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LETTER TO THE EDITOR

Reply to letter to the Editor about the article "Prediction equation of hip external rotators maximum torque in healthy adults and older adults using the measure of hip extensors maximum torque"

We appreciate the opportunity to respond to the comments[1] on our recently published paper.[2] Dr. Fernández-Matías questioned our choice of normalizing the torque values by the individual's body mass, which would have generated a spurious correlation between hip extensors (HEX) and external rotators (HER) torques. Dr. Fernández-Matías suggested to include body mass as a control variable of hip external rotator torque (i.e., $HER_{Raw} \sim HEX_{Raw}$ + body mass) in the prediction equation. We reanalyzed the data according to his suggestion. The results revealed the following parameters for this regression model: intercept of −28.869 ($p = 0.057$); slope for HEX_{Raw} of 0.586 ($p < 0.00001$); slope for body mass of 0.408 ($p = 0.08$); R^2 of 0.69; and SEE[1] of 23.21. Although body mass was not a significant predictor of HER_{Raw}, the regression model should be interpreted as: keeping the individual's mass constant, for each unit increased in HEX_{Raw} torque, the estimated HER_{Raw} torque is increased by an average of 0.58 units in HER strength. Therefore, the readers can have access to the model proposed by Fernández-Matías considering the raw HER torque variable and body mass to estimate the HER torque.

We would like to take this opportunity to explain the rationale used to conduct our analysis. Our first argument is related to the recommendation for using strength body-size-independent measurements because muscle strength is influenced by body size.[3] We used the normalization procedure of torque values by body mass to minimize body-size dependence for strength measures.[3] Our second argument is related to the nature of the variables being studied. Absolute values of muscular strength are highly correlated with each other.[4–7] This correlation occurs because the different muscle tests refer to the individual's force generation capacity construct. Individuals considered strong tend to generate higher values of strength in a wide range of strength tests of a given muscle group.[8] Thus, previously published data demonstrate that absolute muscular strength values are strongly correlated.[4-7] Martins et al.[2] identified a significant correlation of $r = 0.8$ between HEX and HER torque normalized values. When the absolute values of torque are considered, the correlation between HEX_{Raw} and HER_{Raw} was r of 0.83 ($p < 0.01$). In other words, the studied variables showed a strong correlation considering the raw torque values.

In addition to what was demonstrated in the literature, the strong correlation observed between the strength absolute values from Martins et al.[2] is expected because the strength for both tested movements was for the same joint (hip), muscular contraction (isometric), joints positions (prone, with hip in the neutral position and knee flexed at 90°), open-kinetic chain movement, and same equipment. Besides, hip extension and hip external rotation movements share a common muscle with a large cross-sectional area (gluteus maximus).[9] The similarity related to which and how many muscles and joints are involved in the test, the type of muscular action, type of movement (closed or open-kinetic chain), and movement velocity contribute to a strong correlation observed between different muscular strength tests.[3] As we discussed in our published article,[2] caution should be taken when generalizing our findings because our sample consisted of healthy young and older adults. In addition, the characteristics of the test (type of contraction, equipment, joint position) need to be considered when applying the equation.

The comments made by Fernández-Matías allowed us to provide further information that may improve the understanding of our paper's procedures. We thank the BJPT editors-in-chief for allowing us to clarify the raised issues.

Conflicts of interest

The authors declare no conflicts of interest.

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[1] SEE Standard error of estimate calculated as: $SEE = \sqrt{(y - \hat{y})^2/(n-1)}$, where $\hat{y}$ is the predicted HER torque, is y the actual HER, and *n* is the number of participants.

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