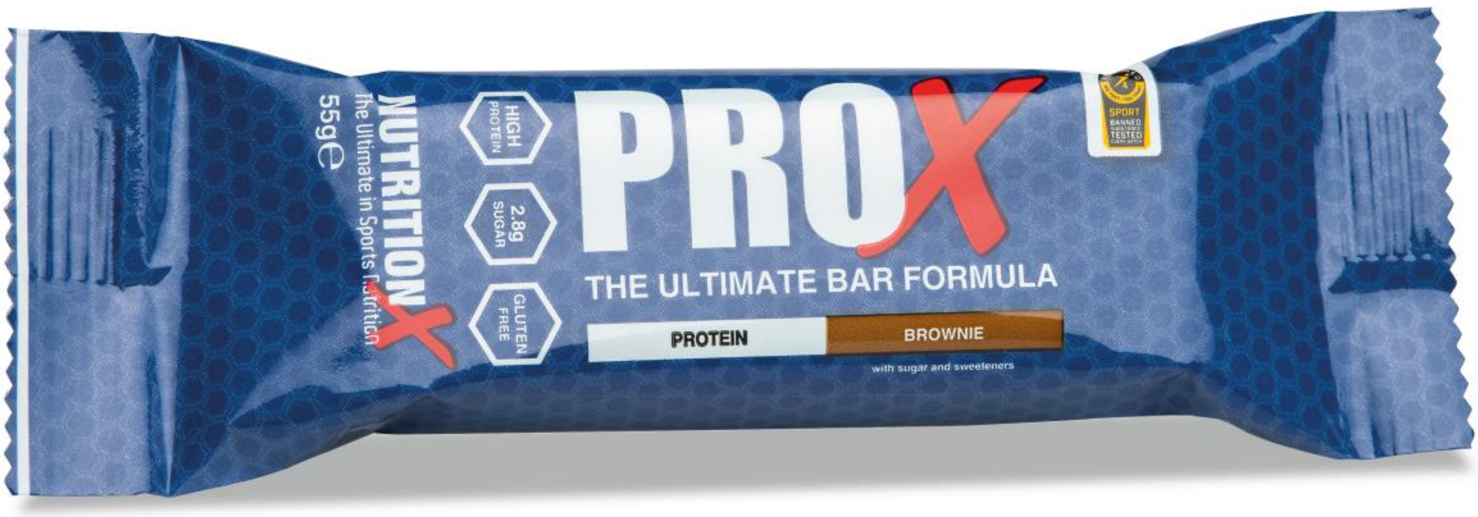
THE SCIENCE BEHIND



PROX

PROX BAR: a good snack bar?

Key Points

- Consuming protein alone results in a degree of stimulating muscle protein synthesis (MPS), but consuming protein before and/or following appropriate exercise stimulates MPS further.
- Research findings suggest that an amount of ~0.24g protein per meal/snack results in maximal MPS. Furthermore, a daily amount of protein equivalent to 1.6 – 2.2 g/kg is beneficial for athletes in training.
- Eating a combination of 3 meals and 3 snacks through a day (in effect eating every 3-h or so) each containing ~0.25g/kg of protein is advisable.
- Snacking is an important part of an athlete's nutritional strategy
- Any snacks or meals should focus on protein, with the carbohydrate content dependent on the aim for that training period
- A low calorie, low carbohydrate bar containing adequate protein is desirable for busy athletes as a snack (particularly at night or when attempting to keep body fat low)
- The 55g protein bar fulfills a sound nutritional need for athletes since it contains ~20g protein yet only 2.8g of sugar. Such a protein intake provides ~0.25g/kg for an 80kg person
- The major forms of carbohydrate in the Protein bar are polyols, which are lower in energy content than sugars
- It is advisable to consider eating 1 bar per day (and no more than 2 per day) since polyols do have laxative properties if eaten in large amounts

Introduction

Maintaining skeletal muscle mass throughout a person's life is important for preserving the health as well as independence of that individual – think about carrying, lifting, and moving. For athletes it is not just important to maintain muscle mass but also to enhance the adaptive response to training such as improved force production and increasing muscle size i.e. hypertrophy with the aim of maximizing performance. Consequently, strategies to augment skeletal muscle hypertrophy and promote remodelling and reconditioning of skeletal muscle following exercise is important and has led to a significant area of scientific research. There is now a wealth of studies that have characterized the response of skeletal muscle to changes in nutritional and contractile stimuli. What these studies have shown is that the size of skeletal muscle is dependent upon the processes of muscle protein synthesis (MPS) and muscle protein breakdown (MPB), whereby the difference (MPS-MPB) results in net protein balance (NPB). When MPS equals MPB, muscle mass is maintained; when MPS > than MPB muscle mass may increase; when MPS < MPB muscle atrophy may occur.

Increased loading of skeletal muscle by appropriate exercise and elevating amino acids in the body via dietary means, independently and synergistically exert a positive influence on NPB by modulating the relative balance between MPS and MPB (Phillips, 2014). In the postabsorptive state, an acute bout of resistance exercise stimulates MPS by more than 100% above basal levels, although NPB remains negative because of a greater increase in MPB during the exercise bout. It is only when protein is ingested following a resistance exercise bout is there an impact on MPS resulting in a state of positive NPB. Repetitive bouts of resistance exercise in combination with protein intake increase NPB and promote muscle protein accretion over time.

So, we can appreciate that a sufficient amount of protein intake is desirable through the day not just for health but also, in the case of athletes, for maintaining (and even promoting) muscle integrity and growth. This is achieved by consuming meals and snacks through the day with a protein content. Indeed, many athletes often feel hungry at night and wish to eat something nutritious, sweet, and protein based. Consequently, the choice may be to reach out for a sweet protein-containing bar.

Availability of Protein intake from meals and snacks

The capacity to digest and absorb dietary protein and the subsequent increase in blood amino acid (AA) levels is greater than the capacity of skeletal muscle to use the amino acids for muscle building/recovery. After eating a meal or snack containing protein, the protein is digested initially in the stomach and then mainly in the small intestine where the end products (individual amino acids and small peptides) are absorbed. The gut itself will use up ~40%–50% of the amino acids for its own metabolism and protein synthesis. The remainder (~50%) of amino acids is released into the hepatic portal vein and transported to the liver. As with the gut, the liver also uses a proportion of these amino acids for metabolism, mainly for the synthesis of hepatic and liver-derived blood proteins (Stokes et al., 2018). The amino acids that have been sequestered by the splanchnic tissues and the liver are ‘first-pass cleared’ and thus are not available for skeletal muscle metabolism. This is similar to ingested carbohydrates, in which much of the absorbed glucose from digestion is also first taken up by the liver.

The branched-chain amino acids (BCAAs), which are so important for skeletal muscle anabolism, are used to a relatively minor extent by the liver in comparison with other AAs. This means that a comparatively greater amount of AAs released from the splanchnic bed into the hepatic vein are BCAAs (leucine, isoleucine, and valine). Overall, ~50% of the amino acids in a protein-containing meal are extracted by the splanchnic tissues whereas the rest are released into the plasma circulation for extra-splanchnic utilization. In effect, this means that ~25% of the total protein intake at a meal/snack becomes available for skeletal muscle use (~50% is used by gut cells and ~25% by the liver). Although skeletal muscle is a large depot for the use of amino acids, not all the amino acids released into plasma become incorporated into new skeletal muscle tissue. In a recent tracer study only ~2.2 g or 11% of the amino acids consumed by young men in a 20 g bolus of casein protein were used for *de novo* protein synthesis, with the remaining AAs being used for a range of metabolic processes from energy production and urea synthesis (Groen et al., 2015).

So, if protein is important for skeletal muscle repair and growth, what is the best type of protein to consume? Most of the available protein supplements are based on whey protein, although casein and soy are also available. The ‘Science for Big Whey’ highlights the value of using whey protein since lower quality proteins, such as soy or wheat protein, that lack or are low in one or more essential amino acids, fail to stimulate MPS to the same degree (Tang et al., 2009). Having said that, regardless of the protein source, the increase in plasma AA concentrations from protein ingestion promotes uptake of AAs across the muscle membrane, quite possibly due to an increase in AA transporters induced by gene activation.

When there is an increase in plasma AAs due to feeding, there is ~30 min delay in the stimulation of MPS before it peaks at 2 h. This response is transient and MPS reverts to basal levels after ~2–3 h even if plasma AA levels remain elevated. This phenomenon has been termed the ‘muscle-full’ effect and explains why simply consuming protein in the absence of exercise fails to induce protein retention and skeletal muscle hypertrophy. The stimulation of MPS in response to elevated AA levels appears to be entirely driven by the essential amino acids (EAAs) within the protein (Volpe et al., 2003), and of these amino acids, leucine is the primary ‘driver’ (Stokes et al., 2018). Although leucine is able to stimulate MPS in the absence of other amino acids, it must be remembered that protein synthesis will eventually become limited if the other EAAs are not present since these AAs provide the building blocks.

How much protein is required for maximum MPS from a meal/snack? It appears that ~0.24 g/kg body mass maximally stimulates rates of MPS in young males (Moore et al., 2015). This means that a 70 or 80kg person should consume 17-20g of protein in a meal/snack to maximally stimulate MPS. Figure 1 illustrates that for a 70-80kg person 10g of protein is not enough whereas 40g of protein in a meal is too much, and that ~20g protein is desirable. If dealing with larger athletes of 100kg+, then appropriately larger amounts of protein should be ingested i.e. 24g+. What was noteworthy in this investigation was that taking a larger amount of protein (40g) had no significant additional benefit i.e. more is not better!

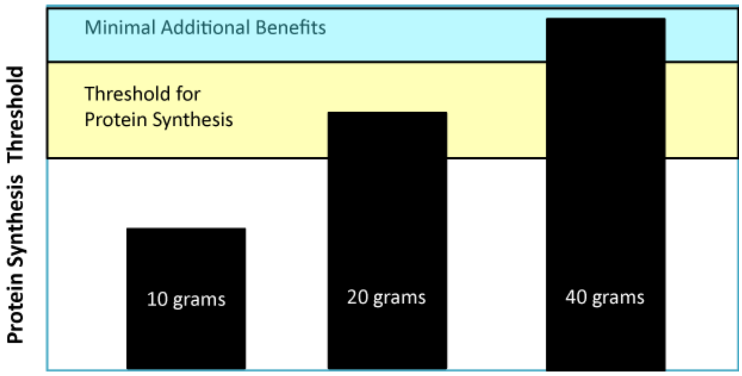


Figure1. Protein requirements to stimulate MPS

How frequently should protein be eaten through the waking hours in a day in order to stimulate MPS? Areta et al. (2013) observed that an intake of 20 g whey protein every ~3 h was more effective at stimulating MPS over a 12 h period following leg exercise than an equivalent total amount of protein ingested as smaller, more frequent amounts (10 g every 1.5 h), or larger boluses consumed less frequently (40 g every 6 h). So, these findings suggest that ~20 g of high-quality protein (or ~0.24 g/kg/meal) is sufficient to maximally stimulate MPS after a single meal and, when repeatedly provided 3 h apart, optimizes MPS throughout the day. Figure 2 provides an illustration of the likely protein intakes regularly through a day from meals and snack/supplements.

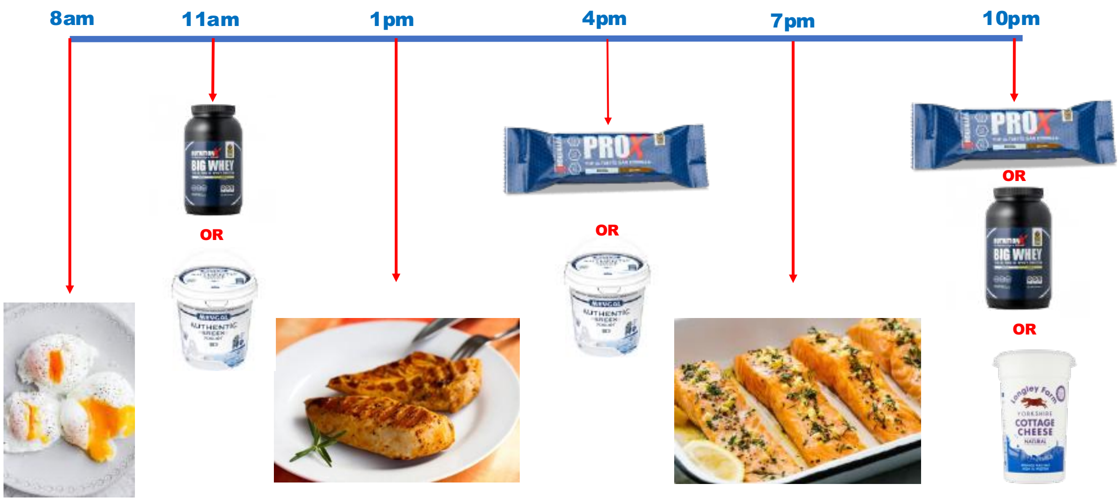


Figure 2. Schematic to illustrate how sufficient protein can be ingested to meet daily needs when training. Note the regular protein intake i.e. ~every 3 hours or so.

If you calculate the total likely amount of protein consumed in a day based on Figure 2 and in which each meal/snack provides ~0.24g/kg, you arrive at a figure of 1.44g/kg/day. This requires a 70-80kg athlete to eat ~ 100-115g of protein per day. Is this sufficient? What does the research suggest? According to Stokes et al. (2018) following metanalyses of various research findings, a daily protein intake of ~1.6 – 2.2 g/kg/day appears to be the most influential factor to consider when the goal is to increase muscle mass with resistance exercise. It is likely that the lower amount (~1.6g/kg) would be suitable for maintaining muscle mass and aiding recovery, whilst the higher amount (2.2g/kg) beneficial for enhancing muscle mass. Of course, all this depends to some extent on the severity of training and competition. Strenuous resistance training or complex training would probably necessitate a greater intake of protein compared with recovery and light training sessions or rest days.

ProX bar: how and when to use it

A frequently asked question by many athletes in a variety of sports relates to being able to eat something sweet at night (when often there is a need to reduce carbohydrate intake – at least high GI carbs) or between meals (especially when on a carbohydrate-reduction programme to lose body fat). With this in mind a protein bar would seem to address the issue. NutritionX have produced a Protein bar into the product range. The essence for the production of this bar is that it contains adequate amounts of protein yet contain small amounts of carbohydrate. As a result, the bar provides a nutritious snack to be eaten at night (maybe even as a supper) and/or between meals in the day.

Following strenuous training or competition there is a need to aid muscle recovery with adequate amounts of protein. This can be achieved by using Big Whey or NightTime protein. Of course, appropriate eating strategies to achieve a similar goal is encouraged. However, there are occasions whereby an athlete wishes to have a sweet chewing/eating snack rather than a sweet drink or maybe a nutritious protein-based sweet snack rather than a sugar-filled dessert. ProX bar fulfills such a need.

Remember that one of our mantras is that each meal or snack should contain some protein i.e. try never to eat a meal or snack which doesn't contain some protein. Consuming carbohydrates in these meals or snacks is dependent on what are the training goals for that period i.e. high intensity training and so a need for adequate carbohydrate intake; preparation for a match and so a need for adequate carbohydrates; recovery of muscle but attempt to reduce body fat stores and so adequate protein but low carbohydrate intake and so on.

If the emphasis for the periodised training programme is to reduce body fat stores but maintain (or perhaps increase) muscle mass, then focus should be on an overall reduction in carbohydrate intake, particularly high GI carbohydrates (MacLaren & Close, 2009). With this in mind, it is possible to enjoy a sweet treat which is low in high GI carbohydrates and still contains adequate amounts of protein. Having a small fat content is not an issue. The NutritionX protein bar contains approximately 20g of protein and only 1.2g of 'useable' carbohydrate. Such a composition is sound in terms of protein content and so would help stimulate MPS for recovery and/or maintenance of muscle. Although the overall carbohydrate composition is relatively high (14g per bar), most of the carbohydrate is low-calorific because they are what are known as sugar alcohols or polyols. Polyols are carbohydrates but not sugars and are not easily digested or absorbed by the gut. Polyols serve as useful sugar replacers in a wide range of products as part of a sugar free diet. These sugar free foods and products include chewing gums, sweets, ice cream, baked goods and fruit spreads. In addition, they function well in fillings and frostings, canned fruits, beverages, yogurt and tabletop sweeteners. In addition to their sweet taste and unique functional properties, polyols offer important health benefits. For example, they are low in calories and do not cause sudden increases in blood sugar levels. Importantly, polyols are not readily converted to acids by bacteria in the mouth and, therefore, do not promote tooth decay.

The reason polyols are present in the ProX bar is to sweeten it and also to reduce the overall calorific content – whereas 1g of carbohydrate contains 4kcal, a 1g amount of polyol contains ~2kcal. Eating too much polyols (i.e. by eating too many bars in a day) is not recommended since they can act as a laxative or produce bloating. Our recommendation is that eating 1 or 2 bars in a day (when required) is more than sufficient. Suggestions would include an evening snack after dinner if hungry or between lunch and dinner if required or even after a training session when travelling home for a meal.

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