The trainability of elderly people

Studies of physical training to improve cardiorespiratory fitness in people over 75 years of age are rare. The two papers published in this issue of Age and Ageing by Kallinen et al. [1] and Malbut et al. [2], are important for all those involved in the training and rehabilitation of elderly people. Training studies with elderly people are difficult: the variability of the response to training means that a notable mean improvement in fitness relative to a control may not achieve statistical significance (see Kallinen et al.). Attempts to maximise statistical power (such as using each subject as their own control) may actually create difficulties with data interpretation, (see Malbut et al.). Interpretation is complicated by the prevalence of chronic disease and medications, and there is also the question of potential hazards associated with training heterogeneous groups of frail elderly people.

The results of the two studies are different: Kallinen et al. did not show a statistically significant improvement in the peak oxygen consumption (VO₂peak) of a group of elderly female volunteers (taking an average of 2–3 medications each) after 18 weeks of training, despite improvements of 7% and 9% in the training groups and a 6% decline in the controls. (But post-hoc calculations showed statistical ‘underpowering’). Malbut and her colleagues studied healthy men and women and did show a significant improvement in maximal oxygen uptake (VO₂max.) after 24 weeks of training but only in the women. It would appear that the men were not as responsive as the women to training (although their data are more difficult to interpret). Both studies expose important issues regarding the method of measurement of cardiorespiratory fitness and its responsiveness to training.

The measurement of cardiorespiratory fitness

The first issue relates to the measurement of cardiorespiratory fitness. While VO₂max. is undoubtedly a valid and reliable indicator (and indeed the ‘gold standard’ measure) of cardiorespiratory fitness in young healthy individuals, its choice as an outcome measure in this type of study is questionable. While criteria for the achievement of a true maximal value by older people have been suggested, none has been universally adopted. Since it requires a maximal exhaustive effort, VO₂max. is difficult to measure in very elderly people on practical grounds alone, but it may also be impossible in those with chronic disease. In patient studies, a symptom limited VO₂ is often used (VO₂peak) but this measurement could be presumed to be subject to even greater variability. Perhaps it is time to shift the focus away from a maximal or peak measurement to a submaximal measurement which, while still measuring cardiorespiratory fitness, may be more achievable, reliable and meaningful. A decreased heart-rate response to a given submaximal value of oxygen uptake is a classical response to endurance training and was demonstrated in Malbut’s study by a significant reduction in heart rate at a VO₂ of 10 ml.kg.⁻¹.min.⁻¹. (One could argue that if the peak values for heart rate and oxygen uptake reported in Kallinen’s study were actually submaximal values, then their results are also consistent with this training response). Nevertheless, given the increased prevalence of disease in old age and an increased use of medications such as β-blockers and digoxin which affect the interpretation of the heart rate response to exercise, we need alternative submaximal indicators of cardiorespiratory fitness which could be applied within a heterogeneous elderly population.

Factors influencing the cardiorespiratory response to training

A second issue relates to the influence of health status upon the ability to respond to training. Participants in Kallinen’s study had evidence of ischaemic heart disease, hypertension, respiratory disease and musculoskeletal problems. The results of this study therefore raise the question of whether responsiveness to training is diminished in the presence of some chronic diseases. Although the evidence relating to older patients is sparse, previous studies have shown that the muscles of frail elderly people such as those in institutional care and those recovering from hip fracture can respond to strength training with improvements in strength, power and functional ability [3–6]. With respect to cardiorespiratory training in elderly patients, the picture is unclear, due to the lack of research in this area. Nevertheless, in one study of cardiac rehabilitation which included an element of training, the improvement in aerobic capacity in patients aged 75 and over was proportionately at least as great as in patients under 60 years [7].

Could the negative results of Kallinen and the question mark over the response of Malbut’s male subjects, perhaps reflect that it is not groups who differ in their responses to training, but individuals...
within groups? The variability of the response of \( \text{VO}_2\text{max.} \) to training within ‘older’ (60–71 years [8]) and young adults has been described and indicates that within any training group, there may be a large variation in the response. This phenomenon may have a genetic basis: Recent advances in molecular biology have enabled the identification of genes and their polymorphisms that contribute to differences in human physical performance [9]. The most extensively studied ‘performance’ gene so far is the ACE gene. There is some evidence from studies of young adults that ACE genotype may influence the responsiveness to endurance or strength training [10]. Studies of older adults have yet to be reported, but the possibility of explaining (and predicting) someone’s responsiveness to training (including therapeutic exercise) on the basis of their genotype, is becoming less remote.

Can elderly people be trained safely and effectively?

Kallinen and colleagues report adverse changes in the health of several of their volunteers. They question whether these could have been caused by physical training and state the need for more research on the dose-response relationship. This is essential if training programmes are to be adapted to the needs of the individual, in order to minimise risk and maximise benefit [11]. In addition, further research should test whether some pathologies (or medications) limit a patient’s ability to respond to training. Then, perhaps we will be better able to use physical training as a safe and effective countermeasure against physical frailty.

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References