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Letter to the Editor

Comments on the article “Optimum waist circumference-height indices for evaluating adult adiposity: An analytic review”: relationships to previous studies

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To the editor

The recent review of Hwaung et al. provides a detailed and valuable account of the history and rationale of the body mass index (BMI) and of indices relating waist circumference (WC) to body height that take the form WC/height\(^{\alpha}\). I show here how their evidence and analysis are usefully supplemented with those of earlier studies.

The ratio WC/height, with \(\alpha = 1\), is widely used, but the authors have concluded that the optimum value of \(\alpha\) is approximately 0.5, with this giving the strongest association with adiposity and the weakest correlation with height for men and women of four race/ethnic groups. Burton\(^2\) also considered 0.5 to be an appropriate round-number value.

On dimensional grounds, one might choose a value of 1 for \(\alpha\), making the index dimensionless, but data scatter associated with variable body shape must lower values of \(\alpha\) as estimated by regression analysis — just as it lowers the height exponent, \(p\), of the Benn index, (body mass)/height\(^p\).\(^2,3\) (Here I am applying the symbol “\(\alpha\)” just to WC and not also to body mass as in the review.) Both \(\alpha\) and \(p\) necessarily correlate strongly with the respective correlation coefficients for WC and height and for body mass and height.\(^2,4\) The negative value of \(\alpha\) for Korean women (-0.43) — unadjusted for age — must be associated with a negative correlation between WC and height (though \(R^2\) is positive). These negative values were also found by Han et al. for Europeans.\(^4\) This, as well as Table 1,\(^1\), illustrates the importance of age in considering the height dependences of WC and body mass and therefore both \(\alpha\) and \(p\). In contrast, Table S9 in the supplementary material indicates that there is conveniently little
influence of age on correlations between WC and % fat and between body mass and % fat. With increasing age, body mass tends generally to increase and height tends to decrease.4

Figure 2 of Burton2 shows a strong correlation between p and α (with α there denoted q) with most of the points being for data that were age-adjusted or grouped for age4. The tabulated results of Hwaung et al. show similar relationships, for values both un-adjusted and adjusted for age.1 Moreover, their eight age-adjusted values, together with eight age-adjusted values of Han et al.4, show a single clear straight-line relationship, with a correlation coefficient of 0.91. This suggests a link beyond the obvious between WC/heightα and (body mass)/heightp that has yet to be elucidated. The reduced major axis regression equation is:

\[ \alpha = 0.69p - 0.78. \]

Hwaung et al. discussed the question of whether 1/BMI and 1/(WC/heightα) are additive in multiple regression models for the prediction of % fat. Their Table S7 shows, for age-corrected values, that, for men, R² for % fat and 1/(WC/height0.5) is higher than for % fat and 1/BMI, while the opposite is true for women. Multiple regression of % fat on both indices together did not increase R² above the highest of the two values by more than 0.01. So the two indices are not usefully additive. As a correlate or predictor of % fat, the better index evidently differs between men and women and WC/height0.5 is only more appropriate than the BMI for men.

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