The importance of anthropometric measurement error

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Dear Editor-in-Chief,

Milanese et al. (2010) offer further evidence to suggest that anthropometric variables are related to the development of motor fitness in pediatric populations. The anthropometric measures of body mass, stature, hip girth, waist girth, skinfolds (triceps, subscapular, chest, abdominal and front thigh) and composite calculation of body mass index (BMI) were used in this study. As the primary aim of the paper was to evaluate the possible relationships between selected anthropometric parameters and motor abilities, it is deemed pertinent that the intra-observer reliability of these measures should have been reported. Without quantification of intra-observer measurement error the acceptability of these variables for subsequent analyses in the main study is unknown.

If one considers the potential additive effect of imprecision through human error, and undependability through biological variation, it is not unreasonable to suggest that interpretation of these results may be impaired (Ulijaszek & Kerr, 1999) as high levels of error can artificially inflate the variance associated with a particular measurement (Goto & Mascie-Taylor, 2007). A number of methods for assessing measurement error exist, the correlation coefficient (r), or alternatively the intra-class correlation coefficient (ICC) may provide a measure of consistency between two continuous variables, but does not permit clarification of the magnitude by which two measurements differ i.e. two observers can measure the weight of twenty children and show a mean difference of 0.1 kg but still display a correlation coefficient of 0.9! (Goto & Mascie-Taylor, 2007).

An alternative method which can be employed is the technical error of measurement (TEM), an accuracy index which measures the standard deviation between repeat measurements. It is obtained by taking repeat measurements of the same subject by one or more observers and entering them into the following equation:

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Submitted for publication July 2010.
Accepted for publication September 2010.
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202
© Faculty of Education. University of Alicante
doi:10.4100/jhse.2010.53.19

$$TEM = \sqrt{\sum \frac{D^2}{2N}}$$

Where D is the difference between replicate measurements and N is the number of individuals measured. A further equation is required when two or more observers are involved. Further, the relative TEM (%TEM) may be calculated to express the magnitude of error relative to the size of the measurement (Ulijaszek & Kerr, 1999). The determination of acceptable levels of measurement error is not easy, and is related to the variable used, and the age and sex of the participants in question. However, Ulijaszek & Kerr (1999) have offered acceptable intra-observer limits for a range of anthropometric measure including height, weight, skinfold sites and girth measurements from a number of studies in both boys and girls (Ulijaszek & Kerr, 1999).

Whilst anthropometric measurement error is unavoidable, it should be minimised by paying close attention to every aspect of the data collection process, such as equipment calibration and the training of research personnel. The reporting of observer measurement error should be commonplace, and it is this issue that should receive adequate attention in future studies using anthropometric measures as a main study outcome.

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