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Original article

THE EFFECTS OF A PRE- AND POST-EXERCISE WHEY PROTEIN SUPPLEMENT ON PROTEIN METABOLISM AND MUSCULAR STRENGTH AMONG ELITE WRESTLERS

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Abstract

Purpose. Whey protein is a high-quality dairy protein that contains all the amino acids the body requires for muscle protein synthesis. Evidence suggests that whey protein, found naturally in milk, increases muscle protein synthesis that in combination with resistance exercise can improve body composition. The aim of this study was to determine the effects of a pre- and post-exercise whey protein supplement on protein metabolism and muscular strength among elite wrestlers.

Methods. Eighteen male wrestlers volunteered to participate in this study. Subjects were randomly divided into supplement pre -exercise (S1; n = 10, 21.3 ± 2.9 y, 175.7 ± 4.9 cm, 86.7± 9.8 kg) or supplement post -exercise (S2; n = 8, 20.8 ± 2.03 y, 172.6 ± 5.7 cm, 85.3± 7.9 kg). subjects were tested for maximal strength (1-RM) on the squat , chest and arm exercises. S1and S2were consumed the whey protein (optimum) 1.4 g/kg.bw/day supplements after immediately following of training session for S1 group and 40 minutes prior to training session for S2 group, all subjects for a period of twelve week, three days weekly.

Results. There was a significant difference between the two experimental Groups (S1 and S2) in total protein, albumin, urine and Creatinine and muscular strength for S2 group.

Conclusions. The best way to supplement the whey protein was immediately following the training workout.

Key words: whey protein, protein metabolism, Muscular Strength, wrestlers.

Introduction

Wrestling is a sport with a long history. It was first made an Olympic sport by the Greeks in 708 B.C.E., and thereafter became popular in the ancient world.

Wrestling is a form of combat that uses the body as a weapon. Using nothing but the body, a wrestler must use strength, tactics, domination and sheer will to overcome his opponent. Each competitor wrestles his opponent, not for life or death, but for the pin, and glory and fame.

But glory, fame and victory are made possible by a well-developed and well-balanced skills set that makes the wrestler effective from all wrestling positions. Any weakness in your skills set will give your opponent a competitive advantage that could lead to your defeat.

At the highest competitive levels, the more conditioned wrestler will always win. When a wrestling match extends into the fifth, sixth and even seventh minute, conditioning will determine victory or defeat. When your opponent is the only thing standing between you and glory, you want to make sure that you make a statement - you want to make sure that you are ready.

To achieve top condition, the wrestler must eat right, train right and use the best available nutritional supplements. If even one area of your athletic program is off, your performance will suffer. Wrestlers train hard and eat hard, but what about supplementation?

Protein has long been the favored macronutrient for wrestlers. The logic is simple: if you want big muscles and muscle is made of protein, then eating more protein equals more muscle. This simple rationale is more fiction than fact, but it is difficult to convince athletes that protein is not the most important nutrient for sports performance. Flip through the pages of any health and fitness magazine, and it is easy to see why athletes worship at the altar of protein- men with bulging muscles who look like cartoon heroes and women with perfectly toned bodies without a drop of cellulite smile from the magazine pages and claim that the latest protein powder, shake, or supplement is all it takes to achieve the perfect body. (Rosenbloom, 2009)

Evidence exists to indicate that these types of athletes have protein needs that are one to two times that of the Recommended Daily Allowance. Not all sources of protein are of the same quality, however. Protein sources that contain all of the essential amino acids are considered to be complete proteins, while those that do not contain all of the essential amino acids are considered to be incomplete. Protein sources with a higher concentration of the branched-chain amino acids (BCAAs) (e.g., leucine, isoleucine, valine) and the other essential amino acids are of a higher protein quality and are more effective at promoting protein synthesis (Burke et al. 2001). Recent improvements in the processing of proteins from food (e.g., soy protein, egg protein, casein, whey, etc.) in the form of nutritional supplements have resulted in high amounts of essential amino acids and low amounts of dietary fat.

In recent years, milk constituents have become recognized as functional foods, suggesting their use has a direct and measurable effect on health outcomes.1 Whey, a by-product of cheese and curd manufacturing,

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was once considered a waste product. The recognition of whey as a functional food with nutritional applications has elevated whey to a co-product in the manufacturing of cheese. (Walzem et al. 2006) The two primary sources of protein in milk are the caseins and whey. After processing occurs, the caseins are the proteins responsible for making curds, while whey remains in an aqueous environment. The components of whey include beta-lactoglobulin, alpha-lactalbumin, bovine serum albumin, lactoferrin, immunoglobulins, lactoperoxidase enzymes, glycomacropeptides, lactose, and minerals. (Walzem et al. 2006) Today, whey is a popular dietary protein supplement purported to provide antimicrobial activity, immune modulation, improved muscle strength and body composition, and prevention of cardiovascular disease and osteoporosis.

Whey is a dairy protein that is a by-product of the cheese making process. In its raw state, whey contains substantial amounts of fat and lactose (milk sugar). The primary difference between isolate and concentrate is that the isolate is more pure. In other words, isolate contains more protein with less fat and lactose per serving. Based on whose figures you go by, whey isolate usually contains between 90-94% proteins while whey concentrate has a protein ratio of 70-85%. (Keri, 2004)

Whey protein has long been considered the "Gold Standard" of protein for serious athletes who work hard to develop and sustain a lean, strong and well-defined physique. Research studies support this belief. Athletes need more protein in their diet, often as much as twice the recommended daily allowance. The protein they choose makes a difference and here are several reasons why whey protein is a preferred choice for athletes of all types.

• Whey protein is a naturally complete protein, meaning that it contains all of the essential amino acids required in the daily diet. It has the ideal combination of amino acids to help improve body composition and enhance athletic performance.

• Whey protein is a rich source of branched chain amino acids (BCAAs), containing the highest known levels of any natural food source. BCAAs are important for athletes since unlike the other essential amino acids, they are metabolized directly into muscle tissue and are the first ones used during periods of exercise and resistance training. Whey protein provides the body with BCAAs to replenish depleted levels and start repairing and rebuilding lean muscle tissue.

• Whey protein is an excellent source of the essential amino acid, leucine. Leucine is important for athletes as it plays a key role in promoting muscle protein synthesis and muscle growth. Research has shown that individuals who exercise benefit from diets high in leucine and have more lean muscle tissue and less body fat compared to individuals whose diet contains lower levels of leucine. Whey protein isolate has approximately 50% more leucine than soy protein isolate.

• Whey protein is a soluble, easy to digest protein and is efficiently absorbed into the body. It is often referred to as a "fast" protein for its ability to quickly provide nourishment to muscles.

• Whey protein helps athletes maintain a healthy immune system by increasing the levels of glutathione in the body. Glutathione is an anti-oxidant required for a healthy immune system and exercise and resistance training may reduce glutathione levels. Whey protein helps keep athletes healthy and strong to perform their best. (United States Dairy Export Council, 1999)

Serum protein electrophoresis involves and placing a serum sample onto a semi-solid gel. An electrical current is then applied to this gel, causing the individual proteins within the serum to move along the length of the gel.

The proteins will settle out on the gel in bands, according to their size and electrical charge. The protein bands are then stained with a special dye so that they can be seen. After the gel has dried, a special instrument called a densitometer measures the bands.

In general, protein electrophoresis is not sensitive enough to allow visualization each of the hundreds of individual proteins that are found in serum. Instead, broad groups of proteins with similar size and electrical charge are measured. The major groups, or fractions, of proteins include alpha, beta, and gamma globulins. (Cribb et al. 2006)

Although more studies need to be carried out to make a definitive statement regarding timing of protein intake relative to exercise and its effect on muscle mass and/or strength gains, it is likely that an athlete who consumes protein (plus carbohydrate) sooner and more often after exercise would provide a better environment for anabolism based on other evidence showing that the rate of synthesis of new muscle proteins has a ceiling and that consumption of protein above a certain level would not stimulate protein synthesis further. How much protein would have to be consumed to maximally stimulate muscle protein synthesis is not known; however, large protein meals, in excess of the protein required to maximally stimulate muscle protein synthesis, would not likely offer any benefit to athletes if consumed after resistance exercise. In this situation, amino acids in excess of those used to support protein synthesis would be directed toward oxidation and ultimately lead to increased urea production. (Julius, 2008).

Hence, the aim of this study was to determine the effects of a pre- and post-exercise whey protein supplement on protein metabolism and muscular strength among elite wrestlers.

Methods. Participants

Eighteen male wrestlers volunteered to participate in this study. Subjects were randomly divided into supplement pre -exercise (S1; n = 10, 21.3 ± 2.9 y, 175.7 ± 4.9 cm, 86.7± 9.8 kg) or supplement post -exercise (S2; n = 8, 20.8 ± 2.03 y, 172.6 ± 5.7 cm, 85.3± 7.9 kg). subjects were tested for maximal strength (1-RM) on the squat , chest and arm exercises.

S1and S2were consumed the whey protein (optimum) 1.4 g/kg.bw/day supplement after immediately following of training session for S1 group and 40 minutes prior to training session for S2 group, all subjects for a period of twelve week, three days weekly. subjects were tested for maximal strength (1-RM) on the squat , chest and arm exercises. participation in a training program) current or past history of anabolic steroid use; any metabolic disorders or taking any thyroid, hyperlipidemic, hypoglycemic, antihypertensive, or androgenic medications; 4) ingested any ergogenic levels of creatine, HMB, thermogenics, ribose, pro-hormones (i.e., DHEA, androstendione, etc.) or other purported anabolic or ergogenic nutritional supplements within 6 months prior to beginning the study and to not take any additional nutritional supplement or contraindicated prescription medication during the protocol.

Participants agreed not to undertake any physical activity, nor seek any remedy for muscle soreness, other than the supplement provided, for the duration of the study. All participants were informed verbally and in writing, as to the objectives of the experiments, together with the potential associated risks. All participants signed an informed consent document approved by the Human Research Ethics Committee.

Statistical analysis

All statistical analyses were calculated by the SPSS.V.16 (Statistical Package for the Social Sciences). The results are reported as means and standard deviations (SD). ANOVA analysis was used to compare the variation of the different variables between the three groups for static strength and regional bone. Least Significant Difference Test “LSD” was used to compare group means in variance analysis results which were found statistically significant. Differences in means were considered significant if p, 0.05.

Results

Table 1. Mean ± SD and (T)Test between pre – tests and post - tests in Protein Metabolism, Dynamic strength and Static Strength for experimental group 1 .

Variables	Experimental group 1		Sig.
	Before	After	
Total protein	**6.44±0.25**	**6.76±0.27**	**Sig.**
Albumin	**3.31±0.33**	**3.39±0.39**	**Sig.**
Urea	**22.52±2.31**	**24.73±2.46**	**No Sig.**
Creatinine	**0.70±0.06**	**0.78±0.08**	**Sig.**
Leg extension	**43.29±1.49**	**46.97±1.83**	**Sig.**
Barbell Bench Press	**87.38±2.42**	**90.46±2.68**	**Sig.**
Barbell front raise	**72.64±2.42**	**78.37±2.76**	**Sig.**
LS	**83.45±3.21**	**86.33±2.98**	**Sig.**
BS	**65.2±2.56**	**70.34±3.91**	**Sig.**

Table 1 shows that: significant difference between pre – tests and post - tests in all variables except urea variable.

Table 2. Mean ± SD and (T)Test between pre – tests and post - tests in Protein Metabolism, Dynamic strength and Static Strength for Experimental group 2 .

Variables	Experimental group 2		Sig.
	After	After	
Total protein	**6.48±0.27**	**6.98±0.22**	**Sig.**
Albumin	**3.33±0.30**	**3.66±0.36**	**Sig.**
Urea	**23.11±3.48**	**25.81±3.51**	**No Sig.**
Creatinine	**0.69±0.05**	**0.78±0.06**	**Sig.**
Leg extension	**42.78±2.13**	**47.67±1.91**	**Sig.**
Barbell Bench Press	**88.56±2.74**	**93.59±2.68**	**Sig.**
Barbell front raise	**72.55±2.54**	**79.88±2.78**	**Sig.**
LS	**83.33±3.76**	**89.09±2.76**	**Sig.**
BS	**64.9±2.56**	**72.34±3.91**	**Sig.**

Table 2 shows that: no significant difference between pre – tests and post - tests in all variables except urea variable.

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Table 3. Mean ± SD and (T) Test between post - tests in Protein Metabolism, Dynamic strength and Static Strength for experimental and control groups

Variables	Experimental group	Control group	Sig.
Total protein	**6.76±0.27**	**6.98±0.22**	**Sig.**
Albumin	**3.39±0.39**	**3.66±0.36**	**Sig.**
Urea	**24.73±2.46**	**25.81±3.51**	**No Sig.**
Creatinine	**0.78±0.08**	**0.78±0.06**	**No Sig.**
Leg extension	**46.97±1.83**	**47.67±1.91**	**No Sig.**
Barbell Bench Press	**90.46±2.68**	**93.59±2.68**	**Sig.**
Barbell front raise	**78.37±2.76**	**79.88±2.78**	**No Sig.**
LS	**86.33±2.98**	**89.09±2.76**	**No Sig.**
BS	**70.34±3.91**	**72.34±3.91**	**No Sig.**

It is clear from Table (4) significant differences at 0.05 between post - tests of the two experimental groups in all the variables, except for Urea, Creatinine, Leg extension, Barbell front raise, LS and BS variables.

Discussion

The main findings from this study were the significant Improvements between the two experimental groups (pre and after workout) for after immediately the workout training

In this study of strength-trained men, whey protein supported positive net protein balance that created a favorable environment for muscle hypertrophy. It is also important to note that the amount of protein needed to stimulate muscle growth is not large more, is not necessarily better when it comes to muscle growthV10 g of whey protein was sufficient to build muscle.

Generally, Whay protein is one of the most popular (and most advertised) protein supplements to athletes.

Researcher believe that when the wrestlers take the whey protein after immediately the workout training, this is the most important time to take in a fast acting protein drink.

If you were to only have one protein drink per day, this is the time of day to take it. because ingest a fast acting protein source such as whey protein isolate which blast of insulin.

Insulin kicks the body's glycogen making machine into high gear. Glycogen is considered the principal storage form of glucose and is found mainly in liver and muscle. Glucose supplies the bodies active tissues with energy.

Therefore, insulin will speed up the movement of glucose and amino acids into cells which are what you definitely want and secondly, it activates a special enzyme which is essential for glycogen synthesis.

According to Burke et al. 2001, training is work on the consumption of glycogen muscle to produce the energy required for performance, shall enter the body in the use of amino acids to turn it into glucose, and here comes the role of Whey-protein in the renewal and the speed of the glycogen muscles, and this is confirmed by Tipton, et al. 2004, of the Whey-protein is one of the best supplements that reduce the speed of demolitions within the muscle tissue, so as to contain a Beta-lactoglobulin rate ranging from 50-55%, which is a major source of supply of the muscles during training acids essential amino and glycogen.

Layman, 2003, indicated that the Whey-protein is characterized by value of high biological as well as the speed of digestion and absorption, as it contains Hydro Whey-purified the best way Hydra in the world to be the lighter molecules of Whey-peptide, making it the fastest uptake in muscle.

The findings with the study of (Burke et al. 2001, Buckley et al. 2003, Brinkworth et al. 2004, Cribb et al. 2006, Kerksick et al. 2006, Julius et al. 2008, Walter et al. 2010) in that supplement of Whey protein increases the muscle strength and improves the level of performance skills.

Additional research has shown that ingesting a protein supplement after exercise triggers the release of growth hormone. Great news for building muscle.

And the key could be the amino acid leucine, one of the BCAAs. Whey protein has the highest amount of BCAAs of any protein. After exercise, leucine stimulates signaling pathways to stimulate muscle protein synthesis.

Tipton, et al. 2004 and Nicole & Wayne reported that leucine serves as a crucial regulator of protein synthesis and is donor of nitrogen to alanine and glutamine, important amino acids in muscle protein synthesis.

Researchers are excited about this ‘‘leucine trigger, as it may have important implications not only for muscle growth for healthy athletes.

Whey protein with Strength training has been reported to cause muscle fiber hypertrophy, associated with an increase in contractile protein, which contributes to an increase in maximal contractile force (Sale et al 1990).

Strength training also reduces mitochondrial density and suppresses oxidative enzymes activity which can cause impede endurance capacity, but has minimal impact on capillary density or in the conversion of muscle fiber types from fast twitch (type II fibers) to slow twitch (type I fibers) (Nelson et al 1990, Sale et al 1990).

In contrast, endurance training usually causes little or no muscle fiber hypertrophy, but it does induce increases in mitochondria content, citric acid enzymes, oxidative capacity and the possibility of muscle fiber conversion from fast twitch to slow twitch (Nelson et al 1990).

Because, skeletal muscle makes up 40% to 45% of body weight and is the largest storage site for amino acids.1 However, muscle is more than just protein; it also contains water, fat, glycogen, and some minerals. One pound of muscle contains 70 to 105 g of protein, and to build a pound of muscle, it is estimated that 10 to 14 g of additional protein is needed each day, although others dispute this claim.

In addition to possible growth of muscle, protein is a highly versatile nutrient and is involved in other functions that are crucial to sports performance: cell regulation, muscle repair, immune function, neurological function, nutrient transport, and structural support. (Caleb et al. 2010)

Practitioners most often suggest protein in the range of 1.2 to 1.4 g/kg per day for endurance athletes and 1.2 to 1.7 g/kg per day for strength athletes.3 However, most athletes are very likely to be involved in both endurance and strength activities, so a general range of 1.2 to 1.7 g/kg per day is frequently the shorthand recommendation in practice.

Conclusion

Guidelines for protein quantity were derived from nitrogen balance studies. As (Carol De Nysschen, et al. 2009) nitrogen balance may be adequate for establishing protein needs to prevent deficiency, but it is likely inadequate to quantify optimal intakes for muscle adaptations needed by endurance or strength-trained athletes.

Amino acid oxidation, another technique used in research to determine protein needs during exercise, is also not the perfect measure. Immediately After A Workout is the best time to take it because the body needs raw materials to rebuild and recover with. If the wrestlers don't supply the raw materials through eating, the body will break down muscle from elsewhere in body in order to rebuild the damaged areas.

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