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Editorial: Tailored respiratory muscle training for athletes, patients, and vulnerable groups

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Editorial on the Research Topic
Tailored respiratory muscle training for athletes, patients, and vulnerable groups

Research indicates that the maximum exercise capacity achieved in physical assessment tests is a leading indicator of population survival (1–4). To enhance physical capacity for both health professionals and sports science experts, it is essential to identify the biological systems that primarily limit exercise progression.

The goal is to design rehabilitation and physical conditioning programs that improve these "weaker" systems. In healthy individuals under normal conditions, the cessation of exercise is typically attributed to limitations in the cardiovascular system, particularly the inability to maintain an increase in cardiac output, as stroke volume tends to plateau at about 50% of maximum physical capacity (5–7).

However, in specific situations—such as extreme environments like high altitude or high humidity, clinical settings with ventilatory support or supplemental oxygen, and among populations like elite athletes, older adults, or patients with chronic diseases or cancer—other biological systems may play a crucial role (8, 9).

In this context, understanding the respiratory system is vital. Measuring respiratory mechanics, lung volumes through spirometry, and the strength and endurance of the respiratory muscles are important factors to consider when evaluating the respiratory system's contribution to physical performance in athletes and patients (10).

As a result, respiratory muscle training (RMT) has gained significant attention in health and sports sciences. Empirical evidence demonstrates that RMT can lead to improvements in clinical outcomes such as exercise capacity (including oxygen consumption and enhanced performance in tests like the six–minute walking test or shuttle walking test), reduced dyspnea and leg fatigue, and improved sports performance (11, 12).

Several studies have implemented different RMT protocols using a range of equipment and respiratory muscle tests to improve the program training prescription,

all possessing high validity and reliability in accordance with international guidelines set by recognized organizations, such as the American Thoracic Society (ATS) and the European Respiratory Society (ERS) (13).

Acute interventions, such as warming up the inspiratory muscles, have also been suggested as strategies to enhance sports performance and improve the quality of subsequent physical exercise (14–16). Despite significant advances in the field of respiratory muscle training, the wide variety of methods and intervention protocols employed has posed challenges to reaching a consensus on the most effective approaches in this research and application area.

This research topic encompasses relevant studies on RMT in athletes and clinical populations, including ten submitted articles—five accepted for publication and five rejected. It underscores a significant interest in this area among health professionals and trainers who aim to optimize training by customizing RMT strategies. The focus is on identifying the most effective types, devices, and protocols to enhance these outcomes.

The contributions presented here primarily take the form of reviews, highlighting RMT's effectiveness on exercise performance in athletes and achieving noteworthy improvements in clinical populations. These contributions detail the devices used, the types of protocols implemented, and the reported values for the minimal clinically important difference (MID).

Despite the considerable variability in the evidence, there is a strong consensus on the utility of RMT within physical training programs. These findings convey a central message: regardless of the device used, RMT should be an integral component of all rehabilitation programs and sport contexts. While it is common to evaluate the effectiveness of an intervention based on outcomes relevant to the studied population, it would be misguided to confine the analysis of RMT to this framework.

The physiological response to physical effort is complex and involves integrating various "stressed" variables responding to physical stimulus. Therefore, the intricate interplay between biological systems during exertion requires deeper investigation. For example, improving respiratory mechanics through targeted training of respiratory muscles can enhance efficiency in effort expenditure, yielding benefits in other areas, such as the muscular system due to a delayed onset of metabolic reflexes, or cognitive aspects by mitigating exercise-induced hyperventilation and delaying the cerebral vasoconstriction associated with central fatigue.

As the advantages of RMT in training programs become evident, future research should concentrate on the integrated interactions of biological responses elicited by physiological stimuli and how to stimulate these responses without relying on costly instruments. We hope that this collection of research contributions will inspire new collaborations and encourage more researchers to innovate, aiming to make RMT more tailored, accessible, and recognized by health and sport professionals.

Author contributions

FC-B: Conceptualization, Data curation, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. FM-G: Conceptualization, Data curation, Formal analysis, Methodology, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SW: Writing – original draft, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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