

The Body Composition Effects of Extra Protein in Elite Mixed Martial Artists Undergoing Frequent Training Over a Six-Week Period

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Abstract

Background: The purpose of this prospective open-label pilot trial was to determine if adding whey or rice protein had an effect on body composition in elite mixed martial art athletes undergoing intense training.

Methods: 11 healthy men age 28, underwent anthropometric and body composition testing at baseline and week 6. Participants received 75 g/d of whey protein isolate or rice protein isolate. The first 25g were ingested after the first training session daily and the remaining 50g were ingested throughout the day. Along with protein supplementation, subjects engaged in mixed martial arts training twice daily for 6 days each week. Subjects maintained their normal diet.

Results: At baseline, the groups had similar body mass, body mass index, percent body fat, fat-free mass, and fat mass. Over the six-week period, no significant differences occurred for either the whey (n = 6) or rice group (n = 5) for body mass, % body fat, fat mass, and fat-free mass.

Conclusions: There does not appear to be any comparable advantage to body composition when adding 75 g/day (0.92 gm/kg or 0.41 gm/lb of body mass) of either rice or whey protein to the diet of an elite mixed martial artist undergoing intense training for six weeks.

Keywords: Mixed Martial Arts; Exercise; Sports Nutrition Body Composition; Whey Protein; Rice Protein

Abbreviations

Gm: Gram; kg: Kilogram

Introduction

For elite, as well as recreational athletes, building and maintaining skeletal muscle mass is an important aspect of training and recovery outcomes. Skeletal muscle is maintained and enhanced due to the balance between muscle protein synthesis (MPS) and muscle protein breakdown (MPB). For muscle mass to increase, a net accretion occurs due to MPS being greater than MPB [1]. The primary stimuli for MPS are exercise, hormones, and nutritional intervention, particularly protein intake [2,3], and when MPS is greater, favorable changes in fat free mass and body composition often occur [4]. In addition to the total protein ingested, the separate ingestion of leucine, branched

The Body Composition Effects of Extra Protein in Elite Mixed Martial Artists Undergoing Frequent Training Over a Six-Week Period

chain amino acids (BCAA), and the essential amino acids (EAA) have all been shown to stimulate MPS [5-7]. BCAA consumption alone appears to only stimulate protein synthesis in the post absorptive state [6]. Additionally, while leucine alone stimulates MPS, the impact appears to be greater when combined with other EAA, supporting the idea of consuming whole protein sources rather than individual amino acids [8]. Therefore, determining the effect of different protein sources (e.g. animal vs. plant) with varying amounts of leucine on MPS provides beneficial information for developing training and nutritional strategies for athletes.

Most studies have assessed the post-meal response of MPS by using animal-based proteins such as beef, eggs, milk, and whey. Only a few have examined the effects of consuming plant-based proteins on MPS, and many of those have focused on soy protein [9]. Plant proteins provide an attractive option for many athletes consuming vegetable based diets and are often derived from sustainable sources that increase their appeal. Therefore, it is valid to explore the effects of these proteins on MPS. Plant-based proteins contain 6-8% leucine. For example, leucine makes up 7.7% of soy and 8.3% of rice, compared to animal-based proteins which contain 8-11%; whey protein is comprised of 10.3% leucine [10]. Therefore, based on a higher leucine content at lower doses animal-based proteins provide a greater stimulus for MPS than plant proteins. However, at higher amounts, animal and plant protein sources appear to provide an equal stimulus [11]. In a double-blind crossover study, Purpura, *et al.* examined the blood amino acid content in resistance trained males after consuming 48g of either RPI or WPI. They found that RPI showed a non-significant 6.8% lower amino acid content compared to WPI. In addition, concentrations of all the amino acids peaked slower in RPI compared to WPI, except for leucine which peaked faster after RPI intake [12]. This further supports the use of RPI to stimulate MPS.

Of the plant proteins, rice protein is a popular alternative because it is a nutrient-dense, protein- rich, hypoallergenic food ingredient with widespread potential uses in infant formulas, food items, and sports nutrition supplements [13,14]. It's utilization is also appealing since it contains some micronutrients such as phosphorus, magnesium, and trace amounts of iron, antioxidants, and phytosterols [15-17]. Regarding protein quality using the protein digestibility-corrected amino acid score (PDCAAS), rice bran protein (0.90) and soy protein (0.95) have been shown to have very similar scores, and only slightly inferior compared to whey (1.00), while rice endosperm protein has a PDCAAS of 0.63 [17]. In addition, brown rice concentrate contains 77% total amino acids by weight, 36% EAA and 18% BCAA, similar to the brown rice isolate [10]. Therefore, rice protein, whether derived from bran or endosperm, offers a potential replacement for many non-animal protein sourced products [18].

The ability of whey protein to increase MPS when ingested in conjunction with high-intensity exercise training is well characterized. Based on the high quality of rice protein comparable to whey, and the fact the rice protein also possesses antioxidant properties that can confer benefits towards MPS, rice protein supplementation during exercise training may positively impact body composition. Therefore, it was the purpose of this study to determine if adding extra protein, from either rice or whey, had any effect on body composition in elite mixed martial art athletes undergoing high-intensity training.

Materials and Methods

Subjects

Twelve elite-level mixed martial artists (UFC, Bellator, CES, etc.) who were engaging in frequent, high-volume and high-intensity training, and who were also interested to learn if adding extra protein to their normal diet would have any effects on body composition, were recruited to participate in this open-label pilot study. Of the 12 subjects recruited, 11 completed the study. All subjects signed an informed consent document consistent with the Declaration of Helsinki and ICH standards prior to any study procedures being performed.

Demographic information and body composition were determined at baseline (week 0); body composition was also assessed at the end of study (week 6). Body mass was measured on a standard dual beam balance scale (Detecto®, Webb City, MO), while body composition was measured under standard conditions using validated ultrasound technology in B-mode (BodyMetrix Pro. Intelametrix, Brentwood, CA.) based on previously-established guidelines [19].

The Body Composition Effects of Extra Protein in Elite Mixed Martial Artists Undergoing Frequent Training Over a Six-Week Period

Experimental protocol

Subjects were allowed to choose the protein group they wished to participate in, as this was not a double-blind study. Rationale for self-selection of intervention group was for compliance and to mimic what the person would choose in real world situations. As a result, there were five subjects in the rice group and six in the whey group. In part, this was done to help compliance with the daily protein ingestion. Protein products utilized included NutraBio's Whey Protein Isolate and Growing Naturals Rice Protein Isolate made with Oryzatein® rice protein, (Axiom Foods, Inc., Los Angeles, CA.). Study products (the proteins) were also pre-tested and screened for WADA/USADA banned substances by the Banned Substances Control Group (<https://www.bscg.org/> Los Angeles, CA), and were found to be free of any such substances.

Subjects were educated on how to mix, use and ingest the study protein. Subjects were instructed to use 1 scoop (25g) after the first training session of the day and to ingest 2 more scoops (50g) any other time of the day that they wished. Subjects were given a total of 75g extra protein per day (~300 calories). All subjects were asked to maintain their normal dietary intake and scheduled training sessions for the six weeks. In general, during the six-week study period all participants trained under their coaches in a standardized manner of twice each day for six days each week with one session occurring on the weekend, including two strength and conditioning sessions per week. The exercise and sport training volume equated to ~25 to 30 training hours per week.

Statistical Analysis

Statistical analyses were performed by utilizing separate 2 x 2 [Group (whey, rice) x Time (week 0, week 6)] univariate factorial analyses of variance (ANOVA) with repeated measures. Further analysis of the main effect for Test was performed by a separate one-way ANOVA. At the onset of the data analysis, independent t-tests were utilized to assess the differences between each criterion variable between the groups at baseline. All statistical procedures were performed using SPSS 21.0 software and a probability level of $p \leq .05$ was adopted throughout.

Results and Discussion

Results can be seen in table 1 and data are presented as group means \pm SD. There were no significant differences at week 0 between the whey and rice groups with respect to body mass ($p = 0.12$), body mass index ($p = 0.49$), percent body fat ($p = 0.95$), fat mass ($p = 0.49$), and fat-free mass ($p = 0.13$).

	Body Mass	Percent Fat	Fat Mass	Fat-Free Mass
Whey				
Week 0	87.65 \pm 14.33	10.92 \pm 3.02	9.86 \pm 4.47	77.78 \pm 12.15
Week 6	88.71 \pm 15.59	7.62 \pm 1.75	10.22 \pm 3.79	78.49 \pm 12.49
Rice				
Week 0	75.91 \pm 6.17	11.06 \pm 4.33	8.28 \pm 2.32	67.62 \pm 6.18
Week 6	74.72 \pm 5.66	11.28 \pm 2.88	5.66 \pm 1.09	69.06 \pm 6.01

Table 1: Effects of Whey and Rice Protein Supplementation on Body Composition. Data are means \pm SD. Body mass, fat mass, and fat free mass are expressed in kg.

No significant comparative differences over the six-weeks or between groups due to whey or rice protein supplementation existed ($p > 0.05$).

There were also no significant Group x Time interactions for body mass ($p = 0.82$), percent fat ($p = 0.21$), fat mass ($p = 0.31$), and fat-free mass ($p = 0.93$) indicating no difference between groups over the course of the six-week supplementation period.

This study sought to determine if adding extra protein from either whey or rice had any effect or any added effect on body composition in elite athletes undergoing high levels of frequent stressful training. Over the course of the six-week study period, mixed martial art athletes supplementing with 75g of either rice or whey protein saw modest improvements in body mass, % body fat, FFM and FM that were not significant, nor were they significantly different between groups. The results from the present study are similar to those

The Body Composition Effects of Extra Protein in Elite Mixed Martial Artists Undergoing Frequent Training Over a Six-Week Period

reported previously where 24 resistance-trained college-age males, resistance-trained three days a week with 48g of either whey or rice protein [20]. Compared to our study, this suggests that a lower protein dose, 48g compared to 75g, did not result in a difference between the protein types. Although, it could be argued that the subjects in our study were training more intensely and may have warranted the higher dose. Nevertheless, even at 75g, we failed to see any significant differential impact from either protein source.

A previous study involved 9 weeks of supplementation with either 33g of soy or whey protein while engaging in a resistance training program and reported similar increases in muscle mass with both types of protein [21]. In contrast, the regular consumption of 17.5g milk protein during a 12-week resistance training program lead to greater gains in lean body mass (3.9 kg vs. 2.8 kg) than an amount of soy protein with the same nitrogen content [22]. It has been demonstrated that the ingestion of 24g of whey, as opposed to soy protein, resulted in greater gains in LBM (3.3 vs. 1.8 kg) after 36 weeks of resistance training in young men [23]. Based on the difference in EAA and leucine content between the two proteins [11], and the potential impact on MPS, this contrast is conceivably due to the lower dose of plant-based soy protein compared to that of whey.

After a single bout of unilateral leg resistance, healthy male subjects ingested approximately 22g of either whey, soy, or casein, all containing 10g EAA, and demonstrated greater MPS after consuming whey compared to soy [24]. Similarly, after a single bout of resistance exercise, MPS was greater after the ingestion of 18g of milk protein compared to the same amount of soy [9]. In a dose response study using 0g, 5g, 10g, 20g and 40g of egg protein given post-exercise, Moore, *et al.* reported that MPS followed for 4 hours plateaued at 20g which contains 1.7g of leucine, suggesting that there is a ceiling effect whereby adding more protein and or leucine does not stimulate MPS and further [25]. This supports the idea that higher intakes of protein, from plant and animal sources, seems to provide an equivalent stimulus towards inducing MPS. However, these studies involved only a single bout of resistance exercise and protein supplement ingestion so the observed outcomes for MPS may not reflect body composition changes that occur over the course of several weeks.

Regarding protein quality, the PDCAAS for whey is superior to rice (1.00 vs 0.90 for bran derived RPI, 0.63 for endosperm derived RPI). While the score for rice is indicative of a high protein quality, the incongruence between protein types is reflected through their amino acid content. A recent study investigating the amino acid content of the same rice protein we utilized in the present study assessed the amino acid profiles in batches expressed as mg/100g. Regarding EAAs, BCAAs, and leucine, rice protein contained 38.1%, 18.7%, and 8.3%, respectively, whereas whey was 46.9%, 21.8%, and 10.3%, respectively, for EAAs, BCAAs, and leucine [10]. These data represent 77%, 60%, 65%, and 62% greater content of total AAs, EAAs, BCAAs, and leucine, respectively, for whey protein compared to rice protein. Based on the present results and those of others [20], the amino acid profile of rice protein, while inferior to whey, appears to be adequate enough to evoke similar responses in body composition when supplemented between 48 - 75 g/day for 6 - 8 weeks. This may be explained by data indicating that leucine levels peaked in the blood faster after the ingestion of 48g of RPI compared to an equal amount of WPI in resistance trained males, while the other amino acids appeared faster after WPI and a 6.8% lower overall amino acid content after RPI [12].

Even though this was an open-label pilot study, a limitation of the current study is the small sample size. Another limitation is that supplementation compliance was only monitored through compliance logs, thus the potential for misreports and non-compliance does exist. An additional limitation is that food logs were not collected and dietary analysis of macronutrient intake determined. Subjects were asked to ingest 75 grams of their assigned protein daily, adding ~300 kcalories to their daily intake. It does not appear that adding extra protein-centric calories has an impact on overall body weight or body composition, thus monitoring food intake to examine for compensatory behavior is suggested for future studies. However, as with most highly-trained athletes, their diets often do not change significantly during the course of training so this issue is likely not a confounding factor. While we report similar responses between rice and whey protein supplements, in lieu of these study limitations, our data should be interpreted appropriately.

The Body Composition Effects of Extra Protein in Elite Mixed Martial Artists Undergoing Frequent Training Over a Six-Week Period

Conclusion

There does not appear to be any comparable difference between rice and whey protein when adding 75 g/day (0.92 gm/kg or 0.41 gm/lb of body mass) to the diet of elite-level mixed martial artists undergoing their typical high-volume, high-intensity training regimen. There also does not seem to be a negative impact of ingesting an extra 300 kcalories per day in these athletes (as protein), as no changes in body weight and composition were noted. Both rice protein isolate and whey protein isolate proteins appear to support body composition similarly without differences or negative impact on the athlete. However, further studies are warranted.

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Conflict of Interest

This study was funded by a research grant from Axiom Foods (Los Angeles, CA.) to Combat Club (Lantana, Florida). The authors consult for Combat Club and have no conflicts of interest to disclose.

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The Body Composition Effects of Extra Protein in Elite Mixed Martial Artists Undergoing Frequent Training Over a Six-Week Period

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