

Body Fat Measurement - is there an easier way?

For fitness and medical professionals alike an accurate measurement of body fat allows for diagnostics, preventative care, and effective treatment. The most accurate means of measuring body fat involves a hydrostatic weighing machine, in which the subject is completely submerged under water, and a particular reading is taken and compared to his or her weight out of the water to give a body fat percentage. The hydrostatic weighing machine essentially finds the body density (gm/cm^3), which is used to extrapolate the body fat percentage using known densities of lean body and fat tissue.

There two commonly used equations to extrapolate body fat percentage from density: Siri's equation and Brozek's equation (see Brozek (1963), pp. 113-140). In this exercise, we will use Brozek's equation since it has been found to be more accurate for all age groups (see Guerra et. al (2010), pp. 11).

Letting

$$D = \text{Body Density (gm/cm}^3\text{)}$$

we have:

$$\%BF = [4.570 / BD \text{ (kg/m}^3\text{)} - 4.142] \times 100$$

Because this gold star standard for measuring Body Fat is inconvenient and costly, it is desirable to have easy methods of estimating body fat that do not include a swimming pool. For instance, usually one can estimate body fat from tables using age and various skin-fold measurements obtained by using a caliper. Other ways give predictive equations for body fat using body circumference measurements (e.g. abdominal circumference) (see Katch and McArdle (1977), pp. 120-132).

In this project, we aim to find an easier and less costly method of estimating body fat by examining a dataset containing the target variable, body fat and other much more easier to obtain measurements. We will fit this data to a multiple regression model and see how accurately we can predict body weight.

References

Guerra, Amaral et al (2010). "Accuracy of Siri and Brozek Equations in the Percent Body Fat Estimation in Older Adults," in The Journal of Nutrition, Health and Aging, vol. IV.

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Brozek J, Grande F, Anderson T, Keys A. Densitometric analysis of body composition: Revision of some quantitative assumptions. Ann N Y Acad Sci 1963; 26(110):113-40.