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COMMENT

Sex and age difference in associations between anthropometric indices and hypertension

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Obesity as defined by anthropometric measurements is a traditional risk factor for the development of hypertension. The negative effect of obesity is caused by excessive body fat. The amount of body fat can be measured directly only by computed tomography. Therefore, many anthropometric indices that are calculated by weight, waist circumference (WC), and height (i.e., body mass index [BMI], body roundness index [BRI], a body shape index [ABSI], waist-to-hip ratio and waist-to-height ratio) have been developed to easily identify excessive body fat. Among these indices, ABSI is a relatively new index from the USA that was developed in 2012 [1].

The study by Kawasoe et al. investigated the associations of BMI, WC, BRI and ABSI with the incidence of hypertension by sex and age in a Japanese general population [2]. This study found no significant association or a weak association between ABSI and the incidence of hypertension, regardless of age and sex. However, BMI, WC and BRI were significantly associated with the incidence of hypertension. ABSI was developed on the basis of WC and is independent of BMI [1]. Therefore, the predictive power of ABSI and other indices may differ. Although the lower predictive power of ABSI for the incidence of hypertension than other indices has already been reported in a recent meta-analysis [3], Kawasoe et al. added evidence that its predictive power was low in every generation and in both sexes. A previous study of Malaysian adolescents aged 12–16 years also reported a weaker association between ABSI and hypertension than that between ABSI and BMI and WC [4].

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Another remarkable finding in the study by Kawasoe et al. was that the associations of BMI, WC and BRI with the incidence of hypertension was especially strong in the younger population and in women. Obesity is also strongly associated with the incidence of diabetes in the younger population [5]. Younger populations are at the start of the metabolic domino [6], where there are issues such as obesity and unhealthy lifestyles. In older adults with obesity without hypertension, there is a survival bias that is not have developed hypertension even having obesity. In the real world, we tend to focus on obesity in middle-aged or older individuals who start to develop high blood pressure or high blood glucose concentrations. However, because of the potentially long life ahead of the young population, obesity should be prevented or intervention should be performed. A sex difference in the risk of developing hypertension is also known. According to the present study by Kawasoe et al., the sex difference in the risk of developing hypertension appeared to be large in younger participants. In addition, the differences in mean values of BMI and WC were larger in younger participants. These differences are likely to be caused by differences in gonadal hormones [7]. Secretion of the hormones is different between men and women, and the difference would be larger in younger population than older population. Kawasoe et al. reported that the effect of weight reduction on future elevation of blood pressure was stronger in women than in men. The Suita study reported that, when gaining and losing body weight and WC, the correlation of the change in WC and BMI was stronger in men than in women [8]. Therefore, considering the sex difference is necessary when investigating obesity and changes in obesity.

Another important finding of the present study is that the associations of WC and BRI with the incidence of hypertension was stronger in participants with a BMI < 25.0 kg/m^2 than in those with a BMI of ≥ 25.0 kg/m^2 in most age groups and in both sexes. Another study reported that WC was

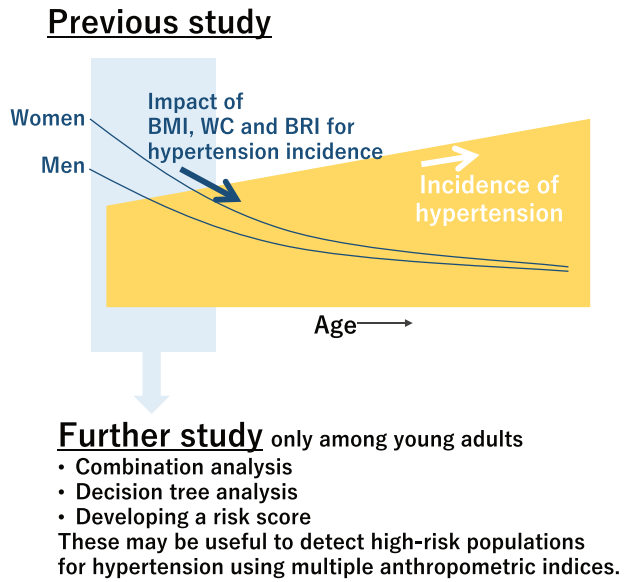

Fig. 1 Summary of the evidences from previous studies, and required further studies to detect a target population of hypertension prevention among young adults. BMI body mass index, BRI body roundness index, WC waist circumference

associated with the prevalence of high blood pressure, high fasting blood glucose concentrations and dyslipidemia [9]. These associations were stronger in participants with a BMI of 18.5–22.9 kg/m^2 than in those with a BMI of ≥ 23.0 kg/m^2. Asians have a lower BMI than Caucasian and Africans. Therefore, in Asian populations, the risk caused by excessive body fat is latent among those without obvious obesity.

There is a lot of evidence of the associations between obesity indices and hypertension. Future studies need to detect a sex-specific target population who have a high risk of hypertension by a combination analysis, decision tree analysis or developing a risk score, which are able to handle the multiple indices of obesity, in young adults with high impact of obesity for hypertension incidence (Fig. 1). This may contribute to focus on strategy of hypertension prevention among young adults who are tended to be looked over because they are at a lower risk of hypertension than older adults.

Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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References

1. Kawasoe S, Kubozono T, Salim AA, Ojima S, Yamaguchi S, Ikeda Y, et al. Association between anthropometric indices and 5-year hypertension incidence in the general Japanese population. Hypertens Res. (ahead of print 5 Nov 2023; https://doi.org/10.1038/s41440-023-01505-6).
2. Krakauer NY, Krakauer JC. A new body shape index predicts mortality hazard independently of body mass index. PLoS ONE. 2012;7:e39504.
3. Calderón-García JF, Roncero-Martín R, Rico-Martín S, De Nicolás-Jiménez JM, López-Espuela F, Santano-Mogena E, et al. Effectiveness of Body Roundness Index (BRI) and a Body Shape Index (ABSI) in predicting hypertension: a systematic review and meta-analysis of observational studies. Int J Environ Res Public Health. 2021;18:11607.
4. Tee JYH, Gan WY, Lim PY. Comparisons of body mass index, waist circumference, waist-to-height ratio and a body shape index (ABSI) in predicting high blood pressure among Malaysian adolescents: a cross-sectional study. BMJ Open. 2020;10:e032874.
5. Tatsumi Y, Ohno Y, Morimoto A, Nishigaki Y, Mizuno S, Watanabe S. Age differences in the risk of diabetes incidence according to body mass index level in Japanese women. Obes Res Clin Pract. 2013;7:e455–63.
6. Itoh H. Metabolic domino: new concept in lifestyle medicine. Drugs Today 2006;42:9–16.
7. Link JC, Reue K. Genetic basis for sex differences in obesity and lipid metabolism. Annu Rev Nutr. 2017;37:225–45.
8. Tatsumi Y, Watanabe M, Nakai M, Kokubo Y, Higashiyama A, Nishimura K, et al. Changes in waist circumference and the incidence of type 2 diabetes in community-dwelling men and women: the Suita study. J Epidemiol. 2015;25:489–95.
9. Tatsumi Y, Nakao YM, Masuda I, Higashiyama A, Takegami M, Nishimura K, et al. Risk for metabolic diseases in normal weight individuals with visceral fat accumulation: a cross-sectional study in Japan. BMJ Open. 2017;7:e013831.