LETTER TO THE EDITOR

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The reliability of methods to estimate the number and size of human motor units and their use with large limb muscles: common mistake

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I was interested to read the paper by Piasecki M and colleagues published in the April 2018 issue of the Eur J Appl Physiol. Current methods for estimating muscle motor unit (MU) number provide values which are similar for muscles of widely differing size. They evaluated reliability of an alternative means of estimating MU number that takes into account differences in muscle size. They reported that intramuscular motor unit potentials (MUPs) were recorded and muscle cross-sectional area (CSA) was measured using MRI to provide a motor unit number estimate (iMUNE). This was compared to the traditional MUNE method, using compound muscle action potentials (CMAP) and surface motor unit potentials (sMUPs) recorded using surface electrodes. Test–retest reliability was evaluated with VL, tibialis anterior and biceps brachii. They reported that all measurements showed strong correlations between test and retest with r values from 0.84 to 0.91 ($p < 0.0005$). As the authors mentioned MUPs, sMUPs and CMAPs were highly reliable ($r = 0.84$–0.91) (Piasecki et al. 2018).

However, this result is not an appropriate estimate to assess reliability. Reliability (precision, repeatability or reproducibility) as an important methodological issue is being assessed by different statistical tests such as Pearson r which is among common mistakes in reliability analysis (Lawrence et al. 1989). The reason is Pearson r just assess the linearity and we can have a strong positive linear correlation with no reliability (Fig. 1). Regarding reliability, it is crucial to know that an individual-based approach
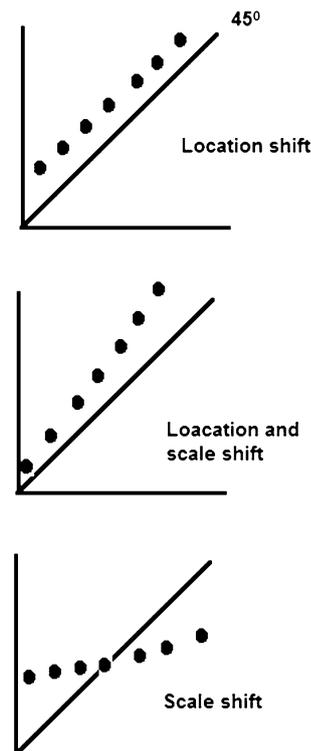

Fig. 1 Cases when Pearson correlation coefficient fails to detect non reproducibility

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instead of global average should be considered. In other words, possibility of getting a positive strong correlation (in this case, $r = 0.84$–0.91) with no reliability at all is high. Briefly, for quantitative variable, intra class correlation coefficient (ICCC) single measure absolute agreement as well as Bland–Altman plot can be applied. As a take-home message, for reliability analysis, appropriate tests with correct interpretation should be applied. Otherwise, misinterpretation may occur (Sabour 2015, 2016; Sabour and Dastjerdi 2013).

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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