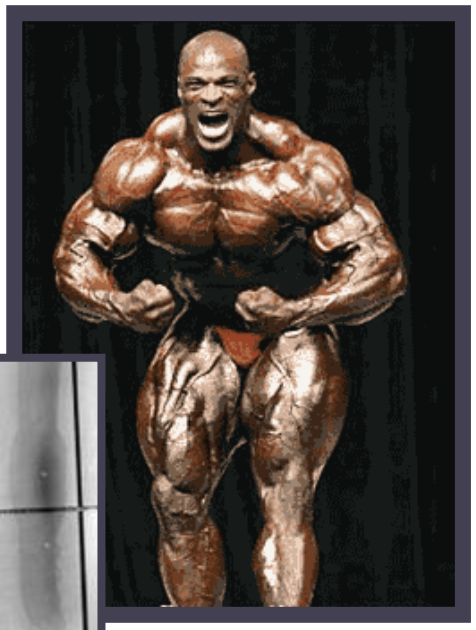
Increasing Muscle Growth With Proteins

Introduction

The constant struggle to put on muscle is one numerous people have been struggling with for many years. People want to see results and they want to see them fast. Some even turn to illegal or unhealthy ways to achieve these results such as steroid use or compulsive exercising. For those who decide to do it the healthy way they will learn it's a difficult process that takes a lot of hard work, discipline, and most importantly, time.

The good news is there are ways to increase this process with healthy, safe opportunities. Appropriate nutrition plays a critical role in the building of lean muscle mass, more specifically, protein. Having adequate amounts of protein in your diet during times when the body is in most need of it helps promote muscle maintenance and the rebuilding of tissues. When is your body most in need of protein? Protein is needed in the diet on a daily basis. According to the Acceptable Macronutrient Distribution Range (AMDR) 10-35% of your daily caloric intake should consist of protein. When exercise is added to one's lifestyle the body is in extra need of protein to repair the used muscle fibers. The breaking down and rebuilding of the tissue with the help of protein is an ongoing process. This process is called protein synthesis and will be discussed in further detail later in this chapter.

When an individual has the goal of adding more mass to their physique in the form of muscle, they may need to consider adding extra protein into their diets.



This is not to be taken in the context that taking in extra protein will magically build you biceps and quads. For muscle to be built there needs to be a purpose for the extra protein. Commonly needing extra protein in the diet may come from a resistance training or endurance training program. Throughout this chapter resistance training will be the main focus for needing additional protein in the diet.

There are many different forms and possibilities for adding extra protein in your diet. A few that will be covered throughout this chapter include whey, soy, and casein proteins. These forms are to be considered high-quality proteins and have been shown to have positive effects on improving muscle growth through increasing muscle protein synthesis (Tang et al., 2009).

How do you know what kind of protein to take? Does one work better than the rest? How much should I take? These may be questions you find yourself wondering. These will be answered throughout this chapter along with other valuable information on the topic of increasing muscle mass with proteins.

Literature Review

Testing the effects of adding protein to participant's diets has been a growing topic over the years. Newer generations are more interested in lean, physically fit body types than ever before. With this being such a large aspect in individuals lives researchers have done extensive studies to test the possibility of adding protein to one's diet and its effect on building muscle mass.

Numerous studies have shown positive results with the addition of protein with a resistance training program. A study done in 2009 proved the importance of needing extra protein in the diet while participating in a resistance training program to boost muscle protein synthesis. Three groups of six healthy men were each given different proteins. Group one received whey protein, another soy, and the third casein. The participants performed a unilateral leg resistance exercise to test the effects of the protein on both the fatigued and rested leg. Participants consumed their prescribed proteins once their exercise bout was completed. Results were obtained through muscle biopsies in both the trained and untrained leg. The information they gathered showed positive increases in muscle protein synthesis in all three groups, with the highest being in the whey, second in the soy, and third in the casein group. Research found in the rested leg muscle protein synthesis with the group that consumed whey protein was the greatest by approximately 93% more than in the casein group and 18% greater than the group given soy. Results were similar in the exercised leg. The whey protein group had muscle protein synthesis 122% greater than caseins and 31% greater than the soy groups (Tang et al., 2009).

It has been found that in order to see hypertrophy, resistance training must be kept for a sustained period of time, roughly six to eight weeks. This extended period of time is due to the slow process of muscle protein turnover (Philip et al., 2004). After a single session of resistance training, muscle protein synthesis is increased by 50% at four hours after the session has ceased. After 24 hours it has been shown to have an increase of 109% (MacDougall et al., 2004). This fact meaning the higher the protein synthesis the greater gains possible. Catabolism and anabolism are occurring instantaneously in the muscle tissues from resistance training (Babault et al., 2013). In order to achieve muscle growth there must be a net positive balance between muscle protein synthesis (anabolism) and muscle protein breakdown (catabolism), NPB=MPS-MPB. Stated in simpler term, muscle protein synthesis needs to be greater than muscle protein breakdown to have hypertrophy and strength gains. Taking in protein combined with resistance training will ensure a net positive balance (Phillip et al., 2005).

Another study similar to the first one discussed presented relatively similar results. During this study 68 males were chosen to participate in a 10 week resistance training study testing the effects of two different proteins and a placebo. The two groups receiving proteins were given 10 grams before and 10 grams after their sessions of either a slow digesting micellar casein protein or a soluble milk protein (similar to whey).

The study tested several components to see which areas had the most significant results. The tests included body composition, the muscle thickness of the knee extensor muscle, max strength and power, and the individual's perceived rate of exertion (PRE) during the training sessions.

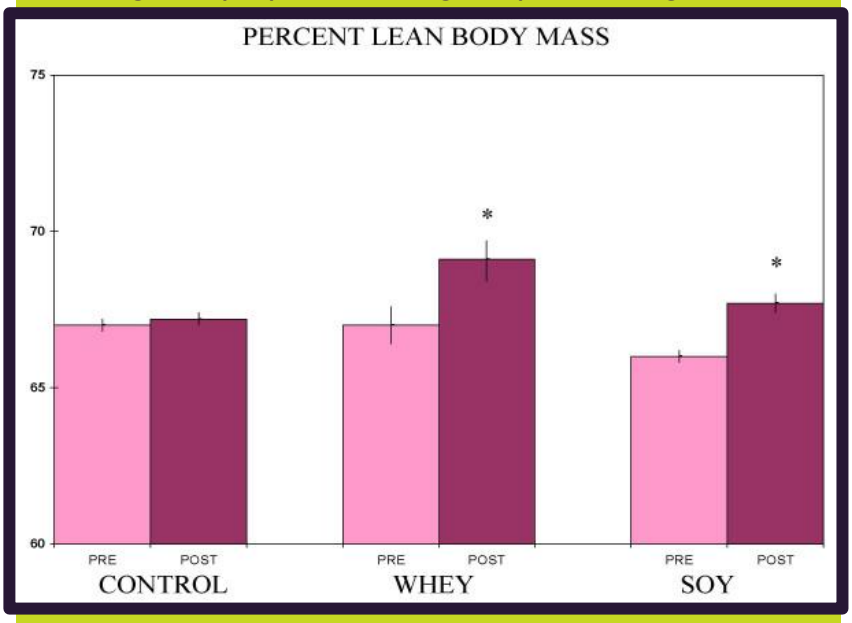
Results indicated the whey similar soluble milk protein produced higher muscle endurance, reduced the amount of power lost or fatigue, and improved recovery as compared to the slow-digesting casein and the placebo (Babault et al., 2013).

Combining either soy protein or whey protein with resistance training have both been shown to have an improvement on increasing muscle mass. The resistant training alone however did not show these improvements. One reason for this may be due to the fact that the study was done over a nine week period of time, which may not have been long enough to see changes in lean body mass with training alone. This data therefor leads us to believe using protein supplementation not only produces larger gains but quicker gains as well. These results can be viewed in the graph to the right, showing whey protein to have a slight edge on soy protein. The soy protein did have an added benefit of higher antioxidants in the plasma compared to the whey (Brown et al., 2004). These antioxidants may have to capability to reduce fatigue in the muscles during resistance training; however more research needs to be done on this topic.

Throughout the many studies and extensive research done there is clear data showing the positive affects protein supplementation has when combined with a resistance training program. Determining the recommendations for how much protein an individual may need based on their resistance training is not an easy task. Each individual is different and reacts differently to both training and ingesting of proteins. Before a recommendation can be made strategies around these variables must be found first.

Thus far these studies have been strictly done on young, healthy individuals. The results we have gotten from these studies will likely come in handy for young adults whose goals are to build muscle mass. The importance of protein however has many benefits for the elderly either for maintaining their muscle mass they already have or increasing their muscle mass. As one ages their muscle protein synthesis is reduced, leading to sarcopenia, or the loss of muscle mass. One recommendation researchers have found to reduce this muscle loss is including 25-30 grams of protein per meal (Paddon-Jones et al., 2009). After a resistance session the window of opportunity for maximum benefits for taking in protein is much shorter in the elderly. Their length of heightened protein synthesis is much shorter; therefore needing protein quicker after a training session (Esmarck et al., 2001).

Figure 1: Comparing lean body mass before and after protein supplementation. Light pink indicates the pre testing with purple indicating the post testing



Another recommendation made for the elderly is taking in larger amounts of leucine. This has been shows to increase muscle protein synthesis in the older population. This population is said to gain the highest results from a resistance training program when they take a fast digesting, leucine-rich protein, such as whey. This same study also looked into the differences between whey, soy, and casein on the average individuals protein synthesis. They came up with the conclusion stating, "We reported that the consumption of whey protein stimulates skeletal MPS to a greater extent than either casein or soy," (Tang et al., 2009). Reiterating again the important role proteins have on muscle growth, particularly whey protein.

Muscle Breakdown and Protein Synthesis

For muscles to grow they need to undergo protein synthesis. This process is the basis for muscle cell growth and is essential for repair and maintenance of cells as well. This process is increased when the muscle experience a stimulus, such as the load they would take on in a resistance training program. Consumption of adequate amounts of protein is a necessary requirement for muscle protein synthesis, the maintenance of muscle mass and keeping the muscles working properly (Symons et al., 2010).

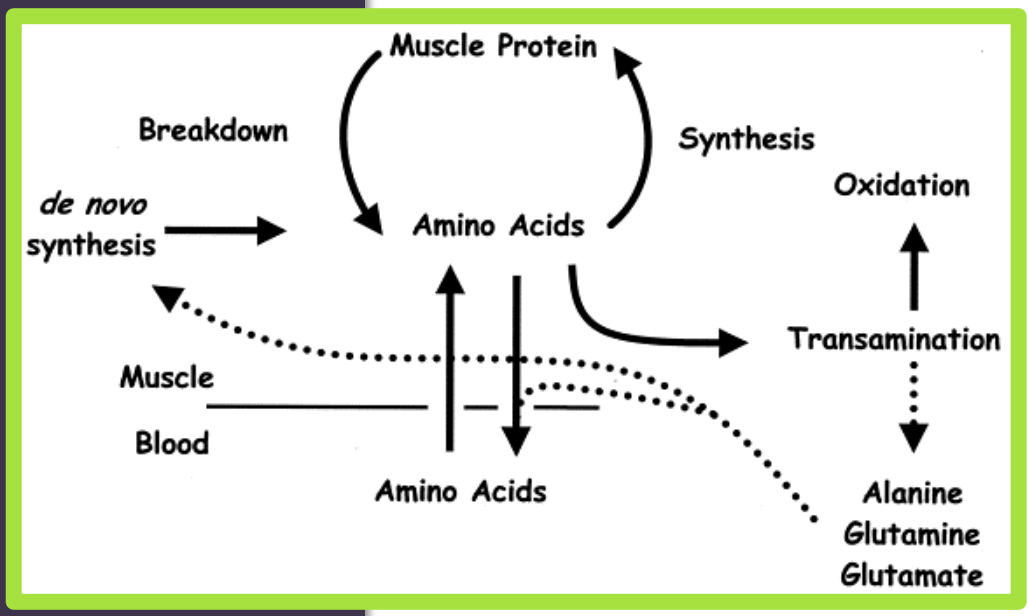
As stated previously in this chapter in order to gain muscle mass there must be a net positive balance of protein. Protein synthesis of the muscles must always be greater than muscle protein breakdown. Numerous studies that have measured this balance between protein breakdown and protein synthesis have found the balance to be negative until protein was taken in through the diet, clearly stating the important role protein plays in muscle protein synthesis. Maintaining this equilibrium ultimately decides the amount and rate of muscle growth (Philips, 2004). Protein synthesis is an ongoing process that is constantly occurring in the body; however it increases drastically when resistance training is paired with a diet of protein. This repeating turnover of protein is how damaged cells from exercise are turned into new healthy cells. Unfortunately this system isn't completely full proof in the recycling of every amino acid in their entirety. During this process many amino acids are lost from the skeletal muscle and typically end up going one of two routes. They are either oxidized or go through gluconeogenesis, which is the process of converting the amino acids into glucose (Phillips et al., 2004). These losses in amino acids is where extra protein in the diet may be need to make up for what is lost during this process. This covers a little more deeply the ongoing need for protein.

The American College of Sports Medicine organizes the process of protein synthesis in five easy to follow steps listed below.

1. Resistance training stimulates protein synthesis
2. Intracellular concentrations of amino acids (AA) go down
3. This decrease stimulates protein breakdown and brings AA into the muscle cell
4. The increase in AA now available stimulate protein synthesis
5. The result is tissue modeling

(ACSM, 1968)

Figure 2: Shows the process amino acids go through during muscle protein synthesis and breakdown.



Protein: What is it?

Non-Essential Amino Acids milligrams per 26 grams

Amino Acid	Soy	Whey
Cysteine	244	869
Aspartic Acid	2180	2039
Alanine	808	230
Glutamic Acid	3589	2683
Glycine	789	78
Proline	940	179
Serine	977	180
Tyrosine	714	172
Totals	10241	6430

Essential Amino Acids milligrams per 26 grams

Amino Acid	Soy	Whey
Leucine	1546	2609
Isoleucine	921	1333
Valine	940	942
Methionine	245	443
Arginine	1428	480
Histidine	489	425
Lysine	1184	2222
Phenylalanine	977	831
Tryptophan	595	244
Totals	9039	10491

List of the average amino acids, both essential and nonessential provided in most soy and whey proteins.

Protein is a macronutrient that plays an essential role in our bodies. It's an organic compound made up of at least one long chain of amino acid. It forms the structure of our body tissues, such as muscle, hair, and collagen, and also aids in the formation of enzymes. Proteins are also found in replicating DNA, and transporting molecules from one part of the body to another.

The acceptable macronutrient distribution range (AMDR) is from 10-35% of daily energy intake for most adults. As noted earlier increases in protein is known to be beneficial when a resistance training program is added to one's lifestyle, however the specific recommendations are still unknown.

What are Amino Acids?

Amino acids are the building blocks of proteins, and therefore the building blocks of muscle. There are two forms of amino acids, nonessential are those that can be made in the bodies and essential are those that cannot. Essential amino acids need to be taken in through our diet through forms of protein. Proteins that contain all 20 amino acids are considered complete proteins and are ideal for maximizing muscle repair and growth. Below is a list separating these two types of amino acids into their appropriate groups. Notice to the left Leucine is one of the top essential amino acids with considerable amounts in both the soy and whey proteins.

Leucine plays a large role in stimulating the synthesis of muscle protein. This amino acid is responsible for stimulating the m-tor pathway. This pathway is responsible for cell growth, which in turn leads to increased muscle growth (Babault et al., 2013). Whey protein is known for providing a more beneficial leucine balance than casein (Phillips et al., 2005).

Essential Amino Acids	Non-Essential Amino Acids
Histidine	Alanine
Isoleucine*	Arginine**
Leucine*	Asparagine
Lysine	Aspartic acid
Methionine	Cysteine**
Phenylalanine	Glutamic acid
Threonine	Glutamine**
Tryptophan	Glycine**
Valine*	Proline**
	Selenocysteine**
	Serine
	Taurine**
	Tyrosine**

**Branched-chain amino acid*

***Conditionally essential amino acid*

Figure 3: Shows the different Essential amino Acids compared to the Non-Essential Amino Acids.

Whey, Soy, and Casein

Whey and Casein

Milk is made up of two different protein components, soluble proteins (whey), and casein. Whey has the ability to be digested quickly; its amino acids are delivered more quickly to the muscles. Casein has a much slower digestion rate, meaning its amino acids may take up to several hours to arrive to the tissues. Whey protein is also known for providing amino acid oxidation for the whole-body more than casein is capable of (Phillips et al., 2005). With these facts known it is suggested to use whey protein directly before or after a resistance training session, while the use of casein may be beneficial to use before going to bed, allowing the amino acids to help recover muscles while one sleeps. Throughout research there has been various studies proving whey protein to have higher rates of muscle protein synthesis (Babault et al., 2013). This typically leads whey protein to be the protein of choice for many trying to increase their muscle mass.

Soy

Soy protein is plant based and comes from soy beans. It is similar to whey protein in the way that it is also digested fast (Tang et a.l, 2009). This type of protein contains antioxidants. Antioxidants can either be ingested through diet or made by our bodies. They aid with molecular damage that arise from oxidation reactions from free radicals. Free radicals are produced in the body with exercise and lead to muscle damage that can cause fatigue. Despite soy protein commonly coming in second to whey, it is an effective supplementation with the added benefit of containing antioxidants that when and casein don't have (Brown et al., 2004). Some may recommend soy protein to those who take part in a vegan lifestyle since this protein is completely plant based.

When to take protein

There has been a considerable amount of controversy whether in taking protein directly before and after a workout has any added benefits. A study done by Paul Cribb, and Alan Hayes, 'Effects of Supplement Timing and Resistance Exercise on Skeletal Muscle Hypertrophy' proved that taking supplemental proteins immediately before and after a resistance training session are more successful than if taken outside this period of time.

Their study was done on resistance-trained men placed into two test groups. The men between these groups were matched for strength. The PRE-POST group was given 1 g/kg of a supplement consisting of protein, creatine, and glucose immediately before and after resistance training. The MOR-EVE group was given the same amount and form of supplementation, only they were given there's in the morning and in the late evening. All tests were done one week before and one week after a 10 week supervised resistance training program. Tests included strength in the form of a 1RM for the bench press, squat, and deadlift, body composition, and vastus lateralis muscle biopsies to test muscle fiber type (I, IIa, IIx), cross-sectional area, and contractile protein content.

Results showed a greater increase in lean body mass and strength in the 1RM's in the PRE-POST group. This group also showed a higher decrease in body fat percentage compared to the MORN-EVE group. Lastly the PRE-POST group had greater increases in hypertrophy of the type-IIa and IIx muscle fibers, and contractile proteins.

These results clearly show that the timing of protein supplement ingestion plays a large role in increasing muscle mass. To the right you will see three graphs showing the differences between the two groups. Notice there was still improvements in the MOR-EVE group, however not as great of improvements as the PRE-POST group.

A related study found similar results. The subjects in this study were given 10 g of protein either two hours after their training session was completed, or immediately after. After 12 weeks of this regimen the group who had received protein directly after training showed additional strength gains and hypertrophy than the group receiving the protein with a two hour delay (Esmarck et al., 2001).

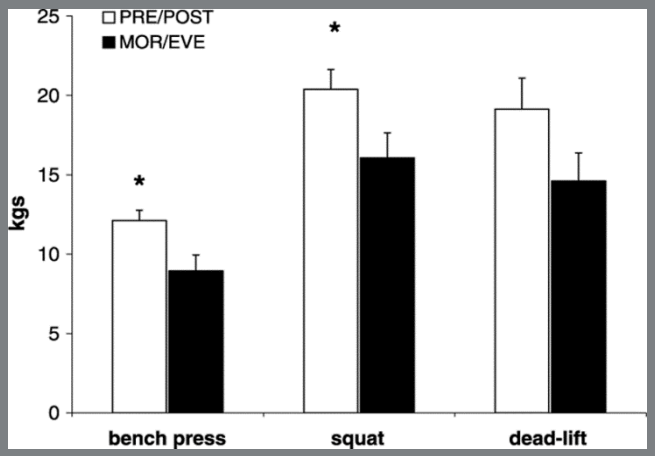


Figure 4: Comparing the strength changes in a 1RM in the bench press, squat, and dead lift. Shows the differences between the PRE-POST group and the MOR-EVE group

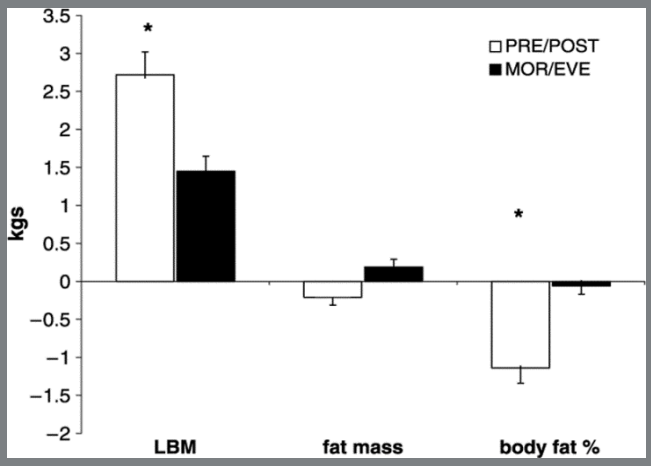


Figure 5: Shows changes in the LBM, fat mass, and body fat % between the PRE-POST and MOR-EVE groups.

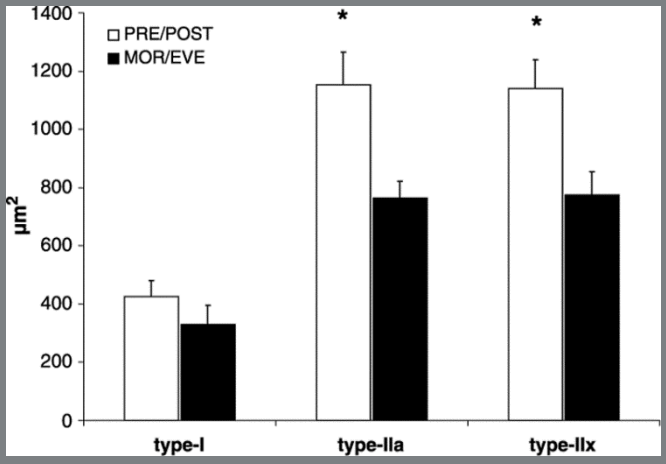


Figure 6: Shows the changes in cross sectional area between I, IIa, IIx fiber types comparing PREE-POST to MOR-EVE groups.

Food Recommendations

Protein doesn't have to be difficult or expensive to add to a diet. Plenty of foods are packed with the nutrient and are right at our finger tips; it's just a matter of knowing which foods they are. Sticking with getting additional protein in the diet through food options may be beneficial for those who are hesitant to buy proteins in powdered form. Supplement shops may be intimidating with all the options and isn't the only way to get extra protein in one's diet. Listed below are common foods that are high in protein. To the right are a couple of recipes for protein dense snacks.

Food	Amount of protein per 1 serving
Ground Beef	28g
Chicken Breast	30g
Tuna	40g
1 Egg	6g
Milk	8g
Cottage Cheese	15g
Greek Yogurt	15g
Lentils	18g
Quinoa	9g
Peanut butter	8g

Overnight Peanut butter Oats

1 cup	Unsweetened almond milk
1/2 cup	Plain low fat greek yogurt
1/4 cup	Peanut butter
1/4 tsp	Salt (or to taste)
2 tbs	Baking stevia
1 cup	Old fashioned oats
1/4 cup	Protein powder

Total protein: 30g

Protein Pancakes

1/3 cup	Oats
1/3 cup	low fat cottage cheese
3	egg whites
1 t	vanilla
1/3 scoop	protein powder

Total protein: 27 g

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