comparisons, data not shown).

Among 914 hypertensive patients, 34.8% were aware of their diagnosis, 22.1% received treatment, and 5.6% achieved BP control. Men had a higher awareness rate (38.0% *vs.* 27.7%, *P*=0.003) and treatment rate (24.1% *vs.* 17.7%, *P*=0.033) than women. However, the control rate was similar between men and women (5.4% *vs.* 6.0%, *P*=0.693). The awareness, treatment, and control rates among hypertensive patients in our study are still low, when compared with data from several large Chinese cities in 2007-2008[3].

Multivariate logistic regression analysis indicated that hypertension was significantly correlated with age, overweight and obesity, diabetes, and dyslipidemia in both men and women (Table 3). In addition, lower education, alcohol consumption, and less walking were risk factors for men. Most studies have reported that the prevalence of hypertension increased with age[4], which was also observed in our study.

Like other studies[4], we found that lower education level was associated with hypertension in men. In this study, men with a lower education level were more likely to smoke (58.1% *vs*. 51.0%, *P*=0.006) or drink alcohol ≥3 days per week (26.7% *vs*. 21.2%, *P*=0.012) than well-educated men; these unhealthy behaviors may partially explain their higher hypertension prevalence.

A strong relationship between heavy alcohol consumption and hypertension is well-known. In our study, we evaluated the association between the frequency of alcohol consumption and hypertension, and found that men who drank ≥3 days per week and weekly drinkers were 1.44 and 1.57 times more likely to be hypertensive, respectively. It has been reported that decrease in alcohol consumption among heavy drinkers has a pronounced effect on BP decrease[5]. These findings strongly suggested that decrease in alcohol consumptionplays an important role in preventing hypertension.

In the present study, we observed inverse associations between walking time and hypertension in men. Persons who walk less may not get enough exercise, and previous studies have indicated that physical inactivity is related to hypertension[6].

Table 2. Levels of Blood Pressure, Glucose and Cholesterol (mean±SD) in Hypertension and Non-Hypertension Groups

Variables	Non-hypertension (*n*=1905)	Hypertension (*n*=914)	*P*-Value
Blood pressure (mmHg)			
Systolic	118±10	145±15	<0.001
Diastolic	76±8	96±10	<0.001
Fasting plasma glucose level (mmol/L)	5.49±0.95	6.00±1.57	<0.001
Cholesterol levels			
Total cholesterol (mmol/L)	5.01±0.92	5.30±1.00	<0.001
Triglycerides (mmol/L)	1.50±0.94	2.04±1.29	<0.001
LDL cholesterol (mmol/L)	2.87±0.82	2.95±0.88	0.029
HDL cholesterol (mmol/L)	1.48±0.41	1.42±0.40	<0.001
HDL cholesterol/total cholesterol ratio	0.30±0.10	0.27±0.08	<0.001

Table 3. Factors Associated with Hypertension in Men and Women

Factors	Men (*n*=1575)		Women (*n*=1244)	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Age (year)	1.03 (1.02-1.05)‡	1.03 (1.02-1.05)‡	1.02 (1.00-1.03)*	1.02 (1.00-1.03)*
Ethnicity				
Other	1.0		1.0	
Han	0.87 (0.65-1.18)		0.90 (0.65-1.26)	
Education level				
College or higher	1.0	1.0	1.0	
High school or lower	1.87 (1.52-2.30)‡	2.01 (1.59-2.55)‡	1.33 (1.02-1.74)*	
Cigarette smoking (daily or occasional)				
No	1.0		1.0	
Yes	1.01 (0.83-1.24)		1.20 (0.50-2.87)	
Alcohol drinking, last year				
Never	1.0	1.0	1.0	
Less than monthly	0.76 (0.53-1.08)	0.79 (0.53-1.17)	0.88 (0.65-1.20)	
Monthly	1.12 (0.79-1.58)	1.21 (0.83-1.77)	0.72 (0.43-1.23)	
Weekly	1.65 (1.16-2.34)†	1.57 (1.06-2.33)*	0.83 (0.38-1.85)	
≥3 days per week	1.63 (1.16-2.28)†	1.44 (1.00-2.08)*	1.29 (0.71-2.37)	
Eating meat >50 g per day				
No	1.0		1.0	
Yes	1.10 (0.88-1.37)		1.20 (0.84-1.73)	
Eating vegetables <300 g per day				
No	1.0		1.0	
Yes	1.27 (0.99-1.62)		0.73 (0.49-1.09)	
Eating fruit <200 g per day				
No	1.0		1.0	
Yes	1.21 (0.99-1.48)		0.97 (0.72-1.32)	
Moderate and above intensity physical activity (≥5 days per week, ≥30 min per day)				
No	1.0		1.0	
Yes	0.86 (0.67-1.10)		1.04 (0.76-1.41)	
Walking time (every day, >30 min per day)				
No	1.0	1.0	1.0	
Yes	0.61 (0.45-0.83)†	0.68 (0.48-0.96)*	1.00 (0.68-1.49)	
Sedentary activity per day (hours)				
<3	1.0		1.0	
3-6	0.88 (0.65-1.20)		1.01 (0.69-1.48)	
≥6	0.89 (0.65-1.24)		0.93 (0.62-1.39)	
Body mass index (kg/m^2)				
Normal	1.0	1.0	1.0	1.0
Overweight	2.02 (1.57-2.59)‡	1.70 (1.25-2.31)‡	2.62 (1.94-3.52)‡	1.86 (1.30-2.65)‡
Obese	4.27 (3.17-5.76)‡	3.29 (2.25-4.81)‡	4.51 (2.89-7.02)‡	2.24 (1.30-3.86)†
Central obesity				
No	1.0	1.0	1.0	1.0
Yes	2.54 (2.03-3.19)‡	1.36 (1.01-1.82)*	3.22 (2.44-4.25)‡	1.82 (1.27-2.62)†
Diabetes				
No	1.0	1.0	1.0	1.0
Yes	2.60 (1.86-3.64)‡	2.13 (1.48-3.05)‡	3.93 (2.36-6.54)‡	3.70 (2.13-6.42)‡
Dyslipidemia				
No	1.0	1.0	1.0	1.0
Yes	2.19 (1.78-2.70)‡	1.65 (1.31-2.07)‡	2.59 (1.96-3.40)‡	2.16 (1.61-2.89)‡

Note. OR: odds ratio; CI: confidence interval; AOR: adjusted odds ratio. *: $P<0.05$; †: $P<0.01$; ‡: $P<0.001$.

Consistent with other studies, our results also indicated that overweight, obesity, or central obesity were significant risk factors for hypertension. Recent data indicated that the prevalence of overweight and obesity has increased dramatically in China from 1993 to 2009[7]. In order to decrease the burden of obesity-related diseases, education programs are urgently needed for maintaining healthy body weight and waist circumference through the adoption of healthier diets and regular exercise.

Many observational studies have confirmed that subjects with diabetes or dyslipidemia have a greater risk of hypertension[8]. Our study also proved this positive association. Given that hypertension, diabetes, dyslipidemia, and obesity occur concomitantly, the risk of cardiovascular disease is increased. Therefore, it is important to consider comprehensive treatment, management, and prevention strategies to decrease the occurrence and health risk of these diseases.

In conclusion, hypertension is highly prevalent among the Karamay labor force population, whereas hypertension awareness, treatment, and control rates are unacceptably low, all of which alerted the government and health departments that hypertension has become a common issue and a serious threat in Karamay. It is noteworthy that the hypertension-related risk factors identified in our survey are closely correlated with high-risk diet and life habits. Effective hypertension prevention and control programs including lifestyle modifications should be extended to various work units in this region, by increasing physical activity, control of alcohol consumption, and healthier diets.

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