The Association Between The Number of Meals with Adequate Protein Intake and Maximal Deadlift Strength

Alejandro Gaytán-González, Roberto Gabriel González-Mendoza, Sergio Alejandro Copado-Aguila, Juan Antonio Jímenez-Alvarado, Marisol Villegas-Balcázar, Francisco Torres-Naranjo, Juan R. López-Taylor

Institute of Applied Sciences for Physical Activity and Sport. University Health Sciences Center. University of Guadalajara. Guadalajara, Jalisco, México.

Email: alejandro.gaytan@cucs.udg.mx

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ABSTRACT:

PURPOSE: To analyze the association between the number of meals with adequate protein intake and maximal deadlift strength in college athletes.

METHODS: We evaluated 250 (107 women) college athletes previous to a national contest. Maximal strength was assessed with one repetition maximum (1RM) on deadlift and was adjusted for body mass (kg lifted weight/kg body mass). The protein intake per meal was assessed with 24-h dietary recalls. The reported protein intake was expressed as absolute (g) and relative (g/kg body mass). Adequate protein intake per meal was deemed as ≥20 g and ≥0.3 g/kg. Next, we calculated the number of meals that achieved these thresholds and were grouped as ≤1, 2, 3, ≥4 meals for each criterion. Then, 1RM was compared between groups with and without adjustment for covariables (age [years], lean body mass [kg, bioelectrical impedance], height [cm], sex, relative protein intake [g/kg/d]) for each criterion.

RESULTS: For ≥20 g criterion, the ≥4 meals group showed significantly higher 1RM than ≤1 group for the unadjusted model. When it was corrected for age, lean body mass, height, and sex, it remained significant. However, the differences were no longer significant when the model was also adjusted for relative protein intake. As the model was adjusted, the number of meals decreased their contribution to the model. The same pattern was observed with the ≥0.3 g/kg criterion (Table).

CONCLUSIONS: The number of meals with adequate protein intake is associated with higher deadlift 1RM. However, its importance decreased when were adjusted for relative protein intake. Therefore, the association between protein intake and deadlift 1RM could be mediated by total relative protein intake, and the number of meals with adequate protein intake could serve as a strategy to eat more protein rather than playing a "timing" role.

INTRODUCTION

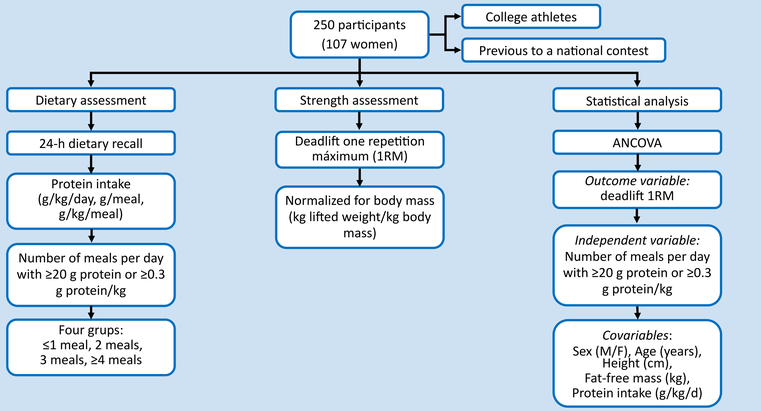
It is well known that protein intake stimulates muscle protein synthesis (1,2). At adequate doses, it overcomes muscle protein breakdown, leading to positive protein balance, which is the base of muscle protein accretion (3,4). When resistance exercise is performed, adequate protein intake may lead to a more positive protein balance and better training adaptations (4,5).

Recently, protein intake per meal has gained attention. Protein doses of 20 g or ≈0.3 g/kg per meal optimally stimulate muscle protein synthesis in young adults (6,7). Additionally, multiple meals containing protein above 20 g each, stimulate 24-h muscle protein synthesis to a greater extent than consuming the same daily protein in a different pattern (8).

While a recent study suggests that consuming three meals with ≥0.24 g protein/kg each was significantly associated with higher total fat-free mass than those that did not reach this threshold for at least one meal (9), this association with strength is less known.

Therefore, the purpose of this study was to analyze the association between the number of meals with adequate protein intake and maximal deadlift strength in college athletes.

METHODS



RESULTS

Table 1. Participants general characteristics depending on the number of meals per day with ≥20 g protein and ≥0.3 g protein/kg (n = 250).

	≥20 g protein					≥0.3 g protein/kg				
Number of meals	≤1	2	3	≥4	p§	≤1	2	3	≥4	p§
n	52	73	91	34		56	78	86	30	
Age (y)	20.2 ±1.8	20.6 ±2.2	20.7 ±2.0	21.3 ±1.8	0.084	20.3 ±1.9	20.7 ±2.2	20.7 ±2.0	21.2 ±1.9	0.226
Body mass (kg)	67.5 ±14.8	67.4 ±14.4	69.6 ±14.1	73.7 ±10.8	0.057	77.2 ±16.9	67.1 ±13.5	64.9 ±11.0	70.9 ±10.7	<0.001
Height (cm)	167.1 ±8.9	168.3 ±9.7	171.6 ±9.1	174.7 ±7.0	<0.001	171.1 ±10.0	169.3 ±9.7	169.3 ±9.0	173.1 ±7.2	0.091
Fat-free mass (kg)	50.2 ±9.9	52.1 ±10.0	55.6 ±10.6	60.4 ±6.9	<0.001	56.4 ±11.9	52.6 ±10.4	52.5 ±9.4	58.5 ±7.9	0.002
Protein intake (g/d)	67.8 ±20.5	95.3 ±28.9	136.9 ±41.1	184.3 ±47.9	<0.001	71.8 ±25.0	101.2 ±34.1	135.1 ±42.6	189.2 ±46.6	<0.001
Protein intake (g/kg/d)	1.05 ±0.39	1.48 ±0.54	2.04 ±0.73	2.53 ±0.65	<0.001	0.96 ±0.34	1.52 ±0.45	2.11 ±0.65	2.71 ±0.69	<0.001

Data expressed as mean ±standard deviation.
§ P-trend for comparison between groups (one-way ANOVA with Welch correction).

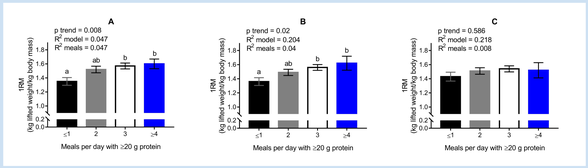


Figure 1. Maximal deadlift strength on one repetition maximum (1RM) depending on the number of meals per day with ≥20 g protein. A: Unadjusted model; B: Adjusted for sex, age, height, and fat-free mass; C: adjusted for sex, age, height, fat-free mass, and protein intake (g/kg/d). Bars represent mean, whiskers represent standard error of the mean. Different lowercase letters denote significant differences (p<0.05) between groups (Bonferroni adjustment). R^2 meals: Contribution of the number of meals to the model´s R^2.

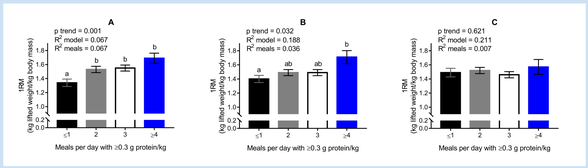


Figure 2. Maximal deadlift strength on one repetition maximum (1RM) depending on the number of meals per day with ≥0.3 g protein/kg. A: Unadjusted model; B: Adjusted for sex, age, height, and fat-free mass; C: adjusted for sex, age, height, fat-free mass, and protein intake (g/kg/d). Bars represent mean, whiskers represent standard error of the mean. Different lowercase letters denote significant differences (p<0.05) between groups (Bonferroni adjustment). R^2 meals: Contribution of the number of meals to the model´s R^2.

CONCLUSIONS

The number of meals with adequate protein intake was associated with higher deadlift 1RM. However, its significance and contribution decreased when were adjusted for relative protein intake. Therefore, the association between protein intake and deadlift 1RM could be mediated by total relative protein intake, and the number of meals with adequate protein intake could serve as a strategy to eat more protein rather than playing a "timing" role.

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