Beyond BMI: Assessing Body Composition in Response to Pulmonary Rehabilitation

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Background

The effectiveness of pulmonary rehabilitation (PR) for improving exercise capacity and quality of life in people with Chronic Respiratory Disease is well established. [1] Further, combined aerobic and resistance training within PR can be effective in favourably modifying body composition, enhancing lean mass and reducing fat mass. [2, 3] In this *quarterly bite*, we discuss the current evidence and practical advice for clinicians assessing body composition in response to PR.

What do current guidelines recommend?

Body composition is not considered amongst the core outcomes in current PR guidelines, which consist of exercise capacity, dyspnoea and health status. [1, 4] However, both the American Thoracic Society and European Respiratory Society highlight the predisposition for adverse body composition in Chronic Respiratory Disease and have included potential interventions and brief methods of assessment in a recent joint position statement. [1]

Who may benefit most from an assessment?

Considering this current guidance, assessment of body composition may be justified in individuals at greatest risk of underlying abnormalities, particularly muscle depletion or high adiposity. Conditions such as sarcopenia (low muscle mass and strength), obesity, and sarcopenic obesity appear to be more prevalent in individuals with chronic respiratory disease than in the general population and are associated with poorer health status. [5-7] Those who have experienced a recent hospital admission, as well as those with advanced age and higher levels of sedentariness may be at greatest risk of abnormal body composition. [8]

Methods of assessment

For at-risk individuals, several tools for assessing body composition are available for clinicians. The methods of assessment, their outcomes produced, accuracy, and resource use (initial and ongoing costs, time, staffing and training requirements) are outlined in Figure 1.

	Outcomes				Resource use		
Method	Adiposity	Fat free /lean	BMD/ BMC	Accuracy	Cost per-test *	Time	Staff/ training
Bioelectrical Impedance Analysis (BIA)	✓	✓	✗	**	$	~5 min	Low
Dual Energy X-ray Absorptiometry (DXA)	✓	✓	✓		$$$	~15 min	Moderate
Computed Tomography (CT)	✓	✓	✓		$$$$	~15 min	**High**
Magnetic Resonance Imaging (MRI)	✓	✓	✗		**$$$$$**	**~20 min**	**High**
Skinfold thickness via calliper	✓	✗	✗		$	~5 min	Moderate
Ultrasound	✓	✓	✗		$$	~15 min	Moderate

Figure 1. Non-exhaustive summary of body composition assessment methods in PR. *Costs reflect approximate per-test estimates. Capital equipment and installation costs not considered. For CT and MRI, availability and opportunity cost are likely to represent a greater practical barrier than per-scan cost. **Accuracy is reduced in the presence of oedema and fluid shifts - common in patients with chronic respiratory disease. Results should be interpreted with caution in this population, and repeated measures should be conducted under standardised conditions (e.g., hydration status, time of day, prior exercise). Abbreviations: BMD = Bone Mineral Density; BMC = Bone Mineral Content.

Outcomes of interest and how to interpret them

For certain body composition outcomes, healthy population based normative values are available, [9] though should be interpreted cautiously and relatively in certain disease populations. Fat-free mass may be of particular interest to clinicians, as a lower value relative to overall body mass is independently predictive of adverse outcomes in chronic respiratory disease. [10] However, monitoring changes in fat-free mass can be challenging, as many tools may lack sensitivity to detect small changes, and there are no guarantees that modest improvements will translate to patient-perceived benefit. Therefore, it remains important that clinicians consider the patient’s baseline features (e.g., patient-reported body composition changes in last 12-months, baseline presence of sarcopenia or frailty) and the patient’s own perception of response following PR when interpreting change.

Body fat percentage (%) may add useful context when combined with fat-free mass. For example, rapid weight loss in an overweight or obese individual, whilst likely beneficial for respiratory mechanics and cardiometabolic risk, is often accompanied by a substantial loss of lean mass. As such, individuals with a higher body fat % but lower fat-free mass relative to their weight may benefit from targeted exercise training (e.g., resistance training bias) combined with specific lifestyle advice and dietary requirements to encourage a body composition shift more likely to result in sustainable physical performance benefits. [11]

Conclusion

Body composition provides physiological context beyond weight or BMI, which can allow greater personalisation in PR. Assessments can be performed pragmatically (e.g., BIA, skinfold thickness); however, in the absence of costly gold-standard techniques (e.g., MRI, DXA), interpretation of change following PR is likely best guided by an understanding of the patient's baseline status alongside their own perceived change.

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