Analyses incorporated after expert peer review

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Comparison Between Methods for Analyzing the Reproducibility of the Muscle Architecture of the Vastus Lateralis Using Ultrasound

5 - Minimal Detectable Change

The minimal detectable difference (MDC) is defined as an estimate of the smallest change that reflects a real alteration in the evaluated variable.

$$\mathrm{MDC} = \mathrm{z} \times \mathrm{TE} \times \sqrt{2} \qquad (5)$$

Equation 5 - z represents the critical z-value from the normal distribution corresponding to the desired confidence level. For a 95% confidence level, z = 1.96. TE represents the estimate of the typical error of the measurement presented in Equation 1 (Justifications and formulas.pdf). √2 is the mathematical factor required because the MDC considers the comparison between two independent measurements. It incorporates the combined variability of these two measurements in the calculation.

5.1 – Confidence Interval of the Minimal Detectable Change (MDC)

Since MDC was determined as a linear function of TE, the confidence interval was determined based on the critical Z value and TE:

$$\mathrm{CI95\%MDC} = \mathrm{MDC} \pm \mathrm{z} \times \mathrm{TE} \qquad (5.1)$$

Equation 5.1 - MDC represents an estimate of the smallest change that reflects a real alteration in the assessed variable. z represents the critical z value of the normal distribution corresponding to the desired confidence level. For 95% confidence, z = 1.96. TE represents the estimate of the typical error of the measurement presented in Equation 1 (Justifications and formulas.pdf).

6 – Confidence Interval for the Typical Error (TE)

$$\mathrm{CI95\%TE} = \mathrm{TE} \times \left[\sqrt{\frac{n-1}{X^2 1-\alpha/2,n-1}},\ \sqrt{\frac{n-1}{X^2 \frac{\alpha}{2},n-1}}\right] \qquad (6)$$

Equation 6 – 95% Confidence Interval for Typical Measurement Error (TE). TE represents the estimate of the typical measurement error. n is the number of participants. X^2 represents the critical value from the chi-squared distribution (χ^2) with n - 1 degrees of freedom. The subscript $1-\alpha/2$ refers to the upper percentile of the distribution and $\alpha/2$ to the lower percentile ($\alpha = 0.05$).

7 – Confidence Interval for the Coefficient of Variation (CV)

$$\mathrm{CI95\%(CV)} = \mathrm{CV} \pm 1.96 \times \mathrm{SE} \qquad (7)$$

Equation 7 - 95% confidence interval (CI) for the coefficient of variation (CV). CV represents the coefficient of variation, a measure of relative variability of the variable of interest. SE denotes the standard error of the CV. The value 1.96 is the critical value from the standard normal distribution corresponding to a 95% confidence level.

$$\textit{Standard Error of the}\ \mathrm{CV(SE)} = \frac{\mathrm{CV}}{\sqrt{2\mathrm{n}}} \qquad (7.1)$$

Equation 7.1 – Standard error (SE) of the coefficient of variation (CV). SE represents the standard error of the CV, providing an estimate of the precision of the CV measurement. CV is the coefficient of variation, and n is the sample size.