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LETTER TO THE EDITOR

Does resistance training modulate cardiac autonomic control in diseased but not in healthy individuals?

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Dear Editor,

We read with great interest the recent meta-analysis written by Bhati et al. [1], which investigated the effect of resistance training (RT) on the modulation of cardiac autonomic control. The authors concluded that RT has no or only a minimal effect on the cardiac autonomic control of healthy individuals, but leads to improvement in the cardiac autonomic control of diseased individuals. We appreciate the authors' thorough analysis. However, some limitations of the findings of their review should be noted.

Although the selection of databases, the search strategies applied, and the analysis of the quality of the studies are adequate and consistent with the guidelines for conducting systematic reviews and meta-analyses [2], the decision to include uncontrolled studies and data obtained using different experimental designs appears to have compromised the implementation of the meta-analysis as well as the interpretation of the data.

Regarding the effects of RT on the cardiac autonomic control of healthy individuals, the authors conclude that there does not seem to be a significant change in cardiac autonomic control after RT. However, in the analyses of subgroups with different heart rate variability (HRV) domains, although no significant differences were identified between the control condition and RT, there was high heterogeneity in, for example, the mean N–N interval (NN), low-frequency (LF)/high-frequency (HF), and the standard deviation of the instantaneous beat-to-beat variability (SD1). Thus, the conclusions need to be drawn in light of the presence of this heterogeneity, which may be related to the demographics of the study participants, who were mostly middle-aged and older men [3].

On the other hand, the conclusions drawn about the effects of RT on diseased individuals are, in our view, more worrisome and deserve further clarification. The authors conclude that RT seems to be effective at improving cardiac autonomic control in diseased individuals. Although significant differences were observed in the subgroup analyses, with RT favored in all HRV domains, heterogeneity was present in almost all comparisons. In addition, the number of studies included in the meta-analysis of subgroups of individuals with diseases was much lower than that included in the analysis of healthy individuals, which is important to take into account when drawing conclusions based on the results. Moreover, in the nonlinear domain, only two studies by the same author were used, which could explain the significant effect of the variable SD1 and the low heterogeneity present in this analysis. It also does not seem prudent to consider different diseases in the analysis, since that some diseases are clearly associated with alterations in cardiac autonomic control (e.g., hypertension) while others do not (e.g., obesity) [4]. Thus, the analyses need to be conducted according to the particular diseases considered if we are to discern the true effects of RT on cardiac autonomic control in diseased individuals.

Although the authors have commented on Kingsley's elegant systematic review [5], which examined the acute and chronic effects of RT on cardiac autonomic control, Bhati et al.'s findings add little to Kingsley's findings, since they only reinforce the conclusion that cardiac autonomic control does not change after RT in healthy individuals and (despite the limitations of the analyses discussed above) suggest that RT can induce favorable changes in diseased individuals.

In conclusion, Bhati et al. [1] analyzed an important issue: the effect of RT on the modulation of cardiac autonomic control. However, the results of their meta-analysis should be interpreted with caution due to the limitations

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mentioned above. We believe that our observations may facilitate a more accurate elaboration of the results presented by Bhati et al. [1].

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

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