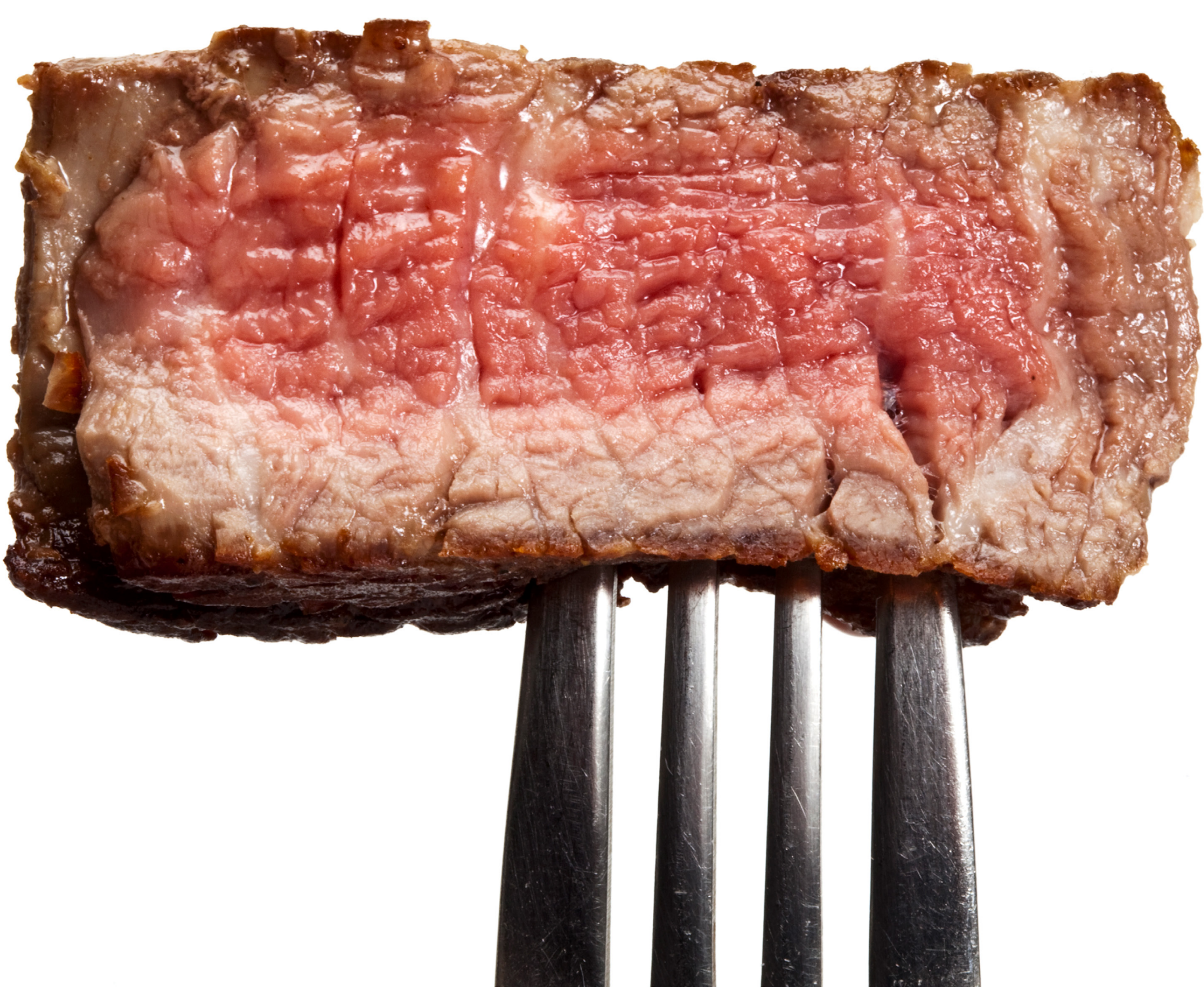
# Beef protein: anabolic underdog?

*Carbohydrates Alone or Mixing With Beef or Whey Protein Promote Similar Training Outcomes in Resistance Training Males: A Double Blind, Randomized Controlled Clinical Trial.*



# Introduction

When it comes to protein powder, whey protein is one of the most popular. With its high bioavailability, solubility, and relatively high content of essential amino acids (including a healthy dose of of branched-chain amino acids), it is an ideal protein source to trigger and sustain muscle protein synthesis. Like whey, beef protein shares these characteristics, but has received much less research attention than its dairy-based brother. A quick PubMed search yields only 60 studies on beef protein, with a only a small percentage of those involving humans.

The research that has been conducted with beef protein, most commonly available in a powdered-hydrolyzed form, has been promising. The consumption of 30 grams of protein from minced beef has been reported to increase muscle protein synthesis to a similar extent as 30 grams of protein from non-fat milk over five hours, although the skim milk resulted in significantly higher levels during the first two hours. Another study that compared the effects of whey, beef, or chicken protein supplements on lean mass, fat mass, and one repetition maximum (1RM) found no significant difference between the protein supplements.

However, there have been few head-to-head trials of beef and whey protein to determine which, if either, has an ergogenic edge. The present study adds to the small body of evidence on this topic by comparing hydrolyzed beef protein to whey isolate and a non-protein carbohydrate control (maltodextrin) in healthy, active males.

**Beef protein shares many of the desirable qualities of whey protein: high bioavailability, BCAA concentrations, and solubility (when hydrolyzed). However, few studies have tested the ergogenic potential of beef protein. The trial under review pits beef against whey protein to determine if one has an ergogenic advantage over the other.**

# Who and what was studied?

This was a randomized, double blind, parallel group, controlled trial that examined the use of either a commercially-available hydrolyzed beef protein powder, whey isolate, or carbohydrate (maltodextrin) on 24 males, ranging in age from 18 to 40. All subjects had consistently participated in recreational resistance training for the last 2 years and had regularly included the bench press and squat using free weights in their routines.

All groups underwent an eight-week, three-day per week resistance training program that was alternated with their normal physical activities as depicted in Figure 1. Strength and conditioning coaches monitored all training sessions to ensure participants complied with the training protocol. Each group consumed 20 grams of their assigned supplement, mixed with 250

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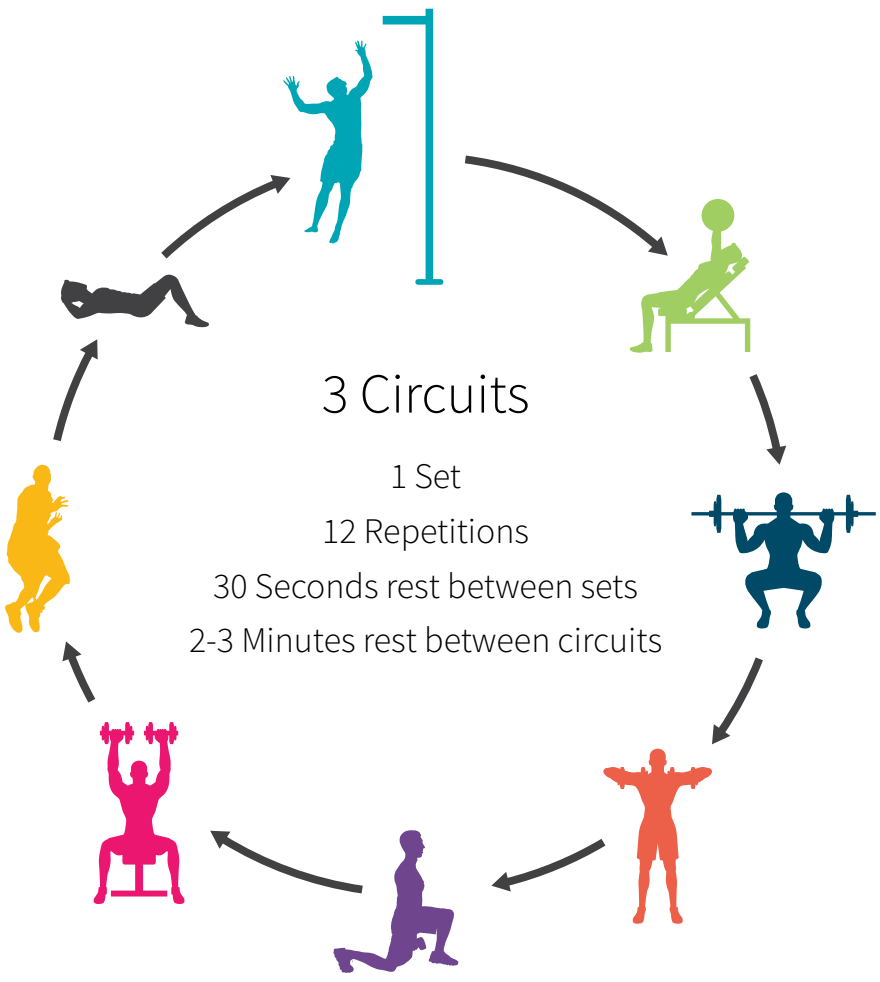
milliliters of orange juice, once a day immediately after the training session on training days, and in the morning, before breakfast, on non-training days. The researchers used text messaging and weekly interviews to monitor supplementation compliance. Each supplement provided about 180 kcal with 16-18 grams of protein and 25 grams of carbohydrate (beef & whey) or 45 grams of carbohydrate only (maltodextrin). Pre/post dietary evaluations were taken to track changes in energy intake and macronutrient composition over the course of the study.

Figure 1: Resistance training program




The primary outcomes were changes in 1RM strength for the bench press and parallel back squat. Secondary outcomes were changes in body composition via a BodPod analysis (air displacement plethysmography), muscle thickness of the biceps brachialis (one of the two muscles that comprise the biceps) and vastus medialis (a muscle in the quadriceps) using ultrasonography, and limb circumference measurements for the upper arm and thigh. All tests were performed twice—once before and once after the eight-week training program.

**Resistance trained males (with more than two years of training experience) were randomly assigned to supplement their diet with 20 grams per day of one of the following supplements: hydrolyzed beef protein powder, whey isolate, or carbohydrate (maltodextrin) over eight weeks alongside a standardized resistance training program. The primary outcomes were changes in 1RM strength for the barbell bench press and back squat. Secondary outcomes were changes in body composition, muscle thickness, and limb circumference.**

## What were the findings?

There were no significant differences between groups in macronutrient or energy intake. All groups significantly increased calorie and carbohydrate intake, while only the beef and whey groups significantly increased their protein intake, compared to baseline. Protein intake was ~1.69 g/kg in the beef group, 1.72 g/kg in the whey group, and 1.44 g/kg in the control group. The beef group was the only group that experienced a significant increase in fat intake compared to baseline (from 1.01 to 1.19 g/kg) of which the beef protein's fat content would have contributed little (1.54 grams per 20 gram dose).

There were no statistically significant differences between groups in bench press or squat 1RM over time. However, all groups improved in one or both 1RM measures over the course of the study. The bench press 1RM improved around 6% to 16% on average, whereas the back squat improved by approximately 15% to 22%. Only the whey group's 1RM for the bench press did not improve significantly from baseline.

There were also no significant differences between groups for any secondary outcome except for biceps brachialis muscle thickness, which increased significantly more in the beef group (+11.2%) compared to both the whey (+1.1%) and carbohydrate control

groups (+4.5%). For the secondary outcome of arm circumference, beef produced significantly larger increases in arm circumference compared to whey, but not carbohydrate. No significant within group changes were seen for total body mass, fat mass, or fat free mass.

**While there were no differences between groups in macronutrient or energy intake, the beef and whey groups achieved higher protein intakes compared to baseline. There were no significant between-group differences for the primary outcomes of bench press or squat 1RM. The only significant between group difference was for the secondary outcome of biceps brachialis muscle thickness, where the beef group improved more than the whey and carbohydrate groups.**

## What does the study really tell us?

The big takeaway is that, for the primary endpoint of changes in strength, no group outperformed the other. In other words, supplementing protein from whey or beef did not lead to discernable strength gains over carbohydrate supplementation during the course of this study, a rather counterintuitive result. However, all groups did see an overall improvement in strength from their own baseline.

So why did all three training groups see similar increases in strength? One possibility is that the amount of protein provided by supplementation was not enough to yield significant differences between the protein and carbohydrate group. In absolute numbers, the protein groups were only ingesting about about 20 grams more a day over the carb group (beef: 126 grams/day, whey: 131 grams/day, carb: 110 grams/day). Another possibility is that the amount of protein being consumed by the carb group was sufficient to meet their training demands, as the 1.44 grams per kilogram of bodyweight per day (g/kg/day) the group consumed on average falls within one of the recommended protein intake ranges of 1.2 – 2.0 g/kg/day for athletes. Among all participants, only two (one whey and one carb) were eating less than 1.2 g/kg/day. The others consumed between 1.2 to 2.6 g/kg/day. A final possibility lies in the details of the study protocol. All participants received guidance from strength and conditioning coaches during their exercise sessions, and the study's exercise protocol was added on top of the participants' baseline training regimen. So it's possible that the study-mandated implementation of progressive overload, oversight from a coach, and an increase in overall training volume led to the large improvement seen in all groups, which swamped any smaller differences between groups that may have been brought on through supplementation.

For the secondary outcome measure of increased biceps brachialis muscle thickness, the beef protein group significantly improved compared to both whey and carbohydrate. But the oddity is, while the beef and carb group both saw increases for the within group comparison of this measure, the whey group did not, as seen in Figure 2. This is possibly an artifact of the training protocol, in that there was only one specific exercise

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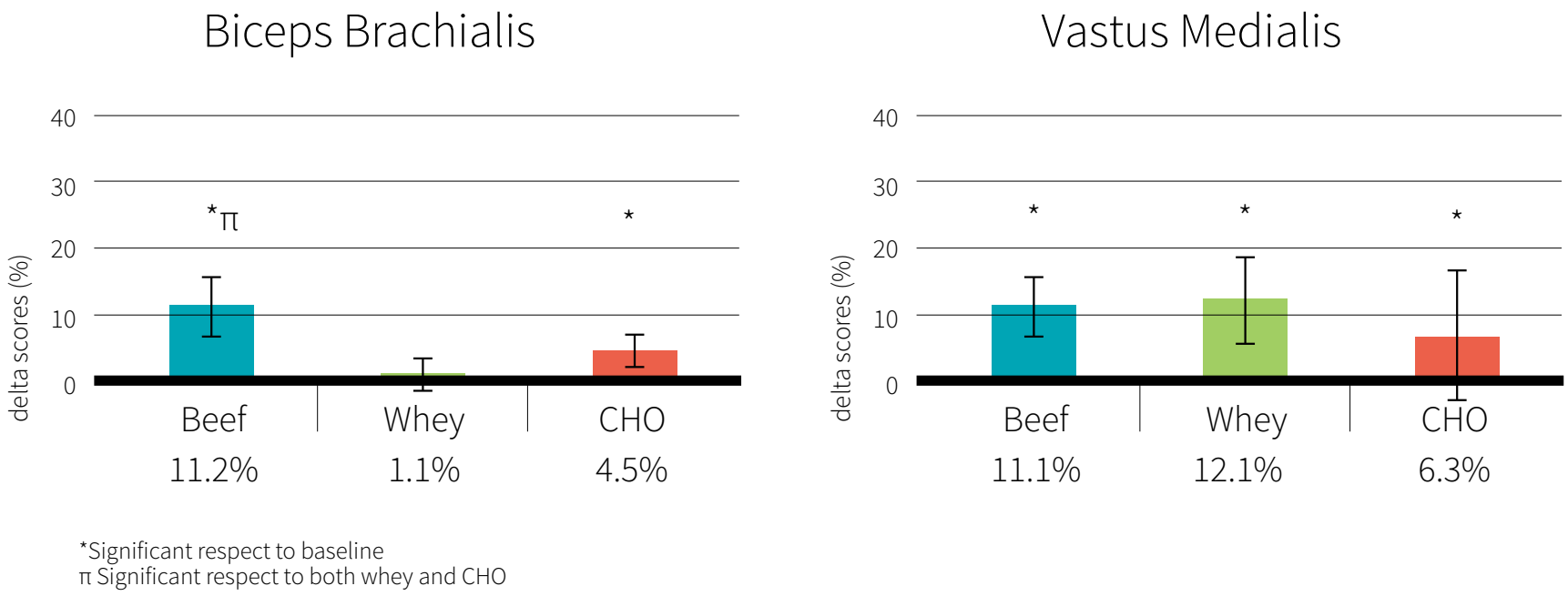
Figure 2: Change in muscular thickness




*Significant respect to baseline
π Significant respect to both whey and CHO

in the protocol that meaningfully activated the biceps brachialis. Another possibility is that, because this was a secondary outcome the study was not powered to test, it could just be a false positive. A proper follow-up study would be needed to flesh out this hypothesis.

The authors had an additional explanation for this outcome. They speculated that that, "when performing very low training volumes per muscle group… the ingestion of carbohydrate-protein supplements with a high micronutrient density such as a beef would be more beneficial at supporting training outcomes compared to other isoenergetic mixtures containing whey or only carbohydrates." While it is true that beef protein has a more robust micronutrient profile over whey, it is very difficult to say if this had any meaningful influence on the studies results. The background micronutrient intake of the athletes was not reported, so it is unknown what kind of influence the beef protein may have had.

The study did have some notable strengths. Supplementation compliance was 98.6% (range: 95.1–100%) across all groups. The order of strength testing for the 1RM back squat and bench press was randomized to avoid any potential muscle group interactions. Additionally, researchers compared beef protein to whey, the current 'top dog' of protein supplements, in addition to a control. The researchers could have just compared beef to a control and would have possibly seen more positive results for beef protein. However, they chose a more rigorous path and put it up against one of the current best options available (whey) to see how it would compare.

There were also some limitations of note. This was a young, resistance-trained male population using a specific type of exercise programming (circuit training). Results may differ among training modalities and populations. Importantly, the prescribed exercise was alternated with the participant's regular physical activity, so it's possible there may have been a training volume mismatch between the study groups as the trial progressed. When it comes to the only significant between-group difference seen, biceps brachialis thickness, we see an implausible result in that the carbohydrate and beef groups both outperformed whey protein. So take this result with a grain of salt.

Funding for this study was partly provided by the Crown Sport Nutrition company, which made the beef protein used by the participants, but the authors noted that they have "no conflicts of interest relevant to the content of this manuscript."

**The fact that all three groups had similar improvements in strength could be due to the protein doses chosen for the study, the participants' high protein intake, or an improved training protocol or higher training volume. The study's authors ascribed the beef group's improved biceps brachialis muscle thickness to the overall low training volume for biceps and the purportedly higher micronutrient density of beef protein. However, since this was one among a host of secondary endpoints explored, this result should be viewed skeptically.**

## The big picture

There have been a few other notable studies looking at the effects of beef protein on muscle protein. One study showed that, while a 340 gram serving of ground beef (90 grams was protein) was able to increase muscle protein synthesis (MPS), pairing the beef meal with a bout of exercise was able to increase MPS two-fold in both healthy young and older adults. However, such a large dose of protein may not be needed to maximize the effects of beef protein on MPS. Another study of middle-aged men fed participants either 0 grams, 57 grams (12 grams of protein), 113 grams (24 grams of protein), or 170 grams (36 grams of protein) of ground beef paired with and without an acute bout of resistance exercise. The 170 gram dose saw greater MPS both at rest and after resistance exercise than all the other doses.

When looking at the effects of beef in longer term trials, one study of 26 young healthy adults supplemented the intervention group with 135 grams of lean beef (20 grams of protein) for eight weeks. Participants also undertook a resistance training program over the same period. Curiously, the intervention group did not lose more fat mass, increase lean mass, or gain more strength compared to the control group. The authors speculated that this may have been due to the overall low intake of protein, even with supplementation - the baseline intake was 1.0 g/kg/day.

A second study compared the effects of 46 grams of either hydrolyzed chicken protein, beef protein isolate, whey protein concentrate, or a carbohydrate control (maltodextrin) on body composition and muscle performance during an eight-week periodized resistance training program. Supplements were taken post-training or at similar times on non-training days. At the study's conclusion, there were no between group differences in body composition, measures of strength, or muscle power. However, the protein supplementation groups were the only ones to significantly increase within-group lean body mass.

While these studies together suggest that beef is a viable option for promoting muscle and strength building, they do not clearly show beef protein's superiority over other high-quality protein sources in these metrics.

**Short-terms trials show that beef can be used as a potent activator of muscle protein synthesis. When compared to other types of high-quality protein in longer term trials, beef does not appear any more or less beneficial.**

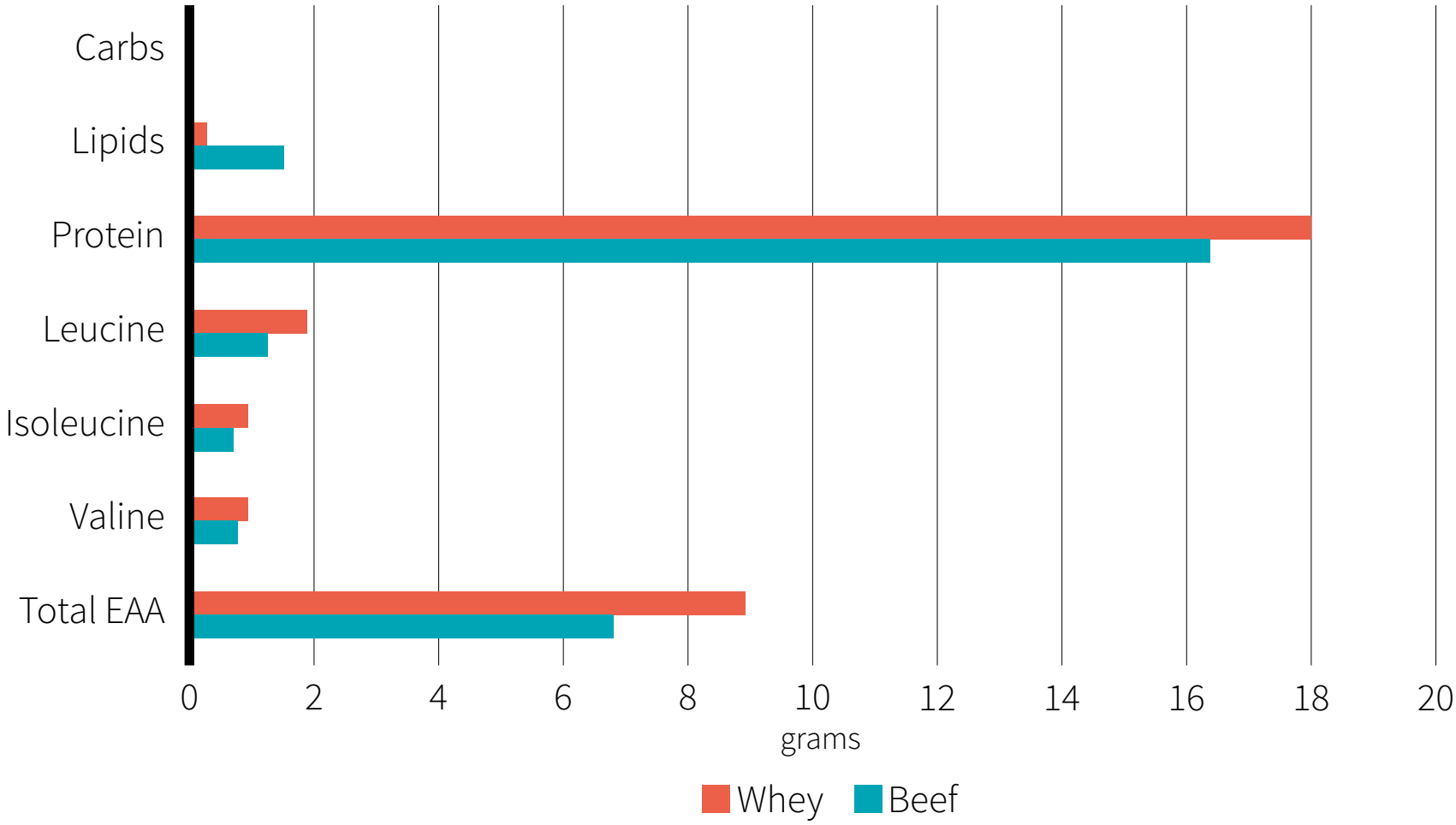
## Frequently asked questions

***Nutritionally, what are the differences between whey and beef protein?***

When comparing amino acid profiles, whey and beef are very similar, as seen in Figure 3. Beef has about 1.6 g less protein, with comparable BCAA and essential amino acid profiles, per 20 grams. However, beef does naturally contain some creatine and carnitine that can provide additional training advantages, at least in theory. Where the differences become greater is when looking at their micronutrient content, particularly the minerals. While whey has higher amounts of calcium and selenium, beef has more iron, phosphorus, potassium, and zinc.

Figure 3: Whey vs beef

20 g serving




## What should I know?

In view of its amino acid profile and absorption kinetics, it is probable that beef shares the beneficial muscle-building effects of whey protein, the current top-dog on the protein supplement market. This study examined the effects of whey or beef protein supplementation when combined with a circuit training protocol, compared to a carbohydrate control. The study saw no difference in strength gains between the three groups, which could be due to the way the study was designed and implemented. The study also found that supplementing beef protein led to larger improvements in biceps brachialis muscle thickness versus whey or carbohydrate. However, this result should be taken with a grain of salt, since it was one among many secondary outcomes explored and, implausibly, carbohydrate also outperformed whey in this measure.

More long-term head-to-head trials of whey and beef powders will need to be undertaken to shed some more light on whether beef protein offers any advantages or disadvantages to whey. At this point, it's unclear if factors such as beef protein's higher micronutrient content could actually lead to real-world improvements over whey in the long term. ◆

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