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LETTER TO THE EDITOR

The mind–muscle connection in resistance training: friend or foe?

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Abstract The results of Calatayud et al. (Eur J Appl Physiol, 2015. doi:10.1007/s00421-015-3305-7) indicate that focusing on the pectoralis major and triceps brachii muscles during bench press exercise selectively enhanced their activation, and thus suggest a training strategy. However, the authors did not discuss the well-established negative effects that focusing on specific muscle groups has on exercise performance. For proper perspective of the results and their practical utility, it is helpful to note the interplay between negative and positive effects of different focus conditions.

Keywords Attentional focus · Motor learning · Hypertrophy · Instructions

Dear Editor,

We read with great interest the study by Calatayud et al. (2015), who observed larger electromyography (EMG) amplitudes from the pectoralis major and triceps brachii muscles upon focusing on these muscles during the bench press exercise. The results are of interest, as they suggest a training strategy. However, while the methodology and analysis are sound, a discussion of the relevant literature concerning the adverse effects of focusing on specific muscle groups on exercise performance is lacking. It is important to discuss such negative effects because they may influence the conclusions regarding the applicability of the results obtained by Calatayud et al. (2015).

The authors state, "…scientific literature evaluating the effectiveness of selectively focusing on specific muscles during exercise performance is scarce." We beg to differ. The effects of focus conditions on exercise performance and motor learning have been extensively investigated during the past two decades, resulting in more than a 100 published studies (for a review, see Wulf 2013). Specifically, there is an abundance of studies comparing internal and external focus conditions. Internal focus refers to a person focusing on a specific muscle group or body part during the task; for example, focusing on the pectoralis major or triceps brachii muscles during the bench press, as requested from the participants in the study by Calatayud et al. (2015). In contrast, external focus refers to a person focusing on the effects of the movement on the environment; for example, focusing on the barbell during the bench press exercise. The results of such comparisons are quite conclusive, with external focus leading to superior performance and learning (Wulf 2013). Omitting a discussion of this literature suggests that the larger EMG amplitudes observed with internal focus in the study by Calatayud et al. (2015) are the only affected variable. This is not the case.

The authors also wrote, "…the possibility of selectively increasing muscle activity during certain exercises without increasing the external load could serve potential benefits during both rehabilitation and conditioning programs." While this may be true, implementing an internal focus, which elicits larger EMG amplitudes, can also hinder both rehabilitation and conditioning. For example, compared

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to external focus, adopting an internal focus decreases the force participants are able to apply in both single- and multi-joint exercises (Wulf 2013). Internal focus also reduces the number of repetitions subjects are able to complete in dynamic exercises, such as the bench press. It also shortens the time subjects are able to sustain an isometric contraction, such as a wall-sit (Wulf 2013). Similar effects are also observed in rehabilitation settings. For instance, participants who suffer from ankle sprains demonstrate inferior balance performance with internal as compared to external focus. Additionally, internal focus is considered to be less suitable for acquisition of motor skills needed for sport reintegration following an anterior cruciate ligament reconstruction (Gokeler et al. 2013). Thus, the potential benefits of larger EMG amplitudes elicited by internal focus should be considered alongside the negative effects internal focus has on performance.

We agree with Calatayud et al. (2015) in that eliciting larger EMG amplitudes could be beneficial under some circumstances. For example, it is possible that the larger EMG amplitudes observed with internal focus are advantageous if hypotrophy is the end goal. However, we stress that, at present, it is unclear as to whether or not greater EMG amplitudes are indeed associated with greater hypertrophy, strength, or with improvements in functional motor tasks. In fact, to the best of our knowledge, no study has demonstrated such effects with clarity. Furthermore, even if such benefits will be eventually confirmed, the interplay between negative and positive effects will remain. Additionally, the authors did not mention that internal focus commonly elicits larger antagonist EMG amplitudes compared to external focus. That is, internal focus leads to larger EMG amplitudes from the focused upon muscles, as well as their antagonists. This, in turn, increases co-contractions, which can hinder performance. In fact, the adverse effects of internal focus are attributed to the increases in co-contractions (Wulf 2013). A discussion of this effect is necessary if one is to reach a fair assessment of the practical utility of the results reported by Calatayud et al. (2015).

Finally, if selective activation of muscles is desired, we believe that alternative strategies to internal focus should be considered. Admittedly, external focus is usually associated with smaller EMG amplitudes. However, we propose that well-chosen external focus strategies have the potential to increase EMG amplitudes. For example, whereas Calatayud et al. (2015) instructed participants, "during this set, try to focus on using your chest", the following can be used instead, "during this set, try to focus bending the barbell inwardly." Similarly, instead of instructing participants, "during this set, try to focus on using your triceps", the participants could have been instructed, "during this set, try to focus on pulling the barbell apart." Such external focus instructions are expected to increase EMG amplitudes of the pectoralis major and triceps brachii muscles, respectively. Note that the specific instructions suggested above are mere illustrations that were not yet systematically investigated. However, they merit attention because they afford the potential to selectively activate the desired muscles without the negative side effects of internal focus.

In light of the accumulated literature delineating the negative effects of internal focus on performance, it is important to explore alternative focus strategies. Accordingly, future research aiming to investigate selective activations of various muscle groups should do so by implementing different focus conditions other than internal ones.

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