# Optimal Anabolic Window: Protein Timing and Distribution Following Resistance Training


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## ABSTRACT


**Skeletal muscle hypertrophy occurs when muscle protein synthesis (MPS) exceeds muscle protein breakdown (MPB). The most efficient way to increase MPS is through resistance training (RT) and consumption of dietary protein. Furthermore, the quality, quantity, and timing of dietary protein are key variables that influence MPS and muscle hypertrophy. With regard to protein quality, milk proteins (whey) are superior to plant proteins (soy). The maximum quantity of protein required to stimulate MPS following RT in young men is 20 g, whereas in the elderly at least 35-40 g of high quality protein maximizes MPS. The leucine content of dietary protein can also influence protein quality and is itself a potent stimulator of MPS. However, the timing and distribution of dietary protein following RT seems to be equivocal. Therefore, the focus of this review is to examine the effect of protein timing on maximizing muscle anabolism in young and elderly populations. Based on the literature, consumption of protein immediately before after exercise does not further augment MPS. However, acute studies suggest that protein timing and distribution can positively influence skeletal muscle anabolism. More research is required to examine the chronic effects of various protein feeding strategies on muscular adaptations following RT.**


## INTRODUCTION

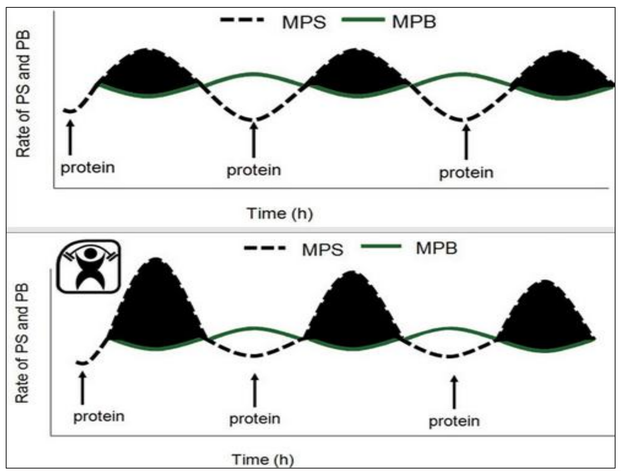


**Figure 1. The synergistic effect of dietary protein and RT on muscle protein balance (*Phillips, Sport Sci Ex 2013*).**

## Protein Dosage in Young

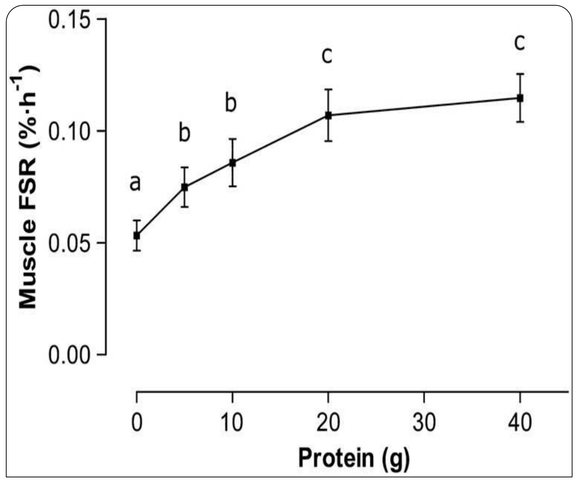


**Figure 2. Myofibrillar FSR in young adults in response tovarious protein dosages following RT (*Moore et al, AJCN 2008*).**

## Protein Dosage in Elderly

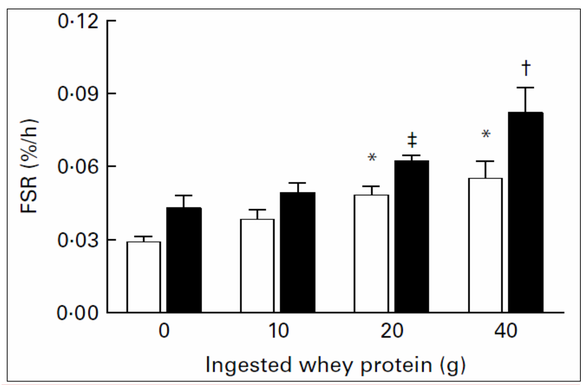


**Figure 3. Myofibrillar FSR in the elderly in response to various protein dosages following RT *(Yang et al, Nutr Metab 2012).***

## RESULTS

### Effect of Protein Timing on Strength in the Young

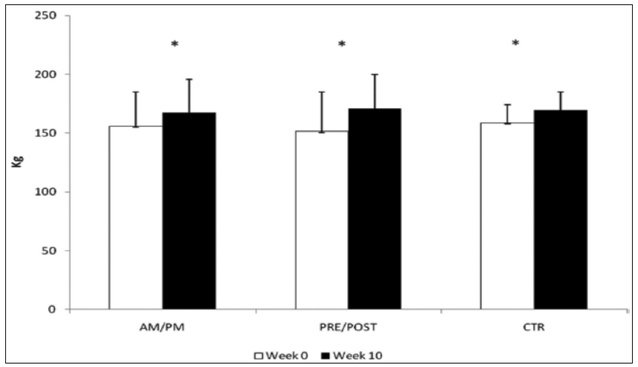


**Figure 4. 1-RM squat performance over 10 weeks. AM/PM= protein in the morning and evening; PRE/POST= protein immediately before and after RT *(Hoffman et al, IJSNEM 2009).***

### Effect of Protein Timing on Body Composition in the Elderly

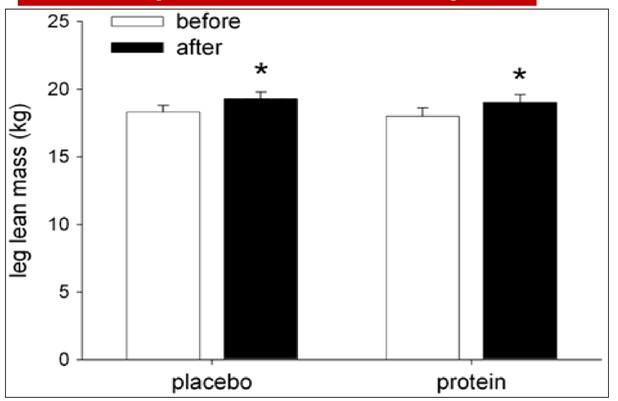


**Figure 5. Leg lean mass changes over 12 weeks of RT following consumption of protein before and after vs. placebo (*Verdijk et al, AJCN 2009*).**

## Protein Timing and Distribution

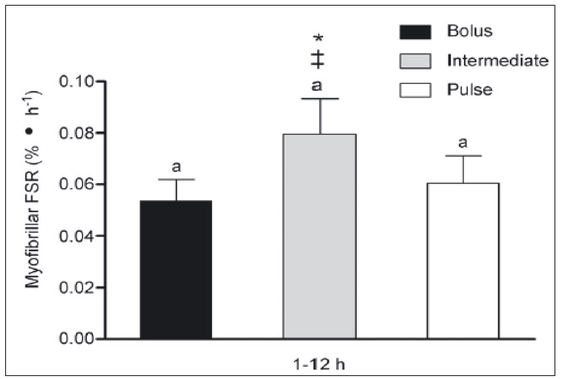


**Figure 4. Mean myofibrillar FSR throughout 1-12 h following RT. Bolus= 2 x 40 g every 6 h, Intermediate= 3 x 20 g every 3 h, Pulse= 8 x 10 g every 1.5 h (*Areta et al, J Physiol 2013).***

## DISCUSSION

**Young:**

- **Short-term (12 h) studies suggest protein timing and distribution (20 g ~3 h) optimizes MPS.**

**Elderly:**

- **Due to anabolic resistance, the elderly require ~35-40 g of high quality protein to maximally stimulate MPS.**

## FUTURE RESEARCH

- **Since short-term studies do not equate to long-term results, it would be ideal to conduct a tightly controlled, 24-week RT study on the effects of manipulating protein timing and distribution.**
- **For the elderly, it would be interesting to see if protein timing using higher dosages (35-40 g) could be effective in the treatment of age-related muscular conditions such as sarcopenia.**

## CONCLUSION

**Based on the current literature there is not enough evidence supporting strict patterns of protein timing and distribution throughout the day.**