THREE AUTHORS REPLY

We would first and foremost like to thank Dr. Krachler for his thought-provoking letter to the editor (1) regarding our recent paper, “A Prospective Study of Fitness, Fatness, and Depressive Symptoms” (2). In our study, we used data from the Aerobics Center Longitudinal Study (ACLS) to investigate the independent and joint contributions of cardiorespiratory fitness (CRF) and fatness (measured as body mass index (BMI; weight in kilograms divided by height in meters squared), waist circumference, and percentage of body fat) to the onset of elevated depressive symptoms. The ACLS uses a modified Balke maximal treadmill protocol (3) to estimate CRF. Treadmill time, which was used in our study to indicate CRF, is highly correlated with maximal oxygen uptake measured as milliliters per kilogram per minute (mL/kg/minute) in both men and women ($r \geq 0.92$) (4, 5). Dr. Krachler essentially raises a concern regarding the validity of our CRF values, suggesting that comparisons of CRF across individuals of varying BMI status require adjustment for body composition (e.g., lean body mass) rather than just body weight. This concern has wide-reaching implications for researchers across exercise science, but especially so for those interested in the relative importance of CRF and fatness to various health outcomes.

When we plotted maximal treadmill time against BMI, as Dr. Krachler requested, we did indeed find a negative linear association between the 2 variables (-0.28 ; $P < 0.0001$). Although these results could suggest a body composition bias, we would like to stress that a negative linear association is expected between fitness and fatness, as most overweight and obese individuals are not fit. Participants categorized as fit and fat also had significantly lower BMIs, on average, than did those categorized as unfit and fat (for fit and fat, BMI = 27.7 (standard deviation, 2.4); for unfit and fat, BMI = 31.0 (standard deviation, 4.5); $P < 0.0001$). Although the average BMI was higher among participants in the unfit and fat group, there was a large range of BMIs in both groups (BMI range = 25.0–47.8 in the fit and fat group and BMI range = 25.0–50.9 in the unfit and fat group), which implies that a systematic underestimation of CRF in fatter persons did not occur. We feel the same logic holds here as for the previous point (i.e., it is expected that the less fit group would also be the fatter group) and that this does not necessarily imply invalid CRF values.

Maximal oxygen uptake (VO_2max) is defined by cardiac output and arteriovenous oxygen difference, the latter of which is possibly influenced by muscle mass, which is highly correlated with total body weight at the population level. Because body weight is easier to measure than is body composition, especially in large prospective observational studies like the ACLS, adjustment for body weight is a more practical method for calculating VO_2max if it can be done without sacrificing accuracy, and we feel that it can be. Perhaps most helpful to addressing Dr. Krachler’s concern are the results from our previous analyses in which fat free mass (FFM)—

adjusted VO_2max (mL/kg FFM/minute) and traditional, body weight-adjusted VO_2max (mL/kg/minute) were assessed as predictors of all-cause mortality in 10,259 women in the ACLS (6). There was a high correlation ($r = 0.89$) between the 2 methods, leading Barry et al. to conclude that the 2 methods (mL/kg/minute and mL/kg FFM/minute) were similarly able to predict all-cause mortality. Although the health outcome is different, these data further bolster our confidence that the CRF values used in our paper are valid.

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