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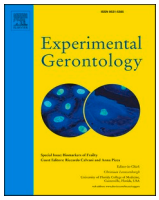

Response to commentary on "The sit-to-stand muscle power test: An easy, inexpensive and portable procedure to assess muscle power in older people"

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Dear Editor,

We read with particular interest the commentary by Fabrica and Biancardi (2022) on the investigations by Alcazar et al. (2018) and Baltasar-Fernandez et al. (2020) about the sit-to-stand (STS) muscle power test calculations. We would like to thank the authors for their comments, and we hope that in conjunction with our response, this discussion will improve the understanding of the goal and applicability of the equation provided in the above-mentioned publications. First, we would like to highlight the fact that our proposed STS power equation aims to estimate lower-limb mechanical power produced during the STS movement, rather than mechanical power experienced by the body center of mass during the STS task. Notably, we believe that the criticisms and discrepancies presented by Fabrica and Biancardi (2022) reside in this misunderstanding.

Briefly, the equation originally presented in Alcazar et al. (2018) transforms time and number of repetitions collected during the STS test into lower-limb STS power, which was validated against other procedures and equipment, such as those using a linear position transducer in a leg press device (Alcazar et al., 2018), the Nottingham power rig (Alcazar et al., 2020) and a force plate (Baltasar-Fernandez et al., 2020). Importantly, the results yielded by this equation have been found to be associated with the risk of mobility limitations, poor quality of life, cognitive impairment, frailty, disability, hospitalization and all-cause mortality in older people (Alcazar et al., 2021a; Alcazar et al., 2018; Alcazar et al., 2021b; Bahat et al., 2020; Baltasar-Fernandez et al., 2021b; Losa-Reyna et al., 2021; Losa-Reyna et al., 2020). In their commentary, Fabrica and Biancardi (2022) mainly criticize one of the assumptions included in the formula presented in Alcazar et al. (2018) regarding the proportion of body mass that is considered in the calculations to estimate mean force. Fabrica and Biancardi (2022) propose that the equation should consider the body center of mass as a reference, and thus include 100% of body mass (or even higher), instead of 90% of body mass. We may agree with this comment on the calculation of the mechanical power of the body center of mass during the STS task; however, as mentioned above, the equation aims to estimate mechanical power exerted by both legs during the STS task. The latter can be accomplished and validated by recording kinetic data using a force plate placed under the feet (Baltasar-Fernandez et al., 2020), and no other force plate for the chair is needed to measure leg mechanical power, so the recording of forces under the chair is futile in this sense. Of course, the power values estimated by the equation are not interchangeable with those derived from the assessment of the mechanical power exhibited by the body center of mass.

On the other hand, Fabrica and Biancardi (2022) argue that our results on the proportion of body mass utilized in the equation being validated in Baltasar-Fernandez et al. (2020) is due to an erroneous definition of the concentric phase of the STS movement, especially in terms of the identification of its onset. First, we would like to point out that there is no consensus in the literature on how many phases the sit-to-stand task has or when each of those phases begins and ends. In addition, Fabrica and Biancardi (2022) define the onset of the concentric phase as the point at which the body center of mass starts rising, and mention that it would occur when the body detaches from the chair, being both arguments inaccurate. The term "concentric" refers to a physiological event consisting in the active shortening of muscle fibers, and so its identification should not be related to the displacement of the body center of mass. Secondly, the rising of the body center of mass have been found to occur well before the body detaches from the chair (Roebroeck et al., 1994). Finally, since the main goal of our STS power equation is to estimate lower-limb mechanical power production, the onset of the concentric phase was defined as the point at which force produced by the lower limbs starts rising, indicating the likely active shortening of the involved muscle fibers. Moreover, the video analysis showed that this point coincided with the instant at which the buttocks

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began to detach from the chair (before the body detached from the chair completely). Therefore, equation-derived concentric mechanical power produced by the lower limbs during the STS test was appropriately validated in our previous study (Baltasar-Fernandez et al., 2020).

Altogether, it seems that the concerns raised by Fabrica and Biancardi (2022) have to do with the actual assessment of the body center of mass. Nevertheless, as mentioned before, our STS power equation aims to estimate average mechanical power produced by the legs during the STS task. Of note, our equation has been validated to evaluate lower-limb muscle power against other protocols using "gold standard" instruments (Alcazar et al., 2020; Alcazar et al., 2018; Baltasar-Fernandez et al., 2020), and has been related to negative conditions and events occurring during aging (Alcazar et al., 2021a; Alcazar et al., 2018; Alcazar et al., 2021b; Bahat et al., 2020; Baltasar-Fernandez et al., 2021b; Losa-Reyna et al., 2021). In addition, when compared to other equations, ours showed the highest clinical relevance according to its association with physical performance and frailty in older people (Baltasar-Fernandez et al., 2021a). In any case, our STS power equation does not aim to substitute "gold standard" methods, and does not provide data that can be interchangeable with those yielded by comprehensive kinematic and kinetic analyses; however, it provides the possibility to assess lower-limb muscle power in contexts in which time or resources constrains inherent to traditional instruments may prevent its assessment.

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Data availability

No data was used for the research described in the article.

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