

## Letter to the Editor

# Exercise beyond nutrition to enhance physical recovery

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Muscle atrophy is an unfortunate consequence of ageing and disease and can compromise physical function and impair vital metabolic processes. Interventions to improve the recovery of muscle strength and function include physical exercise and appropriate nutrition (protein intake) because both have a positive impact on protein anabolism<sup>(1)</sup>. Beelen *et al.*<sup>(2)</sup> recently assessed the effect of protein enrichment on physical function in older adults with adequate protein intakes in the first 6 months after hospital discharge. The findings suggest that a higher protein intake (1.5 g of protein/kg body weight per d) may be useless in improving the physical performance of older patients after hospitalisation. There might be several reasons. A major criticism is that, in most randomised controlled trials, it is hypothesised that supplementation, not the nutrient status itself, is protective. Protein enrichment may not be effective in enhancing physical recovery in these older adults because protein intake was already adequate. In fact, most nutrients have a non-linear, inverted U-shaped association with optimum physiological function. For individuals who are already at a nutrient level for optimum functioning, further protein supplementation would provide no additional benefit.

The authors believe rightly that limited physical activity may be one of the reasons for the absence of treatment effects on physical performance. Indeed, Burd *et al.*<sup>(3)</sup> highlighted the hypothesis that physical inactivity is a key factor responsible for the proposed anabolic resistance of skeletal muscle protein synthesis with ageing. However, it is important to distinguish between physical activity and physical exercise. Physical activities, for example performed as part of daily living, are of substantial benefit in increasing energy expenditure in elderly sedentary subjects, but may not improve the functional capacity of the main organs (lung, heart and skeletal muscles), and hence physical performance. On the other hand, regular exercise (endurance and/or resistance) training with a sufficiently high intensity increases a variety of physiological parameters, and all of them may contribute to the training-induced increase in physical performance. Resistance training is considered to be the best exercise method for increasing muscle mass, strength and functional performance in the older population, without restriction<sup>(4)</sup>, and this may be additionally enhanced by the intake of a protein-rich diet<sup>(5)</sup>.

Although associated with greater muscle strength, simply consuming more protein without appropriate contractile manipulation may not be a suitable approach to improving physical recovery, as there is little effect of nutritional support

by itself on functional capacity and physical performance in older adults<sup>(6)</sup>. Similarly, the results of a recent systematic review of randomised clinical trials demonstrates that, although nutritional therapy increases daily energetic and protein intake, there is little effect of nutritional support on clinical and functional outcomes in malnourished medical inpatients<sup>(7)</sup>. Perhaps just increasing protein might not be sufficient unless you train these patients, because low skeletal muscle area may play a significant role. Thus, older adults should build up a functional reserve early enough through an individually tailored exercise programme based on objective assessments of muscular fitness and physical activity, which is the most important and almost the only effective intervention to avoid or to break the vicious circle of deadadaptation of the musculoskeletal and cardio-respiratory systems, for example due to ageing, disease and physical inactivity.

In the study by Beelen *et al.*<sup>(2)</sup>, a large number of the subjects were chronic obstructive pulmonary disease (COPD) patients, commonly characterised by rapid muscle wasting, impaired exercise performance and reported to have low plasma levels of leucine, which is a nutrient 'trigger' for muscle anabolism and may protect skeletal muscle during periods of disuse. Likewise, tryptophan is a promising candidate since this essential amino acid is linked to inflammation and immune activation via the so-called kynurenine pathway, which is often systemically up-regulated when the immune response is activated<sup>(8)</sup>. Recently, the NUTRAIN-trial<sup>(9)</sup> showed that skeletal muscle mass increased after 4 months of high-intensity exercise training, but this response was not augmented by protein supplementation, supporting the notion that the training component *per se* is of primary importance when it comes to improving muscle strength and function in COPD patients<sup>(10)</sup>.

All in all, it might be concluded that the effect of protein enrichment on physical recovery is minimal in older adults when habitual protein intake is already adequate and physical activity is limited. Nutritional intervention is probably effective in undernourished patients, but most effective when combined with an exercise programme. This simple strategy may help to preserve muscle mass and function in the older population and, as such, support healthy ageing.

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