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Studies on Current Status of Hypertension Prevalence, Awareness, Treatment in Jiangxi Province, China

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Abstract

Objective

To understand the present status of high blood pressure in Jiangxi adults including the prevalence rate, overall awareness, and hypertension treatment.

Methods

a total of 7,200 adult participants (over 18 years old) lived in Jiangxi were recruited using a stratified sampling method. Blood pressure was measured for all the participants and a questionnaire survey was conducted. A 24-hour urine sample was also collected to understand urine sodium and potassium levels.

Results

Our findings revealed that the measured systolic blood pressure (SBP) and diastolic blood pressure (DBP) were 125.9 mmHg (95% CI, 124.85-126.95) and 79.2 mm Hg (95% CI, 78.15-80.25). The prevalence of hypertension among the enrolled adults was 27.43% (95% CI, 26.38%–28.48%). Among the affected participants, less than 30% of them (95% CI) were aware of their hypertension condition, and only 28.56% (95% CI) were under anti-hypertension medications. The mean salt intake converted from urinary sodium was 10.92±4.07 g and the mean±SD of 24-h urinary sodium and potassium excretion were 185.51±65.44 mmol and 25.98±9.16 mmol, respectively. The high-salt condiments was determined to be the main source of sodium in the region.

Conclusion

Findings from this study form the baseline information to understand the hypertension condition in the region and indicate a possible solution for hypertension prevention through avoiding high-salt condiments.

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Introduction

The prevalence of hypertension and hypertension-related mortality has been growing rapidly and the rising trend in hypertension is a concerning issue [1]. According to the China Cardiovascular Disease Report of 2012, the rate of hypertension among adults in China aged 18 and older was as high as 24%, approximately 266 million people. Excess dietary salt intake correlates with hypertension, a major risk factor for cardiovascular diseases (CVDs), which are the leading causes of death and disabilities [2]. It is critical to understand the epidemiological characteristics of hypertension in China in order to establish relevant countermeasures for effective prevention and control [3]. This carries an important practical significance as well.

Jiangxi province is located in the southeast of China with a population of 45 million and is ranked as being the second largest in salt intake [4,5]. The average daily salt consumption in Jiangxi Province is 11.7 close to twice the recommended daily salt intake by the World Health Organization (WHO) [6,7]. Studies show that reducing consumption of salt has an effect of lowering blood pressure and helps to reduce risks of CVDs [8,9]. By reducing salt intake to less than 5 grams per day, it could substantially reduce blood pressure and potentially prevent 1.7 million deaths each year [10,11]. There was no salt intake restriction action or hypertension prevalence survey has been carried out in Jiangxi since 2002 [2]. In 2018, the Chinese government launched a limitation on salt intake in Jiangxi province, aimed to reduce hypertension and hypertension-related diseases, and to better understand the current situation of local hypertension prevalence, awareness, treatment, and control and sodium intake.

Materials and Methods

Sample Sampling

The baseline investigation of Salt Reduction Action was conducted between May 2018 and October 2018. Respondents of the limited salt intake action were between the ages of 18 to 69 and were selected from specific regions. The sample size for the estimated population of the Jiangxi Province was 7200 and 1440 in hypertension and salt intake, respectively. Individuals with disabilities and mental disorders were excluded for this study. A complex, four-stage cluster sampling method was used to select participants.

A total of 9 counties/districts from a total of 100 were enrolled in this study following the characters of geography distribution and residents living status (Figure 1). Second, the proportional sampling method was used to select 2 townships (in rural areas) or 2 streets (in urban areas) from each selected county or district. Third, 2 villages (in rural areas) or neighborhood communities (in urban areas) from each sampled township (in rural areas) or street (in urban areas) were selected as well. Last, 100 local residents were randomly chosen from each of the selected area. This resulted in a total of 7,200 participants. In each village/ neighborhood community, subsample participants were selected for urine sodium and potassium testing and a total of 1,440 urine samples were collected from the participants.

Measurements

All selected participants were recommended for questionnaire investigation, physical measurements and laboratory tests. Questionnaire survey was administered

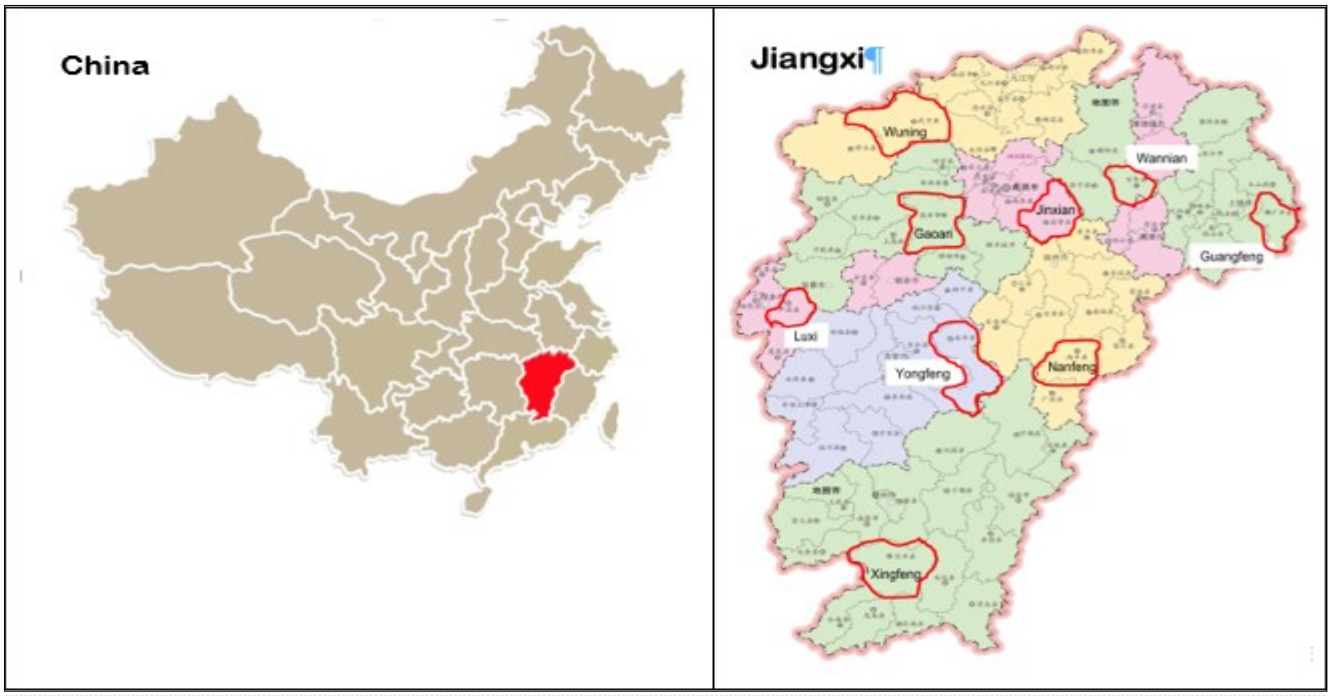

Figure 1. Location of Jiangxi Province (red) in China (Left panel) and nine sampled counties and cities for this study in Jiangxi (Right panel).

face to face by trained health workers. Information collected from questionnaires included personal social demography, history of hypertension and diabetes, smoking and drinking habits, diet, taste preferences and sodium intake. In addition, responses of participant awareness of hypertension, perception of salt consumption, and attitude regarding reducing sodium intake was recorded.

Blood pressure of participants in a relaxed state was measured every 5 minutes by a health technical personnel. A total of 3 measurements were taken for validation. Participant's height, weight, and BWH (bust, waist, hips) were also measured by professional health workers in accordance with the national standards. Body mass index (BMI) was derived from the measured weight and height of each participant. BMI = weight (kg) / height (m). A BMI below 18.5 is considered low weight, a BMI range of 18.5 - 24.99 is considered normal, a BMI range of 25 - 28 is considered overweight, a BMI over 28 is considered obese. A 24-h urine samples were collected from 1,440 subsample participants; a 24-hour dietary recall was administered to each subsample and was carried out for three consecutive days [10]. Professional health workers analyzed and weighed all condiments containing dietary sodium salt and related condiments, such as vinegar, soy sauce, monosodium glutamate and so forth.

Prior to sample collection, participants were given collection instruction in order to accurately determine sodium and potassium amounts in urine. Participants were asked to empty bladder at eight o'clock in the morning, and urine sample was collected afterwards until eight o'clock the next morning. Urine samples were kept in cold storage to prevent deterioration, and the test was repeated for three consecutive days [12]. Assessment of urine sodium and potassium was conducted by professional health workers using the selective electrode method [13]. The urinary potassium and sodium level were evaluated according to the amount of cretonne acid to ensure completeness of urine collection and no over-collection [14].

Statistical Analysis

It was considered to be statistically difference while $P<0.05$ (two-tailed, $P<0.05$) in the large sample, and it was considered to be statistically difference while $P<0.01$ (two-tailed, $P<0.01$) in the subsample. Median and 95% confidence interval (95%CI) or means±SD

were estimated. The Chi-square test was used to assess different characteristics such as gender and age groups. The student's test and variance analysis were used to compare the means between different characteristics. Statistical analysis of all the data was performed with SPSS 19.0. The estimated indicators of high blood pressure were used to represent the overall level of hypertension in the Jiangxi province.

Results

Sample Characteristics

Among 7,200 enrolled individuals, 7,036 respondents participated and completed the survey and interview. Specifically, 3,710 were males and 3,326 were females, with a total response rate of 97.7%. 164 individuals did not completely response the survey, which accounted for 2.3%. In addition, 1,306 participants, out of the target 1440, accomplished 24-h urine collection which accounting for 90.7% (Figure 2).

The average age of participants was 42.7 (SD 12.97). Most participants in this study were Han Chinese and accounted for 99.82%. Of all the participants, 35.89% participants were current smokers. The prevalence of overweightness and obesity were 34.81% and 17.64 %, respectively. 310 participants were classified as low weight, 3,036 (43.15%) had normal weight, 2,449 were overweight, and 1,241 were obese (Table 1)

Prevalence, Awareness, Treatment and Control of Hypertension

Overall, the weight mean ± SD was 128.63 ± 9.08 mmHg for systolic blood pressure (SBP) and 82.27 ± 6.76 mmHg for diastolic blood pressure (DBP), respectively. Males had a higher mean SBP and DBP than females. Participants in urban areas had a lower SBP (123.1 mmHg, 95%CI, 122.05-124.15) and DBP (77.1 mmHg, 95% CI, 76.05-78.15) than those participants in rural areas who had a SBP (126.9 mmHg, 95% CI, 125.85-127.95) and DBP (82.3 mmHg, 95% CI, 81.25–83.35).

The weighted morbidity rate of hypertension in Jiangxi averaged 27.43% (95% CI, 26.38-28.48%). In those with hypertension, nearly a third of people knew their condition of hypertension (27.74%; 95% CI, 26.69-28.79%). 28.56% (95% CI, 27.51-29.61%) were taking anti-hypertensive drugs. Of those, only 18.19% (95% CI, 17.14%-19.24%) could control blood pressure in regards to normal levels after taking blood pressure medication.

The hypertension prevalence rates in rural and urban areas were not significantly different (P = 0.08). However, in terms of awareness and treatment the differences between rural and urban areas were prominent, showing that the awareness rate (P = 0.002) and treatment rate (P = 0.005) in rural areas were lower than that in urban areas. There was no significant difference in the rate of hypertension control between urban and rural areas. The prevalence and control rate of hypertension showed no significant difference with respect to gender (Table 2).

Salt Intake Situation from Urinary Sodium and Potassium Excretion

A total of 1,306 participants completed a 24-h urine collection with average sodium and potassium excretion at 185.51 ± 65.44 mmol and 25.98 ± 9.16 mmol, respectively. The average sodium intake converted from urine was 10.92 ± 4.07 g.

The 24-h urinary sodium excretion showed significant difference between urban and rural areas: the urinary sodium excretion in urban areas was lower than that in rural areas (P<0.01). Such difference was also reflected with respect to gender: males excreted more sodium than females (P<0.01). However, we did not find a difference in the 24-h urinary potassium excretion (P = 0.08) between rural and urban participants (Table 3).

Discussion

Hypertension represents one of the serious health problem worldwide today and a key risk factor associated with cardiovascular diseases [15-17]. Our study indicated that the prevalence rate of hypertension in Jiangxi was 27.43%; nearly one out of every three people had high blood pressure. Currently, the incidence of hypertension in Jiangxi has become more common and the prevalence of hypertension has got more concerned in southern China [18-20]. Findings of current increase of hypertension in the region emphasize the need for government and health organization to establish more specific measurements to

Table 1. Characteristics of respondents in this study from Jiangxi population

Characteristics	Total			Urban			Rural			Male			Female		
	N	%	95%CI	N	%	95%CI	N	%	95%CI	N	%	95%CI	N	%	95%CI
Age (years)															
18-29	1309	18.60 %	17.55-19.65%	470	18.40 %	17.35-19.45%	838	23.00 %	21.95-24.05%	704	18.98%	17.93-20.03%	604	18.16 %	17.11-19.21%
30-39	1511	21.48 %	20.43-22.53%	515	20.16 %	19.11-21.21%	888	19.82 %	18.77-20.87%	740	19.95%	18.90-21.00%	663	19.93 %	18.88-20.98%
40-49	1994	28.34 %	27.29-29.39%	764	29.90 %	28.85-30.95%	1342	29.95 %	28.90-31.00%	1153	31.08%	30.03-32.13%	953	28.65 %	27.60-29.70%
50-59	1402	19.93 %	18.88-20.98%	497	19.45 %	18.40-20.50%	898	20.04 %	18.99-21.09%	743	20.03%	18.98-21.08%	652	19.60 %	18.55-20.65%
60-69	820	11.65 %	10.60-12.70%	309	12.09 %	11.04-13.14%	515	11.49 %	10.44-12.54%	370	9.97%	8.92-11.02%	454	13.65 %	12.60-14.70%
Ethnicity															
Han	7023	99.82 %	99.67-99.97%	2550	99.80 %	99.65-99.95%	4473	99.82 %	99.67-99.97%	3710	99.76%	99.61-99.91%	3322	99.88 %	99.82-99.94%
Other	13	0.002	0.05-0.35%	5	0.20%	0.05-0.35%	8	0.18%	0.05-0.35%	9	0.24%	0.09-0.39%	4	0.12%	0.06-0.18%
Education															
<9	2952	41.96 %	40.88-43.04%	1096	42.90 %	41.85-43.95%	1856	41.42 %	40.38-42.46%	1529	41.20%	40.16-42.24%	1424	42.81 %	41.75-43.87%
9~11	2677	3.47%	2.39-4.55%	980	38.36 %	37.31-39.41%	1697	37.87 %	36.83-38.91%	1429	38.51%	37.47-39.55%	1248	37.52 %	36.46-38.58%
≥12	1407	20.00 %	18.92-21.08%	479	18.75 %	17.70-19.80%	928	20.71 %	19.67-21.75%	753	20.29%	19.25-21.33%	654	19.66 %	18.60-20.72%
Smoking status															
Never	4310	61.26 %	60.18-62.34%	1577	61.72 %	60.64-62.80%	2733	60.99 %	59.95-62.03%	1229	33.13%	32.08-34.18%	3081	92.63 %	92.51-92.75%
Before	201	0.26%	1.78-3.94%	68	2.66%	1.58-3.74%	133	2.97%	1.93-4.01%	190	5.12%	1.04-6.17%	11	0.33%	0.21-0.45%
Current	2525	35.89 %	34.81-36.97%	910	35.62 %	34.54-36.70%	1615	36.04 %	35.00-37.08%	2291	61.75%	60.70-62.80%	234	7.04%	6.92-7.16%
BMI															
Low weight	310	4.41%	3.37-5.45%	103	4.03%	2.97-5.09%	207	4.62%	3.58-5.66%	155	4.18%	3.13-5.23%	155	4.66%	3.60-5.72%
Normal	3036	43.15 %	42.11-44.19%	1114	43.60 %	42.54-44.66%	1922	42.89 %	41.85-43.93%	1629	43.91%	42.86-44.96%	1407	42.30 %	41.24-43.36%
Overweight	2449	34.81 %	33.77-35.85%	886	34.68 %	33.62-35.74%	1563	34.88 %	33.84-35.92%	1299	35.01%	33.96-36.06%	1150	34.58 %	33.52-35.64%
Obese	1241	17.64 %	16.60-18.68%	452	17.69 %	16.63-18.75%	789	17.61 %	16.57-18.65%	627	16.90%	15.85-17.95%	614	18.46 %	17.40-19.52%

Table 2. Means of SBP, DBP and Hypertension prevalence, awareness, treatment and control among adults in Jiangxi

Measure	Total mean (95% CI)	Urban mean (95% CI)	Rural mean (95% CI)
SBP (mm Hg)*			
Male	129.3（128.25-130.35）	126.8（125.75-127.85）	133.6（132.55-134.65）
Female	120.4（119.35-121.45）	119.6（118.55-120.65）	120.6（119.55-121.65）
Total	125.9（124.85-126.95）	123.1（122.05-124.15）	126.9（125.85-127.95）
DBP (mm Hg)**			
Male	81.2（80.15-82.25）	79.2（78.15-80.25）	84.6（83.55-85.65）
Female	76.3（75.25-77.35）	75.7（74.65-76.75）	79.9（78.85-80.95）
Total	79.2（78.15-80.25）	77.1（76.05-78.15）	82.3（81.25-83.35）
Prevalence			
Male	27.00（25.95-28.05）	26.59（25.54-27.64）	27.24（26.19-28.29）
Female	27.90（26.85-28.95）	29.64（28.59-30.69）	26.92（25.87-27.97）
Total	27.43（26.38-28.48）	28.02（26.97-29.07）	27.09（26.04-28.14）
Awareness			
Male	27.43（26.38-28.48）	27.25（26.20-28.30）	27.54（26.49-28.59）
Female	28.08（27.03-29.13）	26.04（24.99-27.09）	29.22（28.17-30.27）
Total	27.74（26.69-28.79）	26.69（25.64-27.74）	28.34（27.29-29.39）
Treatment			
Male	28.92（27.87-29.97）	28.21（27.16-29.26）	29.33（28.28-30.38）
Female	28.17（27.12-29.22）	25.29（24.24-26.34）	29.78（28.73-30.83）
Total	28.56（27.51-29.61）	26.84（25.79-27.89）	29.54（28.49-30.59）
Hypertension control			
Male	17.70（16.65-18.75）	18.00（16.95-19.05）	19.78（18.73-20.83）
Female	18.73（17.68-19.78）	18.42（17.37-19.47）	18.90（17.85-19.95）
Total	18.19（17.14-19.24）	18.19（17.14-19.24）	18.18（17.13-19.23）

*SBP = systolic blood pressure, **DBP = diastolic blood pressure

Table 3. Differences in daily dietary sodium intake and urinary sodium and potassium excretion among participants in Jiangxi Province

24h Urinary measure	N	Sodium (Mmol/24h)		Potassium (Mmol/24h)		24h Na/K		Converted salt (g)	
		Mean±SD	*P*	Mean±SD	*P*	Mean±SD	*P*	Mean±SD	*P*
Sex									
Male	694	201.34±69.12	P<0.01	29.21±9.94	P=0.12	7.09±1.98	P<0.01	10.98±4.08	P<0.01
Female	612	194.26±61.71		28.37±9.15		6.49±1.93		10.31±3.79	
Residence									
Urban	598	190.36±70.11	P<0.01	25.29±9.57	P=0.09	6.34±5.94	P<0.01	9.94±3.49	P<0.01
Rural	708	203.94±69.38		27.68±10.14		7.19±2.31		11.06±4.02	
Age									
18-34	391	181.26±66.65	P<0.01	24.61±9.12	P=0.08	6.98±1.97	P<0.01	10.65±3.89	P<0.01
35-49	432	194.21±67.24		25.39±8.92		6.99±1.89		11.09±4.06	
50-69	483	181.08±62.45		27.94±9.46		6.94±2.01		11.04±4.28	
Total	1306	185.51±65.44		25.98±9.16		6.97±1.95		10.92±4.07	

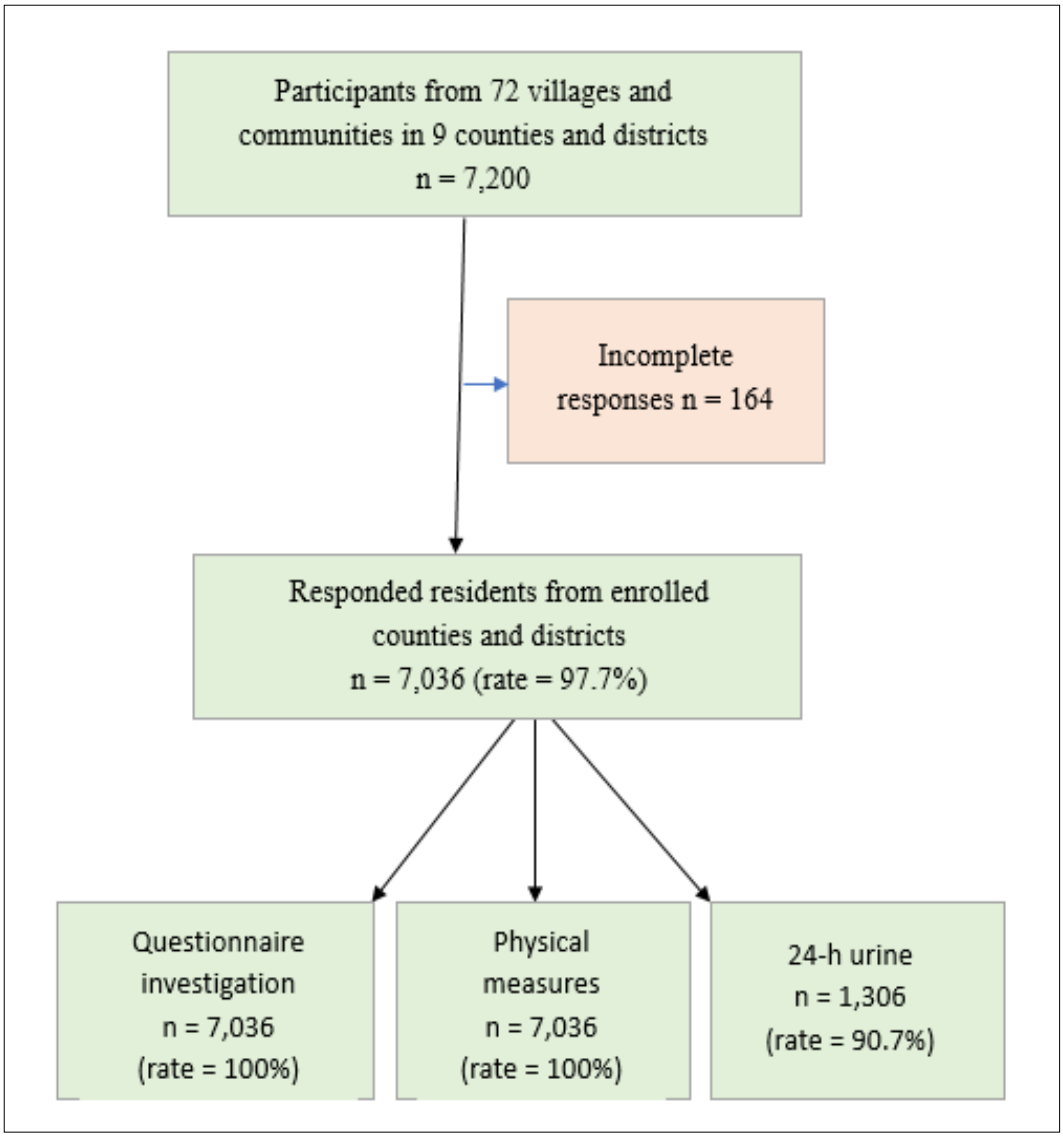

Figure 2. Sample characteristics of the participants on sodium reduction action baseline survey in Jiangxi, China, in 2018

control and prevent the hypertension effectively.

In 2010, studies at the national level concluded that the prevalence of hypertension varies by gender, age, and geographic regions [21]. The hypertension prevalence was more common in rural areas. However, the gap between urban and rural prevalence narrowed significantly over the years; the proportion of urban to rural areas was 1.2. These suggest that economic improvement in rural areas changed living standard of the residents, and provided greater access to measure blood pressure and allowed diagnosis of previously missed hypertension [22]. We found that the prevalence ratio of urban to rural areas in Jiangxi was nearly equal to 1 and there was no significant difference. From the survey results we also found that the male smoking rate was significantly higher than females. However, the incidence of hypertension in men was not significantly higher than that of women.

In our study, we found that the rate for hypertension management through blood pressure control was very low (<20%) in Jiangxi as compared to many western nations [23,24]. A study from Canada reported that their awareness, treatment and control rates among hypertension adults were as high as 82.6%, 80.0% and 64.6%, respectively. Improving the awareness, treatment and control rate of hypertension in Jiangxi becomes an important task for hypertension prevention and control. Routine blood pressure needs to be tested even for normal healthy adults. Community involvement can also operate as a basic level for hypertension prevention. By strengthening community education of hypertension, this may serve as a basis for comprehensive intervention and standardized management [25].

On the other hand, hypertension is known to be related to diet. Therefore, this may represent an important target in regards to nutrition medicine. Findings from our urinary sodium and potassium excretion tests showed that the average of salt consumption is 10.92 g, which was converted from the urinary sodium. Dietary sodium intake and blood pressure levels were significantly correlated. Although salt is one of the most important substances for human survival, the daily salt consumption should not exceed 6 grams. Analysis of daily dietary salt in Jiangxi showed salt, soy sauce and pickles are the main sources and Jiangxi adults are often preferred for high salty food. Thus, limiting salt intake would be a significant approach to reduce the incidence of hypertension and other CVDs. Previous studies also indicated that potassium and sodium excretion can promote each other; increasing potassium intake would promote sodium excretion and prevent salt mediated hypertension [26,27]. By taking a daily 60 mmol potassium supplement, SBP and DBP in hypertensive patients could be reduced by 2.5 mmHg and 4.4 mmHg respectively. In healthy populations, it may be lowered by 1.8 mmHg (SBP) and 1.0 mmHg (DBP) [28]. Our findings further support the importance of Improving and maintaining a healthy lifestyle for prevention and treatment of hypertension and hypertension-related diseases. Since excessive sodium consumption is known to increase the risk of stroke and may also burden the kidneys, this strongly emphasizes the importance of dietary salt restriction. Smoking cessation, weight loss, reducing alcohol consumption, proper exercise, or taking potassium and calcium supplements may also be effective in reducing incidences of hypertension.

Conclusion

This study has generated essential information about current condition of hypertension in Jiangxi province which is useful for the local government for their development of more specific approaches to combat the disease effectively in the region. The findings of high prevalence rate, low awareness rate, low treatment rate, low control rate indicate an urgent need for enhanced public education in hypertension. In addition, this study showed that high dietary sodium intake is likely associated with the hypertension, which emphasizes a potential target area for future prevention and control of hypertension in Jiangxi. These new findings argue for comprehensive intervention to control the occurrence of hypertension including increased awareness of the disease through public education and medical guidance, improved understanding of adverse impact of hypertension on human health, and enhanced participation for medical treatment.

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Conflicts of Interest

The authors declare no conflict of interest, financial or otherwise.

Affiliation

ZHJ & JZ: study design, data collection and analysis, and manuscript preparation.

JYW and JSL: data collection and analysis.

MHH: manuscript preparation.

YL: Data verification and manuscript preparation.

Ethics Approval and Consent to Participate

The study was approved by the Medical Ethics Committee of Jiangxi University. of Traditional Chinese Medicine. To respect and protect the privacy of each participants, the surveys were conducted anonymously. Before the investigation, respondents expressed a verbal understanding of these issues and signed consent forms

Human and Animal Rights

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national).

Consent for Publication

Written informed consent was obtained from all the participants.

Availability of Data and Materials

All data generated or analyzed throughout this research are included in this published article.

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