The Effect of Macronutrient Intake on Strength Training Performance

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Abstract

Introduction: Strength training encompasses a variety of athletic disciplines and is important for maintaining good health. Athletes that pursue strength training may have a variety of goals and diet is an important factor in their performance. However, dietary recommendations for strength athletes has not been established. The purpose of this systematic review is to analyze the current body of evidence to determine the effect of macronutrient intake on strength training performance.

Methodology: After the researches developed their PICO question, they drafted a search plan. The search plan includes a set of inclusion criteria to determine the applicability of studies found via the Google Scholar and PubMed databases, yielding 2,730 articles. The desired study population included healthy, trained male and female strength athletes aged 18 to 63 YO.

Results: Currently 4 articles met the inclusion criteria with 1 being excluded after a quality control criteria analysis. In the case of body composition, data suggests that high protein, low fat diets with a caloric deficit increases retention of lean body mass in two separate studies. In terms of strength performance, moderate protein, moderate fat diets suggest greater retention of strength over a high protein, low fat diet when in a caloric deficit. Additionally, a low carbohydrate ketogenic diet resulted in the greatest weight loss without decreased strength. Furthermore, a high carbohydrate diet increased the overall workload capacity of CrossFit athletes compared to a low carbohydrate diet.

Conclusion: Depending on the goals of the individual athlete, dietary modifications following these guidelines may benefit strength athletes: A high protein, low fat diet may be used if weight loss and lean body mass retention is desired. Athletes could consider either a moderate protein, moderate fat or ketogenic diet if weight loss and strength retention is desired. For overall performance in strength athletes without consideration for anthropometrics, a high carbohydrate diet may be beneficial.

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The Effect of Macronutrient Intake on Strength Training Performance

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ABSTRACT

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INTRO / GOALS / OBJECTIVES

Strength training, sometimes known as resistance or anabolic training is important for: bone development, weight management, chronic condition management, sharpened cognition, and enhanced quality of life. (Strength Training) Strength training includes goals of increasing explosive power, muscular endurance, and muscle hypertrophy. Athletes have used a variety of diets to try to improve performance across multiple disciplines. However, dietary recommendations for strength athletes have not been well established, and currently there is limited research on the subject.

The purpose of this systematic review is to analyze the current body of evidence regarding various amounts of macronutrients consumed by strength athletes. The researchers will attempt to identify ideal amounts and circumstances that produce the best performance results.

METHODS

Following development of the PICO question, the researchers developed a search plan to identify appropriate studies. The search plan listed a set of inclusion criteria to determine the applicability of studies found via the Google Scholar and PubMed databases. The desired study population included healthy, trained, male and female strength athletes between the ages of 18 to 63. Only studies which were conducted since 2010 were considered for evaluation. The resulting search yielded 2,730 articles, of which 5 were selected to be evaluated using a quality control criteria analysis.

Criteria	Inclusion	Exclusion
Age:	18-63 YO	Younger than 18 YO, and older than 63 YO
Setting:	Trained Strength Athletes	Untrained athletes, Non-strength athletes
Study Design:	RCT, Clinical Controlled Studies, Large non-randomized Observational Studies, Cohort, and Case-Control Studies	All studies of a different design than what is listed in the inclusion criteria.
Year Range:	2010-2020	Studies published before 2010
Search Terms: Macronutrients, strength, weightlifting, protein, carbohydrates, fats, macronutrient distribution, lipids		

Table 1. Pertinent criteria taken from search plan.

Summary of Articles Identified to Review	Number of Articles
Number of Included Primary Research Articles Identified from all sources:	2,730
Number of Included Review Articles Identified from all sources:	1
Total number of included articles:	6
Total number of articles considered but excluded:	1
Total number of articles considered:	5

Table 2. Summary of all articles that were identified and selected for review.

RESULTS

A total of 4 articles met the inclusion criteria. One article involved participants that trained for disciplines outside of strength training and was therefore excluded.

The study by Helms et. al. examined a high protein, low fat (HPLF) vs. a moderate protein, moderate fat diet (MPMF). Subjects in the MPMF group had slightly greater losses in bodyweight (.6%) and fat free mass (FFM) (.4%). Explosive power measured by an isometric mid-thigh pull (IMTP) was slightly greater in the MPMF group.

The study by Escobar and colleagues examined low vs. high carbohydrate intake and the effect on explosive power. The high carbohydrate group (6-8 g/kg) completed more repetitions in the same time frame than the control group (< 6g/kg).

The study published by Greene et. al. studied the effect of a low-carbohydrate ketogenic diet (LCKD) to reduces body mass without compromising performance in powerlifting and Olympic weightlifting athletes. In terms of body composition, body mass was significantly lower at the end of 3- month in the LCKD group (-3.26 plus or minus 1.07kg). No main effects in the primary outcomes for fat mass or 1 rep max strength were observed.

RESULTS CONT.

The study by Mero et. al. Examined the effects of weight reduction comparing 2 energy deficient diets with moderately high protein intake (1.4g/kg/day). The 1kcal group consumed 1036kcals and the .5kcal group consumed 1,330 kcal per day. The results showed a loss of fat mass and fat percentage was greater in the 1,100 kcal group (3.8kg) as compared to the 500 kcal group (2.0kg). This may not be sustainable due to the drastic energy restrictions which could lead to nutrient deficiencies. The 1,100 kcal deficit with less protein showed a decrease in bench press and an increase in vertical jump due to an overall decrease in body weight.

CONCLUSIONS AND RECOMMENDATIONS

Depending on the goals of the individual athlete, dietary modifications along the following guidelines may benefit strength athletes:

Study:	Dietary Intervention:	Implications:	Drawbacks/Further Research:
Escobar et. al.	Intervention: High Carbohydrate intake (6-8 g/kg) vs. Low Carbohydrate intake (<6 g/kg) Caloric Intake: Isocaloric	High carbohydrate intake may potentially benefit athletes that are performing sustained, high energy, high repetition movements to outperform those at a lower carbohydrate intake.	Further research may include evaluating carbohydrate intake in other strength disciplines besides CrossFit and modifying the amounts of carbohydrate consumed.
Helms et. al.	Intervention: High protein, low fat intake (HPLF) Caloric Intake: Hypocaloric	Potentially beneficial results for strength athletes in a caloric deficit seeking to maintain skeletal muscle mass while reducing fat mass. Overall strength may decrease.	Further research should be conducted in larger populations for a longer duration and more assessment methods such as muscle tissue biopsy may reveal additional data.
	Moderate protein, moderate fat intake (MPMF) Caloric Intake: Hypocaloric	Potentially beneficial results for strength athletes in a caloric deficit with a goal of maintaining strength. Greater loss of skeletal muscle may occur compared to a HPHF intake.	
Greene et. al.	Intervention: Low carbohydrate, high fat ketogenic intake Caloric Intake: Hypocaloric	Potentially beneficial for strength athletes with a goal of reducing overall body mass while maintaining strength performance.	Further research should evaluate whether a ketogenic diet results in increased strength performance or whether high fat intake without production of ketones assists in increasing strength.
Mero et. al.	Intervention: High Protein Caloric Intake: Hypocaloric (500 kcal deficit)	Potentially beneficial for female strength athletes with a goal of reducing fat mass while maintaining lean body mass and reducing loss of strength.	Further research should address both male and female athletes to determine if these results are consistent among genders.

Table 3. Conclusions and recommendations based on gathered evidence.

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