Association Of The Adequate Intake Of Macronutrients Between Strength Levels From 1RM In University Athletes

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ABSTRACT:

PURPOSE: To analyze the association between the proportions of athletes with adequate macronutrient intake with one repetition maximum (1RM) on bench press in college athletes.

METHODS: 164 (103 men, 61 women) college athletes from different sports were evaluated. 24-h dietary recalls were administered to estimate the macronutrient intake. Carbohydrate (CHO), protein (PRO) and fat (FAT) intake were calculated and adjusted for body weight (g/kg/day). Consumption was classified as "adequate" if the athlete consumed the recommended minimum amounts for each macronutrient: 5 g/kg/day of CHO, 1.2 g/kg/day of PRO, and 0.5 g/kg/day of FAT. Bench press 1RM test was performed to determine the maximal strength. Then, 1RM was classified into sex-specific quartiles: (Men: Q1 <57.8 kg, Q2 57.8 - 66.8 kg, Q3 66.9 - 80.3 kg, and Q4 >80.3 kg; Women Q1 <35.1 kg, Q2 35.2 - 39.6 kg, Q3 39.7 - 48.8 kg, and Q4 >48.8 kg) of displaced weight (kg). The proportion of athletes with an adequate intake of each macronutrient was compared between 1RM quartiles and analyzed by sex. Similarly, the proportion of subjects with adequate intake were compared between macronutrients within quartiles. Chi-square and multiple Z tests (with Bonferroni adjustment) were used to determine significant differences between groups. Significant differences were deemed at a p-value ≤0.05.

RESULTS: There were no significant differences in the proportions of adequate intake between 1RM quartiles for all three macronutrients, for both men and women (p>0.05). However, while analyzing the proportion of subjects with adequate macronutrient intake within quartiles, CHO was the one with the lowest proportion on men for all quartiles. The same pattern was observed in women except for Q1.

CONCLUSIONS: No association between adequate macronutrients intake and 1RM bench press strength levels were observed. However, CHO was the macronutrient with the lowest proportion of athletes achieving the minimum recommended intake.

INTRODUCTION

Resistance training is one of the most practiced and recommended activities to maintain health [1], make changes in body composition, increase muscle strength and size, which likewise are central components to improve athletic performance [2].

The adaptive response to exercise is determined by a combination of factors (i.e. exercise type, duration, intensity, and frequency) [3]. Additionally, proper nutrition is also an important factor to consider. There are different nutritional recommendations focused on providing the proper storage of energy substrates to meet fuel demands during training and the rest of the day, that would help to avoid compromising health and sports performance [4, 5].

Athletes who adhere to a low carbohydrate and protein diet may experience low muscle glycogen stores and lower training adaptation due to suboptimal muscle protein synthesis. Both may lead to lower physical performance.

Otherwise, the adequate consumption of macronutrients provides significant benefits in aspects such as strength, recovery of muscle glycogen, muscle repair, and muscle protein synthesis [2, 4].

It is becoming increasingly clear that adaptations, initiated by exercise, can be amplified or reduced by nutrition and may determine long-term exercise performance outcomes [3].

Therefore, the purpose of this study was to analyze the association between the proportions of athletes with adequate macronutrient intake with one repetition maximum (1RM) on the bench press in college athletes.

METHODS

Subjects

164 college athletes (103 men, 61 women) were evaluated from different sports: athletics (17), baseball (9), basketball (12), boxing (8), fencing (5), flag football (11), indoor soccer (16), soccer (20), aerobics gymnastics (11), weightlifting (8), judo (7), wrestling (11), softball (7), table tennis (3), Tae Kwon Do (6), triathlon (1), indoor volleyball (11), and beach volleyball (1). Age oscillated from 15 to 27 years. They participated in the 2017 National Mexican University Games.

Anthropometry

Basic anthropometric measurements; height (SECA 213, SECA, Hamburg, Germany) and weight (TANITA TBF-410, TANITA, Tokyo, Japan) were performed following a standardized protocol [6].

Dietary assessment

24-h dietary recalls were administered to estimate the macronutrient intake. Carbohydrate (CHO), Protein (PRO) and fat (FAT) intake were calculated and adjusted for body weight (g/kg/day). Consumption was classified as "adequate" if the athlete consumed at least the minimum recommended amount for each macronutrient: 5 g/kg/day of CHO, 1.2 g/kg/day of PRO, and 0.5 g/kg/day of FAT [4].

1 RM Test

Bench press one repetition maximum (1RM) test was performed to determine the maximal strength, which is defined as the highest load (weight) that the subject could lift concentrically in a single attempt. The athletes performed a light load test of 5 to 10 repetitions with 40% to 60% of the maximum weight perceived. After a rest period of 1 minute, participants performed 3 to 5 repetitions at 60% to 80% of the predicted weight. Additional weight was added in the form of small increments until concentric failure occurred [7]. Subjects were encouraged to lift additional load to ensure they had reached maximum muscle strength. When they could not perform the test correctly, no extra load was added and it was accepted as a valid attempt, ending the test. All the assessments were carried out in the presence of trained personnel.

Statistical analysis

1RM was classified into sex-specific quartiles: (men: Q1 <57.8 kg, Q2 57.8 - 66.8 kg, Q3 66.9 - 80.3 kg, and Q4 >80.3 kg; women: Q1 <35.1 kg, Q2 35.2 - 39.6 kg, Q3 39.7 - 48.8 kg, and Q4 >48.8 kg) of displaced weight (kg).

The proportion of athletes with an adequate intake of each macronutrient was compared between 1RM quartiles and analyzed by sex. Similarly, the proportion of subjects with adequate intake were compared between macronutrients within quartiles. Chi-square and multiple Z tests (with Bonferroni adjustment) were used to determine significant differences between groups. Significant differences were deemed at a p-value ≤0.05.

Table 1. General subjects characteristics.

	Total (n=164)	Men (n=103)	Women (n=61)
Weight (kg)	65.8 (58.6—75.5)	70.0 (63.5—79.6)	57.9 (52.5—65.7)
Height (cm)	171 (163—177)	175 (170—180)	162.5 ± 6 *
Age (years)	20 (19—21)	20 (20—22)	20 (19—21)

Data expressed as median (interquartil range 25-75th)
*Data expressed as mean ±SD.

RESULTS

Subjects general characteristics are shown in Table 1.

There were no significant differences in the proportions of adequate intake between 1RM quartiles for all three macronutrients, for both men and women (p>0.05). However, CHO was the macronutrient that showed the lowest proportion of adequate intake within quartiles on men for all quartiles. The same pattern was observed in women except for Q1 (Table 2).

Table 2. Percentage of participants with adequate macronutrient intake by 1RM strength quartile.

		Q1	Q2	Q3	Q4	p-value[1]
Men	PRO	13 (93%)ab	28 (90.3%) a	27 (84.4%) a	24 (92.3%) a	0.734
	FAT	14 (100%) b	29 (93.5%) a	30 (93.8%) a	24 (92.3%) a	0.786
	CHO	8 (57%)a	20 (64.5%) b	18 (56.2%) b	11 (42.3%) b	0.412
	p-value[2]	0.005	0.004	0.001	0.000	
Women	PRO	7 (70%)	20 (83.3%) a	13 (86.7%) a	10 (83.3%) a	0.744
	FAT	9 (90%)	21 (87.5%) a	15 (100%) a	10 (83.3%) a	0.483
	CHO	6 (60%)	9 (37.5%) b	4 (26.7%) b	2 (16.7%) b	0.166
	p-value[2]	0.303	0.001	<0.001	0.001	

Data expressed as frequencies (%). Different letters denote significant differences between nutrients within quartiles (p <0.05).
[1] p-value for comparison between quartiles.
[2] p-value for comparison within quartiles.

CONCLUSIONS

The proportion of adequate macronutrient intake is not associated with 1RM bench press strength in college-aged Mexican athletes. Additionally, CHO was the macronutrient that athletes failed to reach the minimum recommended amount the most.

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