Body composition as a predictor of blood pressure in three communities in Guangdong province, China

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The aim of this study was to compare mean blood pressure (BP), anthropometric and body compositional measurements in three Chinese communities and to examine relationships between BP and body composition in these communities. A total of 935 adult (aged ≥ 25 years) men and women were randomly sampled from three communities (Chauzhou County speaking Teochew, Meixian County speaking Hakka, and Xinhui speaking Cantonese) in Guangdong Province, China. Self-administered questionnaires about food habits, lifestyle and health status were completed. Body weight, stature, waist and hip circumferences and systolic and diastolic blood pressures were measured. Body mass index, waist to hip ratio, fat free mass, total body fat mass and the percentage body fat were calculated to assess body composition. No significant differences were found in stature, body mass index, umbilical circumference, hip circumference, fat free mass, percentage body fat and defined hypertension between the three communities. However, the waist to hip ratio was lower in Chauzhou men than Meixian women. The mean BPs were different between the communities and mean blood pressure was the highest in the Chauzhou community. Intra-community non-parametric relations between BP and body composition were found mostly in men with increased total and abdominal fatness positively related to BP. The relationships of the aggregate communities with blood pressure were found consistent with those for intra-community analyses, although the body fatness–blood pressure relationship was then evident without exception. Anthropometrically assessed body composition predicts BP in Chinese men, but to a lesser extent, in Chinese women in Guangdong Province, China.

Key words: Chinese, China, Chauzhou County, Meixian County, Xinhiu County, Teochew dialect, Hakka dialect, Cantonese dialect, ethnicity, body composition, blood pressure, cardiovascular disease risk, hypertension.

Introduction

Cardiovascular disease is a major cause of deaths in the People's Republic of China with the incidence of stroke being at least five times as common as myocardial infarction.[1,2] Hypertension is a major risk factor for stroke.[3,4] Genetic and dietary factors, socio-economic status, physical activity, and body fatness are known to play a role in the development of hypertension.[5] Of the known risk factors, body fatness has been shown to be consistently and positively related to hypertension.[6]

Although Chinese people living in the same location have been shown to have a much lower prevalence of overweight compared with a Caucasian population,[7] we do not know whether this difference in body fatness translates into lower blood pressure (BP) in Chinese. In this paper we consider the influence of body fatness and its distribution[8,9] on BP in Chinese people in three communities of Guangdong Province, China, each a different Chinese dialect group with substantial ancestral and cultural differences.

Methods

This study was granted ethics approval by the Guangdong Provincial Public Health Bureau and the Guangdong Provincial Cardiovascular Institute. A consent form was signed by all participants. Subjects, aged 25 years and over, were randomly selected from Chauzhou City, Meixian City, and Xinhui county in Guangdong Province of China. The three study communities are major donor populations for overseas Chinese, especially in South-east Asia and Australia. They represent the three major sub-ethnicities of southern Chinese. Each has its own dialect (Teochew, Hakka and Cantonese) and is geographically separated. Questionnaires were self-administered. Information about lifestyle, food habits, socio-demographic characteristics and cardiovascular risk factors were obtained.

Body weight was measured to the nearest 0.5 kg in light clothing on a digital scale and stature was measured, without shoes, to the nearest centimetre. The body mass index (BMI) was calculated by dividing body weight (kg) by stature (m^2). The waist circumference was measured twice at the level of the umbilicus, to the nearest millimetre. The hip circumference was measured twice to the nearest millimetre at the maximum diameter. The waist to hip ratio (WHR) was calculated by dividing the waist circumference by the hip cir-

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cumference. To estimate the fat free mass (FFM), we used an equation of Deurenberg *et al.*:[10] FFM = 0.282height + 0.395weight + 8.4sex–0.144age–23.6 (with sex = 0 when female and sex = 1 when male). Total body fat (TBF) was calculated by subtracting FFM from body weight. The percentage body fat (BF%) equals TBF divided by body weight × 100.

Blood pressure was measured three times in the right arm in the sitting position using a standard mercury sphygmomanometer, with at least 5 min rest between measurements.[11] Korotkoff's phases I and V sounds were recorded for systolic (SBP) and diastolic (DBP) blood pressure, respectively.[7] Hypertensives were defined using the criteria of the Risk Factor Prevalence Study of the Australian National Heart Foundation, which takes into account the use of BP tablets.[12]

Statistical procedures were those of the Statistical Analysing System (SAS).[13–15] The Student's *t*-test was used to test gender differences in mean age, anthropometry, body composition and BP. Tukey's Studentized test was used to test differences between any two communities, separated by gender. Relations between BP, age and body fatness between communities were analysed non-parametrically using Pearson's correlation coefficient. To adjust for age and stature the partial statement in the correlation procedure was used. The analysis of covariance was used to obtain adjusted means and the standard error of the means. Differences in the prevalence of hypertension between two communities were performed using a test of differences in proportions. A significance level of 5% was set for all tests.

Results

A total of 935 adults from Chauzhou city (203 men, 111 women), Meixian city (169 men, 140 women), and Xinhui county (194 men, 118 women) participated in this study. Men and women in Meixian were younger than Chauzhou men and women. Women in Xinhui were older than their counterparts in Meixian. Men in Chauzhou and in Meixian had a higher education level than their counterparts in Xinhui. Women from all communities were less educated than men (Table 1).

There were significant differences between men and women for age, SBP and DBP, and all body fatness variables, except for BMI. The prevalence of a family history of high BP was significantly higher in Chauzhou women than in Xinhui women (Table 2). No significant differences were found in mean BMI, WHR, FFM, TBF, BF%, SBP or DBP between women with, without or of unknown family history of high BP.

The prevalence of hypertensives not using BP medication was greater in Chauzhou men, than in their counterparts in Xinhui. The prevalence of hypertensives not using BP medication was greater in Chauzhou women than in Meixian women. No significant differences were found in the prevalence of total hypertensives between the three communities for men or women. Generally, there was a greater prevalence of hypertension in men than in women (Table 3).

Systolic BP differed significantly between the three communities for men, with Chauzhou men having the highest SBP and Xinhui men the lowest SBP. Diastolic BP in Chauzhou men was significantly higher than in Xinhui men (Table 4). After adjustment for age, similar significant differences between the communities were found for BP in men (Table 5). No significant differences were found for men in the body compositional measurements between the communities (Table 4).

After adjusting for age, however, WHR in Meixian men was significantly higher than in Chauzhou men (Table 5); and for Meixian women it was significantly lower (Table 5).

In women, SBP and DBP were significantly higher in Chauzhou than in Meixian and Xinhui (Table 4). After

Table 1. Socio-demographic variables characteristics, by gender and community

	Men			Women		
	Chauzhou (n = 203)	Meixian (n = 169)	Xinhui (n = 194)	Chauzhou (n = 111)	Meixian (n = 140)	Xinhui (n = 118)
Age (years, mean ± SD)	46.4[a]±9.1	43.2[a]±10.3	44.3±9.6	40.3[a]±9.2	36.7[ab]±8.3	40.5[b]±8.2
Marital status (%)						
Married	98.5	95.9	93.8	91.9	98.6	95.8
Never married	0.5	3.6	4.6	3.6	0.7	2.5
Separated/divorced	1.0	0.0	0.0	0.9	0.7	0.8
Widowed	0.0	0.6	1.5	3.6	0.0	0.8
Education level (%)						
0–6 years	17.3	4.2	31.6	31.8	7.2	35.6
7–9 years	17.8	26.9	25.8	35.5	38.1	22.0
10–12 years	28.2	40.1	25.3	21.8	47.5	31.4
13+ years	36.6	28.7	17.4	10.9	7.2	11.0
Occupation status (%)						
Professional, administrative	19.3	11.9	7.7	33.3	12.1	22.9
Clerical, sales	49.5	53.0	54.6	55.9	78.6	66.1
Manual worker	7.4	5.4	11.3	1.8	1.4	6.8
Other	23.8	29.8	26.3	9.0	7.9	4.2
Gross household income (%)						
< 5000 RMB*	24.5	3.6	9.4	27.3	1.4	12.0
5001-10000 RMB	62.5	63.1	44.0	55.5	57.6	48.7
> 10001 RMB	13.0	33.3	46.6	17.3	41.0	39.3

[a,b]Identical superscripts indicate significant differences between communities ($P < 0.05$); *Renminbi yuan, Chinese currency.

Table 2. Self-reported hypertension and family history of hypertension, by community and gender

	Men			Women		
	Chauzhou ($n = 203$)	Meixian ($n = 169$)	Xinhui ($n = 194$)	Chauzhou ($n = 111$)	Meixian ($n = 140$)	Xinhui ($n = 118$)
Current use of blood pressure medication (%)	3.9	4.8	5.7	2.7	4.3	5.1
Once told of having high blood pressure (%)	10.1	7.1	8.8	8.1	6.4	5.9
High blood pressure in family (%)						
Yes	18.7	20.7	19.6	11.7	16.4	16.9
No	70.0	63.3	64.9	83.8[a]	73.6	72.0[a]
Unknown	11.3	16.0	15.5	4.5	10.0	11.0

[a]Identical superscripts indicate significant differences between communities ($P < 0.05$).

Table 3. Prevalence of defined* hypertensives (%), by community and gender

	Men			Women		
	Chauzhou ($n = 203$)	Meixian ($n = 169$)	Xinhui ($n = 194$)	Chauzhou ($n = 111$)	Meixian ($n = 140$)	Xinhui ($n = 118$)
Hypertensives defined by DBP and treatment						
On BP tablets and DBP < 95 mmHg	3.0	1.2	2.1	1.8	1.4	2.5
On BP tablets and DBP ≥ 95 mmHg	1.0	3.6	3.6	0.9	2.9	2.5
Not on BP tablets and DBP ≥ 95 mmHg	6.9†	5.3	2.1†	5.4†	0.0†	1.7
Total hypertensives	10.9	10.1	7.8	7.1	4.3	6.7
Hypertensives defined by DBP, SBP and treatment						
On BP tablets and DBP < 95 and SBP < 160 mmHg	2.5	1.2	2.1	0.9	1.4	2.5
On BP tablets and DBP ≥ 95 and/or SBP ≥ 160 mmHg	1.5	3.6	3.6	1.8	2.9	2.5
No BP tablets and DBP ≥ 95 and/or SBP ≥ 160 mmHg	8.4†	6.0	2.6†	6.3†	0.7†	1.7
Total hypertensives	12.4	10.8	9.3	9.0	5.0	6.7

*Defined by the National Heart Foundation, The National Risk Factor Prevalence Study 1989; †Identical superscripts indicate significant differences between communities ($P < 0.05$).

Table 4. Mean and standard deviation for blood pressure and body compositional measurements, by community and gender

	Men			Women		
	Chauzhou ($n = 203$)	Meixian ($n = 169$)	Xinhui ($n = 194$)	Chauzhou ($n = 111$)	Meixian ($n = 140$)	Xinhui ($n = 118$)
SBP (mmHg)	126.5[a] ± 18.6	120.8[a] ± 15.7	116.5[a] ± 15.2	119.9[ab] ± 19.3	113.6[a] ± 15.1	110.2[b] ± 13.8
DBP (mmHg)	81.7[a] ± 9.8	79.5 ± 11.2	78.3[a] ± 10.4	77.2[ab] ± 11.3	73.8[a] ± 10.2	73.8[b] ± 9.7
Weight (kg)	58.8 ± 8.2	59.3 ± 8.5	57.7 ± 9.0	50.5 ± 7.3	51.6 ± 8.1	51.7 ± 7.7
Stature (cm)	166.5 ± 6.0	167.1± 6.2	166.3 ± 5.8	155.9 ± 5.2	156.4 ± 5.0	156.6 ± 5.2
BMI (kg/m^2)	21.2 ± 2.7	21.2 ± 2.7	20.9 ± 3.1	20.8 ± 2.9	21.1 ± 3.0	21.1 ± 2.8
Umbilicus circ. (cm)	76.5 ± 8.0	77.1 ± 8.7	76.1 ± 9.5	72.9 ± 8.8	71.2[a] ± 8.1	74.5[a] ± 9.0
Hip circ. (cm)	90.8 ± 5.6	90.4 ± 6.3	89.7 ± 6.2	91.7 ± 6.0	91.2 ± 5.8	91.0 ± 6.7
WHR	0.842 ± 0.054	0.852 ± 0.078	0.847 ± 0.071	0.793[a] ± 0.063	0.779[b] ± 0.054	0.818[ab] ± 0.065
FFM (kg)	48.3 ± 4.6	49.1 ± 4.6	48.1 ± 4.7	34.5 ± 3.4	35.6 ± 3.8	35.2 ± 4.1
TBF (kg)	10.5 ± 4.8	10.3 ± 4.9	9.6 ± 5.4	16.0 ± 5.0	16.0 ± 5.1	16.6 ± 4.5
PBF (%)	17.2 ± 5.9	16.6 ± 6.3	15.8 ± 6.6	31.1 ± 5.9	30.4 ± 5.6	31.6 ± 4.9

SBP, systolic blood press; DBP, diastolic blood pressure; WHR, waist-to-hip ratio; FFM, fat free mass; TBF, total body fat; PBF, percentage body fat.
[a,b]Identical superscripts indicate significant differences between communities ($P < 0.05$).

adjusting for age, WHR and TBF, women in Chauzhou had the highest SBP and women in Xinhui the lowest. Diastolic BP was significantly higher in Chauzhou compared with Xinhui (Table 5). The umbilical circumference was significantly greater in Xinhui women than in Meixian women. Xinhui women also had the highest WHR (Table 4). After adjusting for age, no significant difference was found for umbilicus circumference in women. Waist to hip ratio was the highest in Xinhui women. Body weight and TBF were significantly greater in Meixian women than in Chauzhou women (Table 5).

Blood pressure was positively related to age and most of the anthropometric and body compositional measurements for men and, to a lesser extent indices of body fatness of women in the three communities. Additionally, stature was negatively related to age. There was no correlation between body weight and age for men in all three communities, or for women in Xinhui (Table 6).

When adjusted for age and stature, BP in men from the three communities was positively correlated with all anthropometric and body compositional measurements, except for SBP and WHR in Meixian.

Waist to hip ratio in women was independent of SBP in all three communities and independent of DBP in Chauzhou and Meixian. No body fatness variable of women in Chauzhou was significantly correlated with SBP. In Meixian, only BMI and hip circumference of women were significantly correlated with SBP. Diastolic BP was positively cor-

Table 5. Mean and standard error of the means (in parentheses) for blood pressure and body compositional measurements, adjusting for age, with multiple comparisons, by community and gender

	Men			Women		
	Chauzhou (n = 203)	Meixian (n = 169)	Xinhui (n = 194)	Chauzhou (n = 111)	Meixian (n = 140)	Xinhui (n = 118)
SBP (mmHg)	125.9[a] (1.15)	121.4[a] (1.25)	116.7[a] (1.17)	119.5[a] (1.41)	115.0[a] (1.28)	109.0[a] (1.39)
DBP (mmHg)	81.4[a] (0.73)	79.7 (0.79)	78.4[a] (0.74)	76.9[a] (0.92)	74.6 (0.83)	73.0[a] (0.90)
Weight (kg)	58.7 (0.61)	59.3 (0.66)	57.7 (0.62)	50.2[a] (0.71)	52.2[a] (0.64)	51.4 (0.69)
Stature (cm)	166.7 (0.42)	166.9 (0.46)	166.2 (0.43)	156.0 (0.49)	156.3 (0.44)	156.6 (0.47)
BMI (kg/m^2)	21.1 (0.20)	21.3 (0.22)	20.9 (0.21)	20.6 (0.26)	21.3 (0.24)	20.9 (0.25)
Umbilicus circ. (cm)	76.2 (0.61)	77.4 (0.66)	76.2 (0.62)	72.3 (0.74)	72.3 (0.66)	73.8 (0.71)
Hip circ. (cm)	90.7 (0.42)	90.5 (0.46)	89.7 (0.43)	91.5 (0.57)	91.7 (0.51)	90.7 (0.55)
WHR	0.839[a] (0.0047)	0.855[a] (0.0051)	0.848 (0.0047)	0.789[a] (0.0052)	0.786[b] (0.0047)	0.813[ab] (0.0051)
FFM (kg)	48.5 (0.31)	48.9 (0.34)	48.0 (0.31)	34.6 (0.36)	35.5 (0.32)	35.2 (0.35)
TBF (kg)	10.2 (0.34)	10.6 (0.37)	9.7 (0.34)	16.0[a] (0.39)	16.7[a] (0.35)	16.1 (0.38)
PBF (%)	16.7 (0.40)	17.0 (0.44)	15.9 (0.41)	30.5 (0.38)	31.4 (0.34)	30.9 (0.37)

[a,b]Identical superscripts indicate significant differences between communities ($P < 0.05$); *adjusting for waist-to-hip ratio and total body fat.

Table 6. Pearson Correlation Coefficients for relationships between blood pressure, age, and body compositional measurements by community and gender

	Chauzhou			Meixian			Xinhui			Total		
	SBP	DBP	Age	SBP	DBP	Age	SBP	DBP	Age	SBP	DBP	Age
Men												
Age (years)	0.25***	0.17*	na	0.25**	0.25***	na	0.18*	0.11 ns	na	0.24****	0.19****	na
Weight (kg)	0.29****	0.39****	–0.036 ns	0.23**	0.35****	0.077 ns	0.30****	0.30****	-0.0013 ns	0.27****	0.35****	0.01 ns
Stature (cm)	-0.069 ns	-0.045 ns	-0.25***	0.059 ns	0.040 ns	-0.041 ns	-0.097 ns	-0.078 ns	-0.20**	-0.04 ns	-0.03 ns	-0.17****
BMI (kg/m^2)	0.35****	0.45****	0.10 ns	0.23**	0.37****	0.11 ns	0.36****	0.36****	0.087 ns	0.32****	0.39****	0.10*
Umbilicus circ. (cm)	0.32****	0.41****	0.12 ns	0.25**	0.36****	0.22**	0.39****	0.36****	0.25***	0.31****	0.37****	0.20****
Hip circ. (cm)	0.25***	0.36****	0.046 ns	0.23**	0.36****	0.10 ns	0.32****	0.30****	0.064 ns	0.27****	0.34****	0.08 ns
WHR	0.29****	0.32****	0.15*	0.15 ns	0.15 ns	0.21**	0.32****	0.28****	0.32****	0.23****	0.23****	0.22****
FFM (kg)	0.11 ns	0.21**	-0.40****	0.10 ns	0.18*	-0.28***	0.14 ns	0.17*	-0.36****	0.11**	0.18****	-0.35****
TBF (kg)	0.39****	0.46****	0.33****	0.28***	0.41****	0.36****	0.38****	0.36****	0.32****	0.36****	0.41****	0.33****
PBF (%)	0.42****	0.46****	0.44****	0.30****	0.42****	0.46****	0.37****	0.35****	0.41****	0.37****	0.42****	0.43****
Women												
Age (years)	0.42****	0.39****	na	0.37****	0.31***	na	0.38****	0.34****	na	0.38****	0.35****	na
Weight (kg)	0.22*	0.32***	0.43****	0.26**	0.32****	0.35****	0.24**	0.22*	0.031 ns	0.22****	0.28****	0.26****
Stature (cm)	-0.027 ns	-0.0070 ns	-0.064 ns	0.020 ns	0.044 ns	-0.010 ns	-0.049 ns	-0.065 ns	-0.13 ns	-0.03 ns	-0.01 ns	-0.07 ns
BMI (kg/m^2)	0.25**	0.34***	0.47****	0.29***	0.34****	0.39****	0.30***	0.28**	0.095 ns	0.26****	0.31****	0.31****
Umbilicus circ. (cm)	0.32***	0.42****	0.60****	0.29***	0.30***	0.45****	0.37****	0.33***	0.29**	0.30****	0.34****	0.46****
Hip circ. (cm)	0.24*	0.32***	0.39****	0.31***	0.34****	0.36****	0.29**	0.16 ns	0.10 ns	0.28****	0.28****	0.28****
WHR	0.29**	0.36****	0.58****	0.19*	0.17*	0.39****	0.28**	0.34***	0.33***	0.21****	0.27****	0.45****
FFM (kg)	0.10 ns	0.12 ns	-0.051 ns	0.11 ns	0.19*	-0.027 ns	0.054 ns	0.041 ns	-0.31***	0.04 ns	0.10*	-0.14**
TBF (kg)	0.32***	0.39****	0.66****	0.33****	0.37****	0.57****	0.37****	0.34***	0.34***	0.31****	0.36****	0.53****
PBF (%)	0.35***	0.38****	0.76****	0.35****	0.36****	0.69****	0.40****	0.38****	0.57****	0.34****	0.37****	0.68****

ns, not significant; na, not applicable; *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$; ****, $P < 0.0001$.

related with body weight, BMI, umbilicus circumference, FFM, and TBF in women in all communities. Diastolic BP was not significantly related to BF% in Chauzhou women or to hip circumference in Xinhui women (Table 7).

The combined communities were also analysed for the relationship between body fatness and blood press (Tables 6 & 7). Weight, BMI, umbilical circumferences, waist-to-hip ratio, total body fat and percentage body fat were all positively related to blood pressure. Of interest was the finding that fat free mass was also positively related to SBP & DBP for men, but for women only for DBP with a weak relationship.

Discussion

Socio-economic status variables, such as income, education and occupation, have been shown to be related to BP and body fatness.[16,17] Relationships between education and BP seem to be the strongest.[18] However, the socio-economic variables in this study did not seem to modify the relationship of BP and body fatness.

The total prevalence of hypertensives for men and women in Guangdong Province was lower than what has been reported in Australia.[12] The prevalence of hypertensives among Chinese women in this study was also, for the population at large, lower than their counterparts in Melbourne.[7] The lower total prevalence of hypertensives in women living in China may be attributable to a lower mean age in these communities.

Table 7. Pearson correlation coefficients for relationships between blood pressure and body compositional measurements, adjusted for age and stature, by community and gender

	Chauzhou		Meixian		Xinhui		Total	
	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP
Men								
Weight (kg)	0.34****	0.40****	0.20**	0.36****	0.35****	0.35****	0.30****	0.38****
BMI (kg/m^2)	0.34****	0.44****	0.21**	0.36****	0.35****	0.35****	0.31****	0.38****
Umbilicus circ. (cm)	0.31****	0.40****	0.19****	0.32****	0.37****	0.34****	0.28****	0.34****
Hip circ. (cm)	0.26***	0.37****	0.20**	0.34****	0.35****	0.33****	0.27****	0.35****
WHR	0.26***	0.30****	0.10 ns	0.097 ns	0.27***	0.24***	0.18****	0.19****
FFM (kg)	0.34****	0.44****	0.20**	0.36****	0.35****	0.35****	0.30****	0.38****
TBF (kg)	0.34****	0.44****	0.20**	0.36****	0.35****	0.35****	0.30****	0.38****
PBF (%)	0.35****	0.44****	0.21**	0.36****	0.32****	0.33****	0.30****	0.38****
Women								
Weight (kg)	0.056 ns	0.20*	0.16 ns	0.24**	0.28**	0.26**	0.15**	0.22***
BMI (kg/m^2)	0.065 ns	0.21*	0.17*	0.26**	0.29**	0.27**	0.16**	0.23****
Umbilicus circ. (cm)	0.094 ns	0.26**	0.15 ns	0.18*	0.30**	0.26**	0.15**	0.22****
Hip circ. (cm)	0.086 ns	0.21*	0.20*	0.26**	0.28**	0.15 ns	0.20****	0.21****
WHR	0.057 ns	0.18 ns	0.060 ns	0.050 ns	0.17 ns	0.25**	0.04 ns	0.13**
FFM (kg)	0.056 ns	0.20*	0.16 ns	0.24**	0.28**	0.26**	0.15**	0.22****
TBF (kg)	0.056 ns	0.20*	0.16 ns	0.24**	0.28**	0.26**	0.15**	0.22****
PBF (%)	0.050 ns	0.17 ns	0.16 ns	0.22*	0.25**	0.24**	0.13*	0.20****

ns, not significant; *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$; ****, $P < 0.0001$.

Despite the insignificant differences in prevalence of hypertensives between the communities there were significant differences in mean SBP and DBP between the communities. The classification used to define hypertension was developed for a Caucasian population.[12] It may not be appropriate to use this classification in populations with low mean BP, such as Chinese populations.

It is not clear why there are significant differences in mean BP between the communities. The three communities represent different Chinese cultures, with different food culture. Diet may therefore play a role as a determinant of BP differences. Alcohol consumption has been shown to be associated with BP.[21] The consumption of alcohol in this study was generally low, which is comparable with the low alcohol consumption in the Melbourne Chinese.[6] The possible confounding effect of alcohol on BP in these populations thus may be less important.

The correlation between BP, age, and body weight has been discussed by Pan *et al.*[22] Body weight and fatness could possibly account for the relation between age and BP. However, there was no correlation between body weight and age in men in any of the three communities, and for women in Xinhui. Age showed a higher correlation with BP in women than body weight with BP. Body weight did not seem to account for the relation between age and BP in this study.

There was a difference between men and women in regard to the BP and body composition relationships, even after adjustments for age and stature. No or weak significant correlations between BP and body fatness variables were found for women, especially in the Chauzhou and Meixian populations. Spiegelman *et al.* showed that absolute body mass and body fatness, adjusted for height, is a stronger indicator for BP than relative fatness.[9] Body mass index was positively correlated with SBP and DBP in all communities for men and women, but there was no significant correlation with SBP for women in Chauzhou. The Pearson's correlation coefficients for BP and BMI relationships were lower for women. International studies also confirm a positive correlation between BMI and BP, particularly in men.[23,24] The results of the CARDIAC-study in China showed positive correlations between BMI and BP for both men and women.[20] Waist to hip ratio was a relative measurement of body fatness and was weakly correlated with BP in men. Waist to hip ratio is also weakly correlated with SBP and DBP in women and even less pronounced in men.

Fat free mass, TBF and BF% showed a stronger correlation with BP in Guangdong Chinese men than in women. In this study, body composition was estimated by equations developed for Caucasian populations, such as the Deurenberg formula,[10] and this may explain the gender differences. The interpretation of the results of FFM, BF% and TBF in relation to BP in the present report must therefore be made with caution.

The overall conclusion is that, with appropriate adjustments for potentially confounding variables, men, and to a lesser extent women, in the Chinese Province of Guandong habouring three different sub-ethnicities, have BP partly dependent on body fatness and its distribution. The non-body compositional determinants of BP in Guangdong Province women are apparently greater than in their male counterparts and constitute an interesting area for future enquiry.

Conclusions

Differences were found in mean BP for men and women among the three communities. However, no differences in the prevalence of defined hypertensives were found between the communities. Anthropometry and body composition predicted BP in men, but to a lesser extent in women. When the relationships for the three communities in aggregate were considered, any index of body fatness positively predicted BP, both DBP and SBP, without exception.

Further analyses may help to understand how gender differences in body composition predicts BP.

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Body composition as a predictor of blood pressure in three communities in Guangdong province, China

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摘　要

目的：比較三個中國地區成人的血壓平均值（ BP ），人體測量和身體組成，以檢驗這些地區居民的血壓與身體組成的關係。

研究計劃和方法：從中國廣東省這三個地區（潮州縣，講潮州話；梅縣，講客家話；和新會縣，講廣州話）隨機抽取 935 位成人（ 25 歲或以上）男、女爲對象，他們均填寫食物習慣，生活方式和健康狀況問卷，測定了他們的體重、身高、腰臀圍和收縮壓及舒張壓。計算他們的體重指數、腰臀比值（ WHR ），非脂肪物質、總體脂肪和體脂百分數以評估身體組成。

結果：三個地區對象的身高、體重指數、臍圍、臀圍、非脂肪物質、體脂百分數和高血壓患者沒有發現有明顯差異，但潮州成人的腰臀比值（ WHR ）較梅縣低，潮州地區成人的血壓最高，在各自社區內發現男性總脂肪和腹脂肪的增加與血壓呈正相關。

結論：在中國廣東省可用人體測量評估身體組成作爲中國男性而非女性的血壓預測。

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