Gaining muscle; the role of energy availability

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Changes in skeletal muscle mass are underpinned by the balance between muscle protein synthesis and breakdown. Consequently, nutritional strategies to support muscle maintenance and growth have largely focussed on dietary protein intake and its interaction with exercise. The contribution of energy balance is less clearly defined, despite the longstanding assumption that an energy surplus is required to support (optimal) muscle hypertrophy. Whether positive muscle protein balance requires positive whole–body energy balance is consequential for athletes seeking to increase muscle mass without (or limiting) increases in body mass, or to maintain muscle during weight loss.

Energy restriction can suppress muscle protein synthesis rates, though the extent to which this translates into muscle loss depends on the dietary and exercise conditions imposed. Resistance exercise and increased dietary protein intake can mitigate these responses and, under some circumstances, support favourable changes in body composition despite an energy deficit. Conversely, greater energy provision does not necessarily confer greater muscle anabolism. Understanding these relationships requires consideration of the magnitude and duration of altered energy intake, the source of dietary energy and protein, and the physiological characteristics of the individual. It also requires careful distinction between changes in body mass, lean mass and skeletal muscle, and recognition of how their measurement influences interpretation.

This lecture will examine how energy availability regulates skeletal muscle protein turnover and the implications for longer–term changes in muscle mass, function and body composition. Published evidence will be considered alongside recent unpublished work from our laboratory investigating energy balance and muscle protein synthesis, and weight loss using varying dietary approaches (e.g. very low–calorie diets). The increasing use of GLP–1–based therapies provides a further context in which to consider the composition and functional consequences of weight loss. Particular emphasis will be placed on how dietary manipulations, and exercise, can support muscle maintenance or gain across sporting and clinical settings where energy availability may fluctuate.