Waist-to-hip ratio showed a linear association with mortality in middle-aged men and women, but body mass index did not

Simpson JA, MacInnis RJ, Peeters A, et al. **A comparison of adiposity measures as predictors of all-cause mortality: the Melbourne Collaborative Cohort Study.** Obesity. 2007;15:994-1003.

Clinical impact ratings: GIM/FP/GP ★★★★★☆☆

QUESTION

Which measures of adiposity in middle-aged adults best predict mortality?

METHODS

Design: Prospective cohort study with a median follow-up of 11 years.

Setting: Community-based study in Melbourne, Victoria, Australia.

Participants: 16 969 men and 24 344 women 27 to 75 years of age (> 99% were between 40 and 69 y).

Risk factors: Body mass index (BMI), waist girth, waist-to-hip ratio (WHR), fat mass (weight minus lean mass), and percentage of body fat (fat mass divided by weight).

Outcomes: All-cause mortality.

MAIN RESULTS

At baseline, 53% of men and 36% of women were overweight, and 19% and 22%, respectively, were obese. During follow-up, 1656 men (9.0/1000 person-y) and 1166 women (4.3/1000 person-y) died. In men, compared with the second quintile, risk for death was increased in the top quintile for each adiposity measure and in the lowest quintile for BMI and fat mass (Table). A linear trend was seen only for waist girth and WHR; the other measures showed a J- or U-shaped pattern. In women, compared with the second quintile, risk for death was increased in the top quintile for waist girth and WHR and in the lowest quintile for BMI, waist girth, and WHR (Table). A linear trend was seen only for WHR.

CONCLUSIONS

The highest levels of all measures of adiposity predicted increased mortality for men. For women, measures of central adiposity were better predictors of mortality than measures of overall adiposity.

Source of funding: National Health and Medical Research Council.

For correspondence: Dr. J.A. Simpson, University of Melbourne, Carlton, Victoria, Australia. E-mail julieas@unimelb.edu.au.

Mortality in the lowest and highest quintiles of adiposity measures in relation to the second quintile in middle-aged men and women at median 11 years*

Sex	Measures	Hazard ratios		
		1st quintile (95% CI)	2nd quintile (value)	5th quintile (CI)
Men	Body mass index	1.2 (1.0 to 1.4)	1.0 (24.3 to 26.1 kg/m^2)	1.2 (1.0 to 1.4)
	Waist girth	1.1 (0.9 to 1.3)†	1.0 (85.5 to 90.8 cm)	1.3 (1.1 to 1.5)
	Waist-to-hip ratio	1.1 (0.9 to 1.3)†	1.0 (0.88 to 0.91)	1.3 (1.1 to 1.5)
	Fat mass	1.2 (1.0 to 1.4)	1.0 (17.4 to 21.3 kg)	1.3 (1.1 to 1.5)
	Percentage body fat	1.1 (0.9 to 1.3)†	1.0 (24.0% to 27.5%)	1.2 (1.1 to 1.4)
Women	Body mass index	1.2 (1.0 to 1.5)	1.0 (22.7 to 24.8 kg/m^2)	1.1 (0.9 to 1.3)†
	Waist girth	1.4 (1.1 to 1.7)	1.0 (70.0 to 75.5 cm)	1.3 (1.1 to 1.6)
	Waist-to-hip ratio	1.3 (1.0 to 1.6)	1.0 (0.73 to 0.76)	1.5 (1.2 to 1.8)
	Fat mass	1.0 (0.8 to 1.1)†	1.0 (20.1 to 24.4 kg)	1.0 (0.8 to 1.2)†
	Percentage body fat	1.0 (0.9 to 1.2)†	1.0 (34.1% to 38.4%)	1.0 (0.8 to 1.2)†

*CI defined in Glossary. Hazard ratios were adjusted for age, country of birth, physical activity, alcohol intake, education, smoking, and (for men only) living alone and family history of heart attack.
†Not statistically significant.

COMMENTARY

The study by Simpson and colleagues again reminds us that being overweight or obese is bad by any measure, but worse if the fat accumulates centrally. In other words, excess fat is bad and visceral fat is worse. Higher levels of visceral adiposity lead to overexpression of adipokines and prothrombotic and proinflammatory peptides, which in turn may increase risk for the metabolic syndrome and vascular events.

In this study, BMI was not a predictor of all-cause mortality in women, whereas WHR was predictive. In men, both BMI and WHR were predictive in the highest quintile. Several previous studies have shown that WHR is a better predictor of mortality than BMI, so these findings are not a great surprise. After all, BMI is a crude measure of body fat that does not incorporate muscle mass, fat distribution, or ethnic diversity. As an example, I have seen many people of South Asian or Asian descent with type 2 diabetes and BMI in the 24 to 27 kg/m^2 range who are clearly obese on examination (at least by WHR). WHR is a better predictor of visceral fat but is not perfect either.

Goodpaster and colleagues (1) measured visceral and subcutaneous abdominal fat as well as intramuscular and subcutaneous thigh fat in 3000 older persons. They found that visceral fat content was the most predictive factor for development of the metabolic syndrome.

The challenge of WHR is the difficulty of measurement and reproducibility in usual clinical settings. In my practice, I will continue to obtain BMI measurements because of their ease but, on occasion, will supplement the measure with WHR determinations in selected populations.

David L. Bronson, MD
Cleveland Clinic Medicine Institute
Cleveland, Ohio, USA

Reference

1. **Goodpaster BH, Krishnaswami S, Harris TB, et al.** Obesity, regional body fat distribution, and the metabolic syndrome in older men and women. Arch Intern Med. 2005;165:777-83.