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Invited Commentary

Hypertension and adiposity indices: commentary on the associations of adiposity indices with hypertension in Brazil (Souza *et al.*, 2019)

According to the WHO, hypertension is a major public health problem with one billion people affected worldwide and a leading risk factor for CVD. Hypertension is responsible for at least 45 and 51 %, respectively, of mortality due to heart attack and stroke[1]. Therefore, the early diagnosis and appropriate management of hypertension to prevent the development of complications is crucial. A simple method to determine the need to screen an individual for hypertension is by evaluating his/her adiposity status. Among the key contributors to hypertension is overweight and obesity, which has reached epidemic proportions globally[2].

Various instruments such as BMI, waist circumference (WC), waist-to-hip ratio (WHR) and recently waist-to-height ratio (WHtR) are used to determine overweight and obesity. WC, WHR and WHtR determine visceral or central obesity, which better identifies cardiometabolic diseases such as hypertension and diabetes compared with BMI, a known measure of general adiposity[3]. Nevertheless, the optimal overweight and obesity threshold which identifies cardiometabolic diseases by these instruments may vary across populations. This is on account of differences in body composition across age, gender and ethnicity[4].

The paper by Souza *et al.* published in this journal identified the optimal WC, WHtR and BMI thresholds associated with hypertension by age and gender categories among ≥20-year-old Brazilian adults who participated in the 2013 National Health Survey[5]. There were 57 230 participants recruited, and mixed and black ethnicity adults comprised just over 50 % of the adjusted sample. The optimal WC threshold associated with hypertension in men approximated that of the current recommended cut-off point of 94 cm, except for young men aged 20–30 years in whom it was lower. In contrast, the WC threshold in women was higher than the current cut-off point of 80 cm for all age groups. The WHtR threshold associated with hypertension was greater than 0·5 in men and women, increasing with age and peaking in the oldest participants. The BMI cut-off point, across gender and age, was in the overweight category except for the youngest participants where it was 25 kg/m^2.

Souza *et al.* emphasised the need for different optimal adiposity thresholds by age group[5]. However, it is important to maintain the ease of use of these adiposity instruments by having a single threshold level, for each gender at most. These adiposity measures are frequently used at primary care level by lower-level health-care workers. Multiple adiposity threshold levels for different age groups may create confusion and be time consuming when categorising patients. This may lead to a reluctance to utilise measures that are otherwise low cost and easy to perform. WC, WHtR and WHR require only a measuring tape while BMI requires a scale as well. Nevertheless, with ageing populations globally, research may be required to determine the utility of current thresholds in the elderly and whether cut-off points need to be adjusted accordingly.

The accuracy of adiposity indices to predict hypertension was not high in Sousa *et al.*'s study (area under the receiver-operator characteristic curve was <0·7)[5] but this was in keeping with some other studies including a longitudinal study in Brazil[4]. Considering that many analyses have shown that WC is a reasonable indicator of visceral fat[2,6], there may be other reasons for the less precise predictive capability of the adiposity indices. It may highlight that although obesity is a major risk factor for hypertension, the development of hypertension is a complex combination of genetic and environmental influences that cannot easily be simplified. In any given individual, although one factor may be more important than others, hypertension is often multifactorial[7].

WHtR has come into vogue over the last decade as an indicator of cardiometabolic risk because of the simple message that it conveys: 'your WC should be less than half of your height'[4,8]. Furthermore, unlike the other measures of central obesity such as WC and WHR, there is a single threshold for both genders and it has been found to be appropriate for several ethnic groups. Souza *et al.* concluded that WHtR performed comparably to WC and BMI in identifying hypertension[5]. This accorded with findings of other studies conducted in Brazil including the previously mentioned longitudinal study[4]. Therefore, perhaps the use of WHtR should be encouraged at primary health-care level in Brazil together with being utilised for epidemiological purposes. Reinforcing this is that two systematic reviews and meta-analyses indicate that WHtR may be the best adiposity index to predict several cardiometabolic diseases associated with central obesity, including hypertension[9,10].

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It would be prudent to examine the adiposity thresholds for other cardiometabolic conditions such as diabetes and the metabolic syndrome in the Brazilian population. For practical and clinical purposes, there should be a single optimal threshold level per adiposity indicator for each gender to identify cardiometabolic risk overall rather than for individual conditions such as hypertension, diabetes, etc. These conditions are interrelated and the presence of one condition usually infers a greater risk for the other.

Unlike the findings of Souza *et al.* [5], the optimal WC thresholds associated with cardiometabolic diseases in black African populations have been reported to be higher in women than in men[11]. However, only a small proportion of participants in Souza *et al.*'s study (<10 %) identified as black *per se*, which does not make it comparable with most African studies. Considering the large sample size in Souza *et al.*'s study, it would have been possible and valuable to compare the optimal adiposity thresholds across the white, black and mixed-race groups. This would have illustrated any differences or similarities across race groups and whether the current recommended adiposity thresholds were appropriate for all Brazilian populations.

Interestingly, a South African study conducted in a mixed-ancestry population suggested a single WC cut-off point of 90 cm, applicable for both men and women, to identify the metabolic syndrome[12]. This agrees with the findings of Souza *et al.* where similar WC cut-off points identified hypertension by gender (men: 88–96 cm; women: 85–92 cm)[5]. About 42 % of the adjusted sample was identified as being of mixed ethnicity.

Despite the large sample size and the national representativeness of their study, it needs to be emphasised that Souza *et al.* [5] analysed cross-sectional data. This precludes conclusions on causality and the ability of adiposity indicators to predict hypertension in the study; only associations between the adiposity indices and hypertension may be inferred. Nationally representative long-term cohort studies that examine the health impact of different adiposity indices in the Brazilian population are, therefore, required. This will enable firm conclusions to be drawn on the need to change adiposity thresholds for hypertension and other cardiometabolic diseases by age, gender and ethnicity.

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