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Association of abdominal obesity and systolic blood pressure indices with cardiovascular disease risk prediction among community-dwelling older adults

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ABSTRACT

Background: Excess adiposity is an established risk factor for cardiovascular disease (CVD), therefore the early screening indies with predicted CVD risk is more useful for older adults. The current study evaluated the associations between anthropometric, body composition and dietary indices and elevated 10-year CVD risk in older people.

Methods: This research, which involved 55 to 94-year-olds living in the community. Standard techniques were used to determine anthropometric factors and body composition indicators. The risk prediction chart created by World Health Organization and International Society of Hypertension was used to calculate the CVD risk score. Odds ratio (OR) and 95% confidence interval (CI) were determined.

Results: CVD risk prediction was positively correlated with the anthropometric and body composition parameters. After controlling for confounding variables, the logistic regression analysis revealed that waist circumference (OR=16.34; 95% CI: 7.22, 36.98; p<0.001), systolic blood pressure (BP) (OR=9.53; 95% CI: 4.52, 20.07; p<0.001), and visceral adipose tissue percentage (OR=5.47; 95% CI: 2.98, 10.01; p<0.001) were correlated with cardiovascular risk prediction.

Conclusions: Abdominal obesity and increase of systolic BP were associated to increased risk for CVD. Additionally, a positive association between the risk factors for CVD (%visceral adipose tissue) and diet (cholesterol consumption) was established.

Keywords: abdominal obesity, CVD risk score, waist circumference, visceral adipose tissue, cardiovascular disease

INTRODUCTION

In the majority of countries, cardiovascular disease (CVD) is the main cause of death. The prevalence of the CVD risk factors include high blood pressure (BP), elevated plasma cholesterol levels and plasma glucose, smoking and tobacco use, and obesity, which continues to increase [1]. Excess adiposity is associated with several non-communicable diseases: type 2 diabetes, hypertension, and dyslipidaemia, which lead to a high prevalence of CVD and being overweight or obese also has additional hazards [2]. Therefore, one of the main risk factors for ischemic heart disease mortality that contributes to the worsening of the cardiovascular risk profile is obesity.

Anthropometric indices (waist circumference [WC], waist-to-hip ratio [WHR], and body mass index [BMI]) are currently being proposed as screening tools to identify central obesity and individuals at risk of CVD [3]. Previous studies reported WC and WHR were effective to identify individuals at increased CVD risk than BMI [4, 5]. In contrast, several studies suggested that the combined assessment of BMI and WC identifies obesity patterns associated with CVD risk [6]. However, given that adiposity varied widely by age, gender, ethnicity, and body fat distribution, it is unclear which anthropometric measurements are more connected with CVD risk variables [2]. To our knowledge, no research has been done on the correlation between body composition measurements and CVD risk assessment in Thailand. More research is needed to ascertain, which measurements and indices are better correlated with CVD risk prediction.

The goal of this study was to evaluate the relationship between anthropometric (abdominal obesity) and body composition indices and elevated 10-year CVD risk. The association between these indices of obesity with predicted

CVD risk was calculated using World Health Organization (WHO)/International Society for Hypertension (ISH) risk prediction chart [7]. Finally, we determined which anthropometric and body composition indices are most sensitive and specific for predicted 10-year CVD risk.

MATERIALS AND METHODS

Study Design and Participants

Community-dwelling older adults aged 55-94 years and living in community-dwellings at Dok Khamtai, Thailand. Face-to-face interviews were used to enlist older participants. Age 55 and residence in the region for more than a year were requirements for inclusion. The exclusion criteria included the inability to provide dietary and cognitive information, even with the assistance of caregivers (e.g., due to language impairment or severe deafness). The measurements and surveys were performed over several sessions between May 2021 to November 2021 at the Dok Khamtai, Thailand. All individual variables were measured and surveyed on the same day by multiple registered dietitians.

Anthropometric and Body Composition

The anthropometric and body composition measurements were conducted in the morning. WC was measured by using a stretch-resistant tapeline at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest. Hip circumference was measured around the widest portion of the buttocks, with the tapeline parallel to the floor. WHR was calculated by dividing waist measurement by hip measurement, since the hips are at the widest part of the buttocks. The formula is: WHR=WC/hip circumference.

BP was measured by the principal investigators twice after 15 minutes of rest. The measurement was conducted using an automatic device (HEM 7130 L, Omron Colin Co., Vietnam). The second BP measurement took place at least 15 minutes after the first. The appropriate bladder size (a standard adult cuff with a 12.5 cm bladder or a large adult cuff with a 15.5 cm bladder for obese subjects) was placed around the right arm while participants were seated.

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements were calculated based on the average of the first and second measurements. A DBP≥81 and a SBP≥120 mm/Hg were elevated. Current smokers were asked to refrain from smoking cigarettes for 30 minutes before BP measurement.

Body composition measurements included height, weight, skeletal muscle, body fat percentage (%BF) and visceral adipose tissue percentage (%VAT). Height was measured using a metric stadiometer attached to a wall. The back of the head, shoulder blades, buttocks and heels touched the stadiometer. A body composition analyzer (OMRON Karada Scan Body Composition Monitor HBF-375) was used to measure weight and other body compositions (skeletal muscle, %BF and %VAT).

The BMI was calculated as weight (in kilograms) divided by height (in meters) squared. BMI was evaluated based on body weight in kilograms divided by body height in square meters, where measurements within a range of 18.5-22.9 kg/m^2 were considered normal, 23.0-24.9 kg/m^2 as overweight, and ≥25 kg/m^2 as obese.

Body fat percentage is the ratio of body fat mass to total body weight, represented as a percentage, where %BF 10-20% in male and %BF 20-30% in female was interpreted as normal %BF. Visceral adipose tissue is found in the abdomen and surrounding vital organs. It differs from fat found directly underneath the skin, which is referred to as subcutaneous fat. A %VAT of 0.5-9.5% was classified as normal. Well-trained staff at our institution recorded the anthropometric data.

Dietary Assessment

The dietary intake was collected by 24-hour food records (two working days and one weekend). Prior to the survey, participants were shown how to accurately record food intakes and calculate the amount of solid and liquid foods. The INMUCAL-Nutrients V.3 was applied to calculate total energy intake (kcal), carbohydrate intake (g), protein intake (g), fat intake (g), saturated fatty acid intake (g), cholesterol (mg), sodium (mg) and dietary fibre (g). The investigators and dietary recorders had received expert advice and training.

Thai 10-Year CVD Risk Prediction

Thai CVD risk prediction over the next 10 years was estimated using the WHO/ISH risk prediction chart [7]. The sociodemographic data of individuals were obtained through a face-to-face interview. The risk estimator for assessment of cardiovascular risk required age, sex, smoking status, diabetes history, SBP, WC, and height. The CVD risk prediction profile was evaluated by totalling up the score acquired from each person's variables and converting them into a percentage. The following risk categories were utilized to estimate the likelihood of CVD within the next ten years: <10%: low risk and ≥10%: high risk.

Statistical Analysis

All variables were described using descriptive statistics, such as mean (M), standard deviation (SD), and percentage (%). Participants were divided into a low risk of CVD group and a high risk of CVD group, and differences in evaluation parameters were analyzed using an independent student t test. The relationship between body composition, anthropometry, and dietary intake indices and estimated CVD risk was analyzed using Pearson correlation analysis.

The predictive ability of these anthropometric and body composition measures to identify the CVD risk factors was assessed using sensitivity, specificity, and area under the receiver operating characteristic (ROC) curve. Finally, the odds ratio (OR) of CVD risk factors in the high risk of CVD group and the low risk of CVD group (used as a reference) was analyzed by logistic regression analysis and examined using two models. The first model was unadjusted (model I).

The second model (model II) was adjusted for gender, age, and congenital disease. The results were explained using OR and adjusted OR (aOR) with a 95% confidence interval (CI). All statistical analyses were performed with SPSS statistics (version 26). The level of significance was set as p<0.05.

RESULTS

Demographic Characteristics of the Participants

Participants were 231 community-dwelling older adults (aged 55-94 years). The demographic characteristics are

Table 1. Baseline characteristics of subjects

Characteristics	Overall (n=231)	Low risk of CVD (n=108)	High risk of CVD (n=123)	*p*-value
Age† (years), Mean±SD	62.99±13.85	62.12±16.04	64.11±10.34	0.284
Congenital disease				
Yes, n (%)	113 (48.92)	52 (48.15)	61 (49.59)	
No, n (%)	118 (51.08)	56 (51.85)	62 (50.41)	
Number of congenital diseases				
1	67 (59.29)	46 (42.59)	21 (17.07)	
≥ 2 (multimorbidity)	46 (40.71)	6 (57.41)	40 (82.93)	
Height†, cm	155.15±66.53	157.99±87.93	151.49±13.10	0.464
Weight†, kg	55.59±12.10	52.39±11.74	59.84±11.29	< 0.001
BMI†, kg/m^2	24.05±4.79	22.86±4.64	25.63±4.55	< 0.001
WC†, cm	84.26±15.08	79.42±14.82	90.21±13.20	< 0.001
WHR†	0.90±0.17	0.86±0.17	0.93±0.16	0.003
SBP†, mmHg	127.42±25.42	117.56±26.96	139.98±17.74	< 0.001
DBP†, mmHg	74.75±16.12	71.29±17.23	79.15±13.41	< 0.001
Body composition				
BF†, %	32.29±6.90	31.21±6.92	33.73±6.63	0.006
VAT†, %	9.33±5.10	7.71±4.29	11.48±5.31	< 0.001
Energy†, kcal/day	1,199.90±687.01	1,210.34±728.87	1,185.80±329.52	0.790
Carbohydrate†, g/day	168.03±90.55	162.26±86.82	175.83±95.25	0.264
Sugar†, g/day	25.49±24.04	26.76±24.81	23.77±22.99	0.354
Protein†, g/day	61.49±47.15	60.70±46.37	62.57±48.40	0.768
Fat†, g/day	29.02±27.99	31.35±30.15	25.87±24.56	0.144
Saturated fatty acid†, g/day	6.09±5.46	6.08±5.15	6.10±5.79	0.983
Cholesterol†, mg/day	190.08±165.02	182.20±166.57	200.71±163.17	0.250
Sodium†, mg/day	2,373.28±1,718.34	2,395.77±1,646.38	2,343.38±1,817.88	0.821
Dietary fibre†, g/day	10.81±8.75	11.15±9.34	10.34±7.91	0.490
CVD risk prediction score†	14.46±7.61	8.85±3.20	21.80±5.00	< 0.001

Note. WC: Waist circumference; WHR: Waist hip ratio; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; BMI: Body mass index; BF: Body fat percentage; VAT: Visceral adipose tissue; & †Independent samples t-test

presented in **Table 1**, of whom 123 (53.25%) were high risk of CVD.

The average age of participants was 62.99±13.85 years old (low risk of CVD group 62.12±16.04 years old and high risk of CVD group 64.11±10.34 years old). 48% of participants reported congenital disease (52% of low risk of CVD group and 61% of high risk of CVD group), especially non-communicable diseases such as type 2 diabetes, hypertension, dyslipidaemia, or heart disease.

The prevalence of multimorbidity (≥2 congenital diseases) was higher in high risk of CVD group than low risk of CVD group (46% and 21%, respectively). Comparatively, high risk of CVD group had significantly higher average weight, BMI, WC, WHR, SBP, DBP, %body fat and %VAT ($p \leq 0.05$). However, there was no significant difference between high risk of CVD group and low risk of CVD group in energy and nutrients intake).

Association of Risk Factors for CVD Risk Prediction Scores

The association of risk factors for CVD risk prediction scores are described in **Table 2**. The CVD risk prediction scores of overall participants (n=231) positively correlated with weight, BMI, WC, WHR, SBP, DBP, %BF, and %VAT (r=0.332, p<0.001; r=0.328, p<0.001; r=0.350, p<0.001; r=0.197, p=0.007; r=0.380, p<0.001; r=0.205, p=0.002; r=0.217, p=0.001; r=0.365, p<0.001, respectively). Therefore, a higher weight, BMI, WC, WHR, SBP, DBP, %BF, and %VAT were all related to a higher CVD risk prediction score in community-dwelling older adults.

Dietary assessment (CHO intake) found positive correlation with weight (r=0.145; p=0.029) (A in **Figure 1**), whereas protein and cholesterol intake reported more strongly positive correlation with %VAT (r=0.145; p=0.028, r=0.214; p=0.001) as shown in **Figure 1** (B) and **Figure 1** (C).

Table 2. Association between CVD risk prediction score, body composition measures, and energy intake (n=231)

Variable	Predicted CVD risk	
	r	*p*
Age, year	0.002	0.979
Weight, kg	0.332	< 0.001
BMI, kg/m^2	0.328	< 0.001
WC, cm	0.350	< 0.001
WHR	0.197	0.007
SBP, mmHg	0.380	< 0.001
DBP, mmHg	0.205	0.002
BF, %	0.217	0.001
VAT, %	0.365	< 0.001
Energy, kcal/day	-0.035	0.602
Carbohydrate, g/day	0.030	0.649
Sugar, g/day	-0.057	0.390
Protein, g/day	0.013	0.849
Fat, g/day	-0.098	0.140
Saturated fatty acid, g/day	-0.062	0.546
Cholesterol, mg/day	0.035	0.594
Sodium, mg/day	-0.041	0.538
Dietary fibre, g/day	-0.072	0.279

Note. WC: Waist circumference; WHR: Waist hip ratio; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; BMI: Body mass index; BF: Body fat percentage; VAT: Visceral adipose tissue; & *p*-values are calculated using Pearson correlation, significant at 0.05 level (2-tailed)

Logistic Regression for Factors Associated with CVD Risk Prediction Score

Table 3 shows the result of logistic regression analysis. We further carried out a binary logistic regression analysis using the categorical anthropometric indices (WC, WHR, and BMI) and body composition indices (%BF and %VAT) as independent variables, with the normal set as reference.

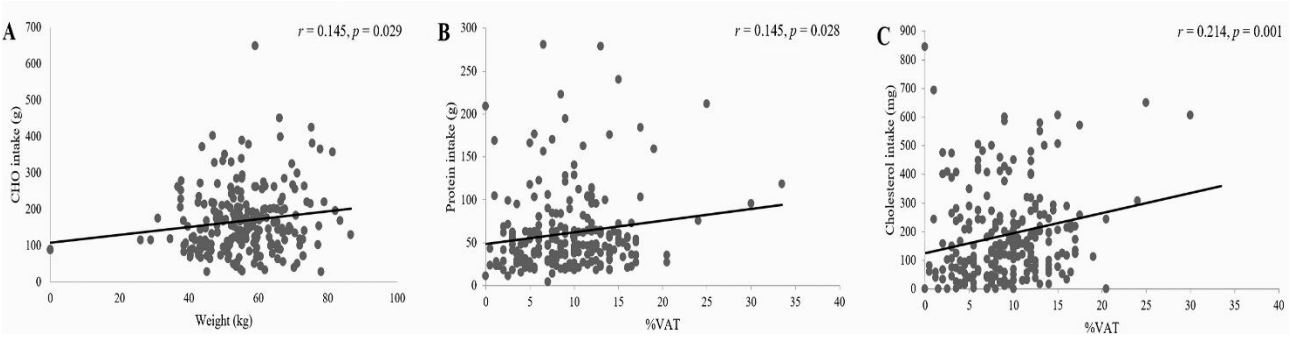

Figure 1. Scatter graphs depicting correlation between weight, %VAT, & carbohydrate, protein, & cholesterol intake (Source: Authors' own elaboration)

Table 3. Logistic regression for factors associated with CVD risk prediction score (n=231)

Variable & indicator	Model I		Model II	
	OR (95% CI)	*p*-value[§]	aOR (95% CI)	*p*-value[§]
BMI, kg/m^2				
Normal (18.5-22.9)	1.00 (reference)		1.00 (reference)	
Overweight (23.0-24.9)	4.63 (2.13, 10.07)	<0.001	4.55 (2.04, 10.15)	<0.001
Obese (≥ 25.0)	5.54 (2.87, 10.69)	<0.001	5.75 (2.92, 11.32)	<0.001
WC, cm				
Male≤90 cm, female≤80 cm	1.00 (reference)		1.00 (reference)	
Male>90 cm, female>80 cm	14.42 (6.69, 31.08)	<0.001	16.34 (7.22, 36.98)	<0.001
WHR				
Male≤1, female≤0.9	1.00 (reference)		1.00 (reference)	
Male>1, female>0.9	2.01 (1.11, 3.65)	0.021	1.77 (0.95, 3.27)	0.070
SBP, mmHg				
≤120	1.00 (reference)		1.00 (reference)	
>120	10.65 (5.09, 22.28)	<0.001	9.53 (4.52, 20.07)	<0.001
DBP, mmHg				
≤80	1.00 (reference)		1.00 (reference)	
>80	2.09 (1.21, 3.60)	0.008	2.66 (1.49, 4.76)	0.001
BF, %				
Male 10-20, female 20-30	1.00 (reference)		1.00 (reference)	
Male>20, female>30	3.71 (1.84, 7.50)	<0.001	3.70 (1.77, 7.70)	<0.001
VAT, %				
0.5-9.5	1.00 (reference)		1.00 (reference)	
>10.0	4.46 (2.55, 7.82)	<0.001	5.47 (2.98, 10.01)	<0.001
Energy, kcal/day				
1,600	1.00 (reference)		1.00 (reference)	
<1,600	0.79 (0.11, 5.77)	0.822	0.87 (0.12, 6.59)	0.894
≥1,600	0.54 (0.07, 4.25)	0.557	0.69 (0.08, 5.73)	0.733
Carbohydrate, % of kcal/day				
50-60%	1.00 (reference)		1.00 (reference)	
<50%	0.98 (0.45, 2.15)	0.976	1.14 (0.51, 2.54)	0.750
>60%	1.57 (0.80, 3.07)	0.185	1.60 (0.80, 3.17)	0.182
Sugar, g/day				
≤40	1.00 (reference)		1.00 (reference)	
>40	0.79 (0.45, 1.36)	0.389	0.77 (0.44, 1.37)	0.378
Protein, % of kcal/day				
15-20%	1.00 (reference)		1.00 (reference)	
<15%	1.09 (0.55, 2.15)	0.797	1.06 (0.53, 2.13)	0.868
>20%	0.96 (0.51, 1.18)	0.902	1.01 (0.53, 1.93)	0.976
Fat, % of kcal/day				
30-35%	1.00 (reference)		1.00 (reference)	
<30%	1.67 (0.49, 5.74)	0.141	1.67 (0.47, 5.89)	0.425
>35%	0.95 (0.23, 3.99)	0.941	0.99 (0.23, 4.29)	0.988
Saturated fatty acid, g/day				
≤20	1.00 (reference)		1.00 (reference)	
>20	0.94 (0.13, 6.94)	0.950	0.95 (0.13, 7.12)	0.956
Cholesterol, mg/day				
≤300	1.00 (reference)		1.00 (reference)	
>300	0.57 (0.28, 1.17)	0.124	0.58 (0.27, 1.23)	0.150

Table 3 (Continued). Logistic regression for factors associated with CVD risk prediction score (n=231)

Variable & indicator	Model I		Model II	
	OR (95% CI)	*p*-value[§]	aOR (95% CI)	*p*-value[§]
Sodium, mg/day				
≤2,400	1.00 (reference)		1.00 (reference)	
>2,400	1.00 (0.59, 1.74)	0.977	1.08 (0.62, 1.90)	0.780
Dietary fibre, g/day				
≤25	1.00 (reference)		1.00 (reference)	
>25	0.71 (0.25, 2.00)	0.521	0.63 (0.21, 1.92)	0.420

Note. aOR: Adjusted odds ratio; CI: Confidence interval; WC: Waist circumference; WHR: Waist hip ratio; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; BMI: Body mass index; BF: Body fat percentage; VAT: Visceral adipose tissue; CV risk score: Cardiovascular disease risk score; [§]All of the models were constructed using binary logistic regression method & results are presented as OR (95% CIs); Model I or crude model was unadjusted; & Model II adjusted on sex, age (years), & congenital disease

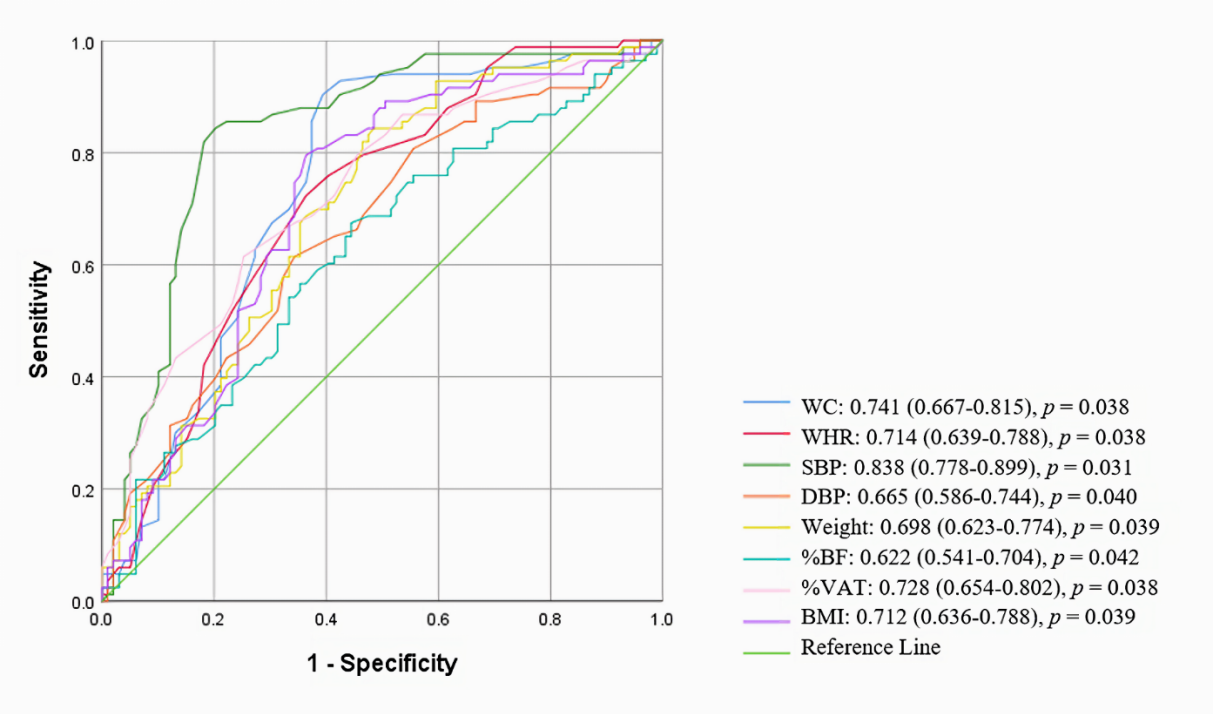

Figure 2. ROC curves for CVD risk prediction score by anthropometric and body composition indices in overall sample. The area under the curve (95% confidence intervals) and significant difference is shown inside the graph (Source: Authors' own elaboration)

The regression models were adjusted for confounding factors such as gender, age, and congenital disease. CVD risk prediction scores after adjusting for gender, age, and congenital disease was conducted on model II, all variables except WHR were significant in predicting CVD risk scores (all $p<0.05$).

The Predictive Ability of Anthropometric and Body Composition Indices for CVD Risk Prediction Score

The most accurate anthropometric and body composition indices for predicting CVD risk factor were examined using ROC curve analysis. AUCs showed significant differences for all risk variables with CVD risk prediction score. As an overall estimation, SBP had the largest AUC for the predicting CVD risk factor (AUC=0.838, p=0.031), WC (AUC=0.741, p=0.038) and %VAT (AUC=0.728, p=0.038), the related ROC curve is shown in **Figure 2**. Although BMI is included in the simplified general CVD model, high area under the ROC curve values (>0.714) for WC and WHR are reported (**Figure 2**), indicating that central obesity measurements independently contribute to predicting the increased risk of CVD when compared with general obesity measurements.

DISCUSSION

The WHO/ISH CVD risk prediction chart is the risk estimator for 10-year risk of atherosclerotic CVD that consists of tobacco use, age, sex, BP, diabetes history, SBP, WC, and height. In our study, weight, BMI, WC, WHR, SBP, DBP, %BF, and %VAT were more strongly positive associated with CVD risk prediction score. These correlation results were like the adjusted model (model II) of logistic regression analysis, except WHR were no predict CVD risk score. Alternatively, the CVD risk prediction score by ROC curve analysis reported SBP, WC and %VAT were the most ability to predict 10-year risk of CVD. SBP were strongly predictive values of CVD risk among participants overall. A similar prospective study reported a strong positive association between average SBP and the risk of CVD [8].

Moreover, the prospective cohort study found that uncontrolled hypertension accounted for about one-third of all CVD deaths at ages 35 to 79 years (almost half of all CVD deaths at ages 35-59 years) [9]. High level of 10-year cumulative exposure to SBP is associated with greater CVD risk [10]. A large prospective cohort study found that BP was related to risk of CVD, although the BP was normal range (SBP 110-119 mmHg

and DBP 75-79 mmHg) [11]. Another previous study reported an increase of 10-15 mmHg interarm systolic blood pressure differences (IASBPD) was an indicator of increased cardiovascular risk [12]. Therefore, SBP increase was positively associated with IASBPD that can predict CVD, similar to findings in the cohort clinical study [8]. In community-dwelling with follow-up over a 21-year, the participants with high-normal BP or ISH-IDH had a higher relative risk of CVD than those with optimal-normal BP [13]. However, some observational cohort studies have been conflicting on the association of high BP with CVD risk in elderly people, and report there was no evidence of association between BP and risk of stroke and CVD [14]. Overall, these analyses have demonstrated that SBP was the most significant factor for CVD risk prediction.

Measures of central obesity that included WC also showed higher sensitivity and specificity than BMI. Previous studies have demonstrated the association between abdominal obesity and an increased risk of CVD [15-17]. In a Malaysian survey of urban residents, it was discovered that the important factor of CVD risk profiles includes the waist-related indicators of abdominal obesity [18]. Furthermore, previous studies reported the combination of abnormal BMI and WC would be more predictive of CVD risk [19, 20]. However, another previous study reported BMI had a weaker correlation with CVD than WC [18]. The association between BMI and the risk of CVD is complicated; nonetheless, BMI did not increase CVD risk on its own but could have a modifying effect on other risk variables. This result was supported by several studies that reported WC was associated with a greater risk of CVD regardless of BMI levels [21-23].

Obesity indicators (%VAT) typically are not considered when predicting the likelihood of developing a CVD, however the results showed that %VAT was substantially correlated with the CVD risk prediction score after adjusting for confounding variables. This outcome was similar to a prospective study was based on the healthy ageing initiative (HAI) in community-dwelling 70 years old, which reported that after adjusting for sex, lifestyle factors, socioeconomic status, cardiovascular risk factors, CVD history, medications, total fat mass, and muscle density, %VAT was significantly associated with the prevalence of CVD and stroke [24]. This is in line with previous studies that found that visceral fat in the abdomen was the best marker of altered CVD risk prediction [25, 26]. Similar to this, a community-based observational study found a correlation between an increase in abdominal %VAT and a higher incidence of CVD risk variables as well as more negative changes in those risk factors over time [27]. Furthermore, a large population study found that the risk of CVD was considerably positively correlated with trunk fat rather than total body fat [28]. It has been found that visceral adipose tissue in the abdominal area is a metabolically active compartment, secreting inflammatory markers, adipocytokines, and markers of hemostasis, and fibrinolysis, which may contribute to its role in cardiometabolic risk factors [29, 30]. Moreover, an increased %VAT was associated with metabolic abnormalities that were associated with metabolic syndrome, insulin resistance, risk to developing type 2 diabetes, atherosclerosis, and CVD [31].

The dietary factor on CVD risk prediction was not discovered in the current investigation, however there found the positive correlation with the risk factors for CVD (%VAT). According to this study, there is a positive correlation between excessive protein, and cholesterol consumption and %VAT. Similar results of previous study found high consumption of cholesterol can increase abdominal VAT mass [32] that can lead to CVD mortality [33].

The current study has various limitations, including that it was conducted in single area therefore cannot represent all community-dwelling older adults in Thailand. Prospective investigations are needed to verify our findings. Hence, our results need to be interpreted with caution. Despite this limitation, this study has some strengths. First, the CVD risk score is a comprehensive index used for CVD screening. Second, anthropometry and body composition measurement are low-cost procedures for patient assessment in primary care settings. Moreover, some marker of anthropometry and body composition indices can be utilized to assess patient nutritional condition.

CONCLUSION

The results of this study, after adjusting for confounding factors, found that increase of weight, BMI, BP, %boy fat and central obesity (WC and %visceral adipose tissue) parameters were strongly associated with CVD risk prediction scores. In practical, the abdominal obesity (WC) with high SBP may be the best screening tool for CVD risk prediction among community-dwelling older adults because it is simple and attainable quickly. Therefore, these parameters should be regularly documented in population-based health screening and primary care settings to be able to assess future CVD risk and design appropriate interventions.

Author contributions: AD: lead researcher, project administration, resources, & supervision; **NP:** introduction writer, methodologist, statistical analyst, discussion writer, & main researcher; & **WS, AO, SP, AY, KJ, & NT:** methodologist & data collector. All authors have agreed with the results and conclusions.

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Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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