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conditions, MHO and fit obese, have not yet been adequately investigated, thereby leaving a void that requires further exploration.

In the recent paper by Chang et al. (8), coronary artery calcium (CAC) scores were assessed among Korean subjects; they had a very low prevalence of obesity and CAC compared with people in the United States and India but had higher CAC scores, even among those with MHO. Although the investigators tried to assess the performance of regular exercise, there was no detailed assessment of physical activity or CRF. Future studies should combine the important components of metabolic health and CRF to determine the impact of adiposity on cardiovascular disease. The need for a healthy metabolic profile and CRF cannot be understated and should be promoted, irrespective of body mass index or CAC score.

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REFERENCES

1. Hinnouho GM, Czernichow S, Dugravot A, et al. Metabolically healthy obesity and the risk of cardiovascular disease and type 2 diabetes: the Whitehall II cohort study. Eur Heart J 2014 Mar 26 [Epub ahead of print].

2. Lavie CJ, McAuley PA, Church TS, Milani RV, Blair SN. Obesity and cardiovascular diseases: implications regarding fitness, fatness, and severity in the obesity paradox. J Am Coll Cardiol 2014;63:1345–54.

3. McAuley PA, Artero EG, Sui X, et al. The obesity paradox, cardiorespiratory fitness, and coronary heart disease. Mayo Clin Proc 2012;87:443–51.

4. Lavie CJ, Cahalin LP, Chase P, et al. Impact of cardiorespiratory fitness on the obesity paradox in patients with heart failure. Mayo Clin Proc 2013;88:251–8.

5. Lavie CJ, Alpert MA, Arena R, Mehra MR, Milani RV, Ventura HO. Impact of obesity and the obesity paradox on prevalence and prognosis in heart failure. J Am Coll Cardiol HF 2013;1:93–102.

6. Myers J. New American Heart Association/American College of Cardiology guidelines on cardiovascular risk: when will fitness get the recognition it deserves? Mayo Clin Proc 2014;89:722–6.

7. Kaminsky LA, Arena R, Beckie TM, et al. The importance of cardiorespiratory fitness in the United States: the need for a national registry: a policy statement from the American Heart Association. Circulation 2013;127:652–62.

8. Chang Y, Kim BK, Yun KE, et al. Metabolically-healthy obesity and coronary artery calcification. J Am Coll Cardiol 2014;63:2679–86.

REPLY: How to Determine a Metabolically Healthy Body Composition in Cardiovascular Disease

We thank Dr. Babu and colleagues and Dr. Scherbakov and colleagues for their interest in our paper (1) and for addressing important points in the interpretation of our results. Several of the arguments of Dr. Scherbakov and colleagues address the issue of categorization of parameters that have an underlying continuous distribution, such as coronary artery calcium (CAC) scores or body mass index (BMI). The actual cutoffs used for these parameters are arbitrary and established for clinical convenience but do not reflect changes in the underlying biological processes. With regard to CAC, cutoffs have been developed for risk stratification; however, CAC scores have a direct continuous relationship to total coronary plaque burden in histology (2), severity of coronary artery disease (3), and risk of coronary artery disease, including comparisons of very low CAC scores with a score of 0 (4,5). In our analysis, we used a cutoff of 80 Agatston units (6,7) in multinomial logistic regression models because of the low prevalence of elevated CAC scores; only 13 subjects (0.1%) had a CAC score >400, and 80 Agatston units corresponded approximately to the 90th percentile of participants with any detectable CAC. These results were consistent with alternative analytical models presented in the paper, including using CAC scores as a continuous outcome. Regardless of the analytical methods, metabolically healthy obese participants had a higher prevalence of subclinical coronary atherosclerosis compared with metabolically healthy participants with normal weight, and this association persisted after adjustment for potential confounders, including sex, cigarette smoking, and alcohol consumption.

With regard to BMI, there is an extensive body of evidence that, for the same level of BMI, Asian subjects have higher total body fat (8) and a higher risk of cardiometabolic disease (9) compared with white subjects. Thus, a World Health Organization consultation proposed Asian Pacific-specific BMI criteria (10), which have gained widespread acceptance. Irrespective of the cutoffs and the characteristics of the study populations, the mechanisms linking higher BMI to subclinical atherosclerosis are likely to be similar across populations.

Both Dr. Babu and colleagues and Dr. Scherbakov and colleagues discuss the obesity paradox and indicate that BMI has a U-shaped relationship with mortality. The obesity paradox is a complex phenomenon and affects primarily studies of subjects older than

50 years of age or with established comorbidities (11–15), raising concerns about selection, survival, treatment, and confounder biases (14). The relevance of the obesity paradox to our study population, composed of relatively young asymptomatic Korean men and women, is uncertain. There is, however, an extensive body of evidence indicating that BMI is linearly associated with the development of metabolic abnormalities such as insulin resistance, type 2 diabetes mellitus, and hypertension (14,16) and with cardiovascular mortality and incidence in the Asian population (17,18).

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REFERENCES

1. Chang Y, Kim BK, Yun KE, et al. Metabolically-healthy obesity and coronary artery calcification. J Am Coll Cardiol 2014;63:2679–86.

2. Sangiorgi G, Rumberger JA, Severson A, et al. Arterial calcification and not lumen stenosis is highly correlated with atherosclerotic plaque burden in humans: a histologic study of 723 coronary artery segments using non-decalcifying methodology. J Am Coll Cardiol 1998;31:126–33.

3. Budoff MJ, Diamond GA, Raggi P, et al. Continuous probabilistic prediction of angiographically significant coronary artery disease using electron beam tomography. Circulation 2002;105:1791–6.

4. Blaha M, Budoff MJ, Shaw LJ, et al. Absence of coronary artery calcification and all-cause mortality. J Am Coll Cardiol Img 2009;2:692–700.

5. Silverman MG, Harkness JR, Blankstein R, et al. Baseline subclinical atherosclerosis burden and distribution are associated with frequency and mode of future coronary revascularization: multi-ethnic study of atherosclerosis. J Am Coll Cardiol Img 2014;7:476–86.

6. Guerci AD, Spadaro LA, Goodman KJ, et al. Comparison of electron beam computed tomography scanning and conventional risk factor assessment for the prediction of angiographic coronary artery disease. J Am Coll Cardiol 1998;32:673–9.

7. Arad Y, Spadaro LA, Goodman K, Newstein D, Guerci AD. Prediction of coronary events with electron beam computed tomography. J Am Coll Cardiol 2000;36:1253–60.

8. Deurenberg P, Deurenberg-Yap M, Guricci S. Asians are different from Caucasians and from each other in their body mass index/body fat per cent relationship. Obes Rev 2002;3:141–6.

9. Wen CP, David Cheng TY, Tsai SP, et al. Are Asians at greater mortality risks for being overweight than Caucasians? Redefining obesity for Asians. Public Health Nutr 2009;12:497–506.

10. World Health Organization Western Pacific Region, International Association for the Study of Obesity, International Obesity Task Force. The Asia-Pacific Perspective: Redefining Obesity and Its Treatment. Sydney, Australia: Health Communications Australia Pty Limited, 2000.

11. Adams KF, Schatzkin A, Harris TB, et al. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. N Engl J Med 2006;355:763–78.

12. Pocock SJ, Ariti CA, McMurray JJ, et al. Predicting survival in heart failure: a risk score based on 39 372 patients from 30 studies. Eur Heart J 2013;34:1404–13.

13. Lainscak M, von Haehling S, Doehner W, Anker SD. The obesity paradox in chronic disease: facts and numbers. J Cachexia Sarcopenia Muscle 2012;3:1–4.

14. Hainer V, Aldhoon-Hainerova I. Obesity paradox does exist. Diabetes Care 2013;36 Suppl 2:S276–81.

15. Standl E, Erbach M, Schnell O. Defending the con side: obesity paradox does not exist. Diabetes Care 2013;36 Suppl 2:S282–6.

16. Kramer CK, Zinman B, Retnakaran R. Are metabolically healthy overweight and obesity benign conditions? A systematic review and meta-analysis. Ann Intern Med 2013;159:758–69.

17. Jee SH, Pastor-Barriuso R, Appel LJ, Suh I, Miller ER III, Guallar E. Body mass index and incident ischemic heart disease in South Korean men and women. Am J Epidemiol 2005;162:42–8.

18. Jee SH, Sull JW, Park J, et al. Body-mass index and mortality in Korean men and women. N Engl J Med 2006;355:779–87.