

Dileucine-enriched essential amino acids support greater whole-body anabolism than branched chain amino acids and collagen hydrolysate after resistance exercise in recreationally active adults

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Abstract

Essential amino acid ingestion after resistance exercise stimulates muscle protein synthesis and whole-body anabolism (i.e., growth). Previous work has demonstrated that ingestion of 2g of dileucine is more effective at stimulating myofibrillar protein synthesis compared to 2g of leucine in young men at rest. We aimed to determine the effect of a dileucine-containing essential amino acid formula (DIEAA; 2g dileucine, 1g leucine) on the anabolic response after resistance exercise in young recreationally active adults when compared with ingesting branched chain amino acids (BCAA; 3g leucine, 1.5g isoleucine, 1.5g valine) or isonitrogenous collagen hydrolysate (COL). In a randomized, double-blind, crossover design, 12 healthy adults (8M, 4F, age 24 ± 3 y) performed a 60 min bout of whole-body resistance exercise after which they ingested DIEAA, BCAA, or COL protein beverages with 100 mg L-[1-¹³C]leucine. Total exogenous leucine retention (as an estimate of whole-body anabolism) was assessed over the 6 h postprandial period by determining total leucine oxidation from ¹³CO₂ enrichment in repeated breath samples. Urinary 3methylhistidine:creatinine ratio (3MH:Cr, estimate of skeletal muscle myofibrillar protein breakdown (MPB)) was also assessed over the 6 h postprandial period. Total exogenous leucine retention was greater in DIEAA compared to BCAA by 161% with both DIEAA and BCAA greater than COL by 852% and 530%, respectively (all p<0.01). There were no differences (p=0.58) in 3MH:Cr between conditions. Dileucine-enriched essential amino acids supported greater whole-body anabolism than BCAA or COL after resistance exercise independent of any attenuation in estimates of MPB in healthy young adults. In conclusion, our research provides the first insights into enriching dileucine peptides in conjunction with essential amino acids to enhance post-exercise anabolism.

Introduction

Food-borne peptides (di- and tri-peptides) and their intact absorption¹ into circulation can regulate skeletal muscle metabolism².

The intestinal absorption of intact dipeptides is up to 185% greater than that of free-form amino acids³.

Previous work has demonstrated that the ingestion of 2g of dileucine (leucine-leucine dipeptide) was more effective at stimulating myofibrillar protein synthesis compared to 2g of leucine in young men at rest⁴.

Following resistance exercise, the ingestion of essential amino acids can enhance whole-body anabolism and attenuate markers of myofibrillar proteolysis⁵.

Thus, it seems plausible that the ingestion of dileucine following resistance exercise could enhance or augment the whole-body anabolic response, although evidence to support this hypothesis is lacking.

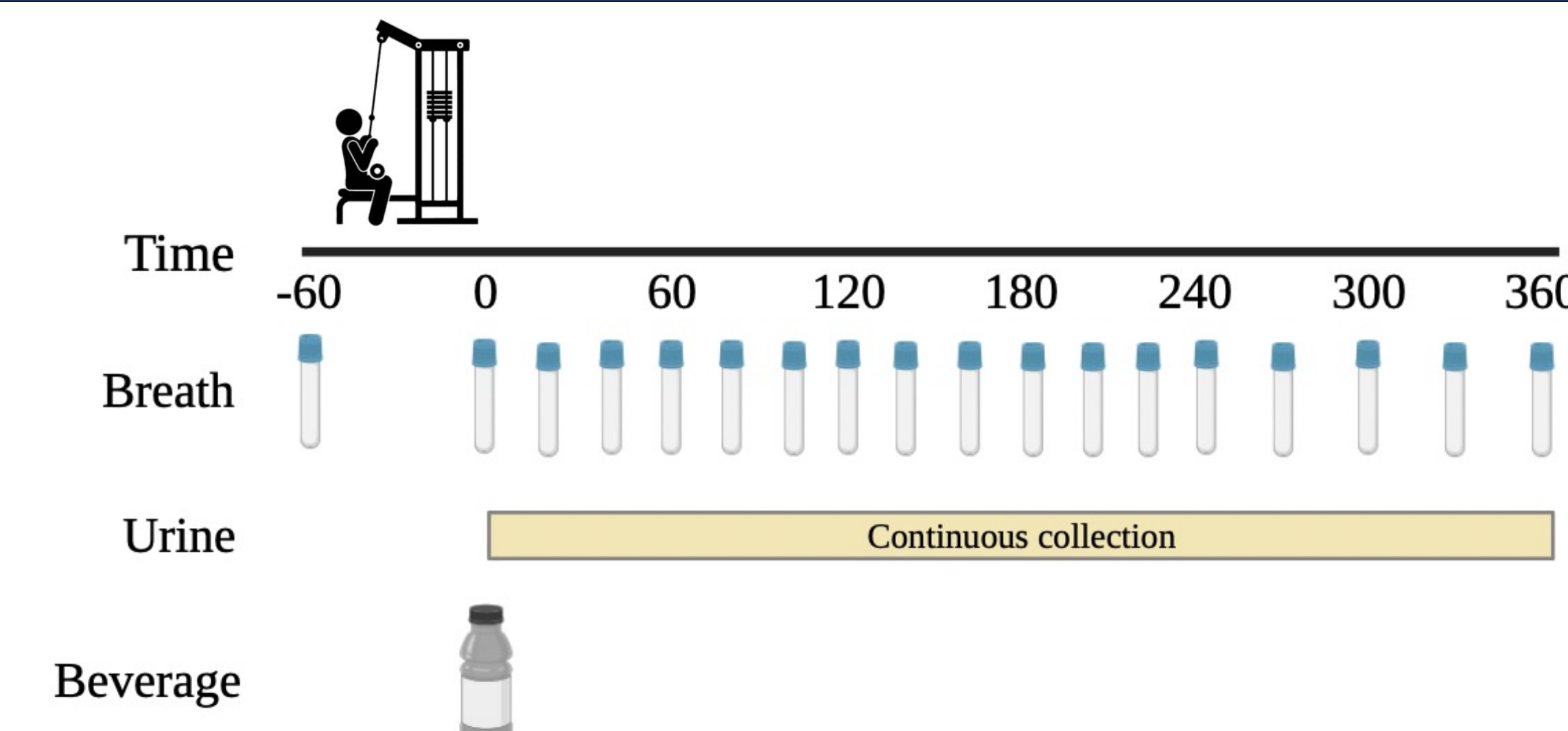
We aimed to determine the effect of a dileucine-containing essential amino acid formula (DIEAA) on the anabolic response after resistance exercise when compared with ingesting branched chain amino acids (BCAA) or isonitrogenous collagen hydrolysate (COL).

References

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Methods

- 12 healthy adults (8M, 4F, age 24 ± 3 y, 72.0 ± 17.5 kg, BMI 24.1 ± 3.8 kg/m²) participated in a randomized, double-blind, crossover study design.
- Participants completed a 60 min bout of whole-body resistance exercise (4 x 8-10, 75% 1RM) that involved the following 4 exercises: 1) bench press and cable row superset, 2) shoulder press and lat pulldown superset, 3) leg press, and 4) leg extension.
- After resistance exercise, participants ingested DIEAA (2g dileucine, 1g leucine), BCAA (3g leucine, 1.5g isoleucine, 1.5g valine), or COL protein beverages with 100 mg L-[1-¹³C]leucine.
- Breath samples were collected to determine ¹³CO₂ enrichment and total leucine oxidation.
- Urinary 3-methylhistidine(3MH):creatinine ratio was assessed over the 6 h postprandial period to provide an estimate of skeletal muscle myofibrillar protein breakdown.
- Total leucine retention (estimate of whole-body anabolism) was determined by the difference between total leucine intake and total leucine oxidation.



Results

Greater total exogenous leucine oxidation in DIEAA compared to BCAA and COL

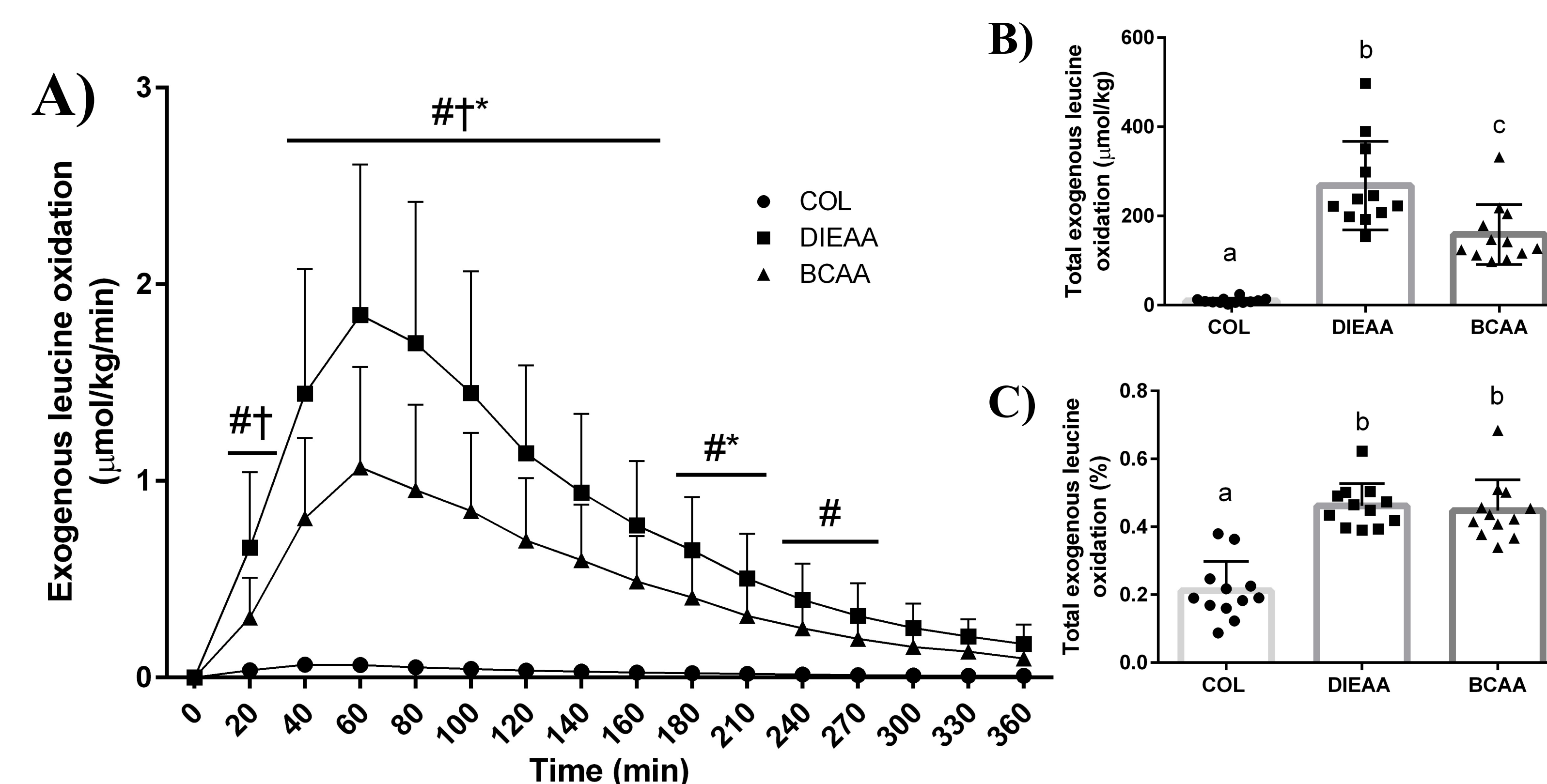


Figure 1: Time course of exogenous leucine oxidation (A) and total exogenous leucine oxidation expressed as an absolute amount (B) and as a percentage of total leucine intake (C). Data are presented as mean ± SD. Conditions that do not share a letter are significantly different (P < 0.001). * COL different from BCAA, # COL different from DIEAA, † BCAA different from DILEU (all P < 0.05).

Greater total leucine retention (whole-body protein synthesis) in DIEAA compared to BCAA and COL

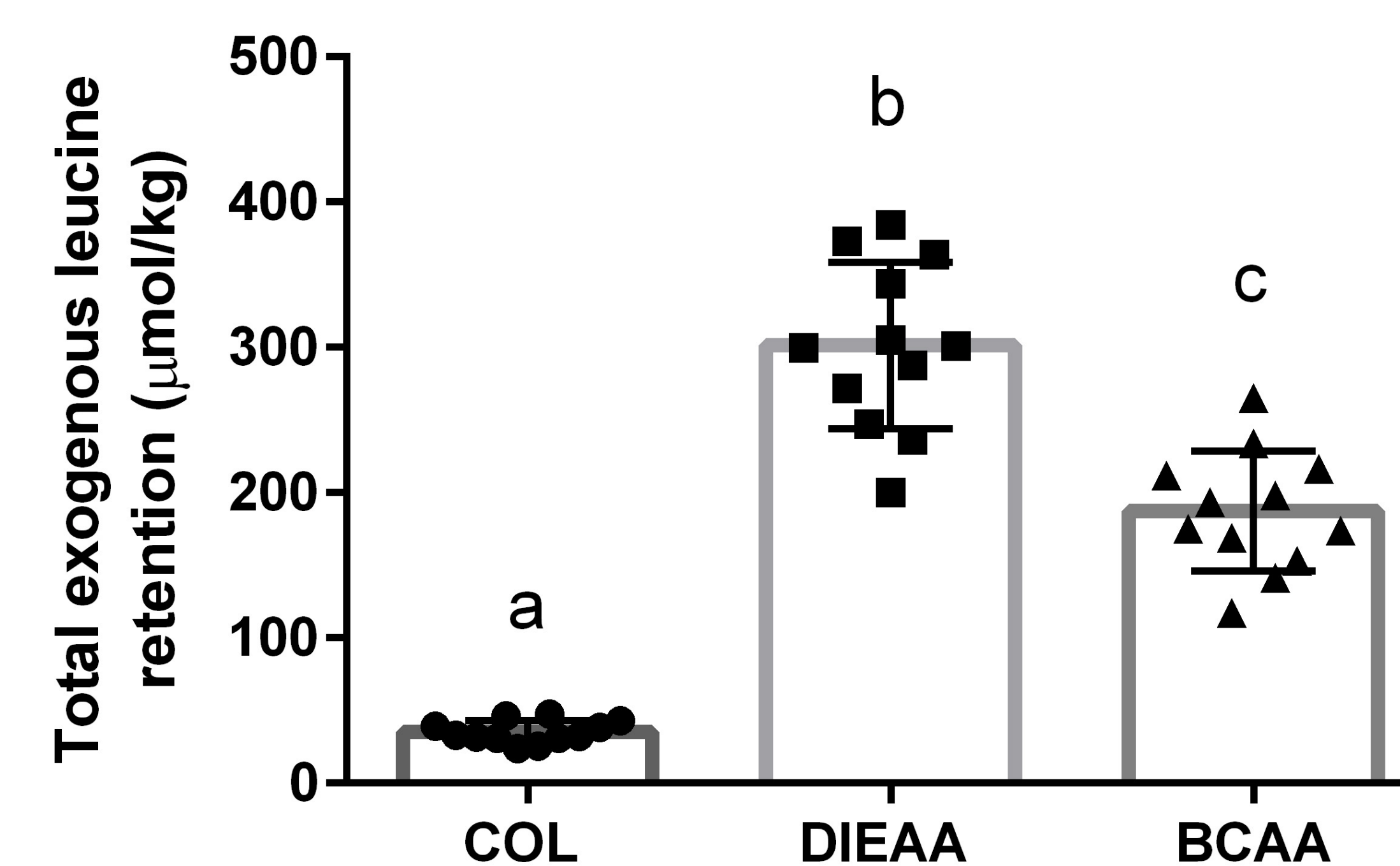


Figure 2: Total exogenous leucine retention. Data are presented as mean ± SD. Conditions that do not share a letter are significantly different (P < 0.001).

Whole-body muscle protein breakdown was not attenuated by the provision of essential amino acids

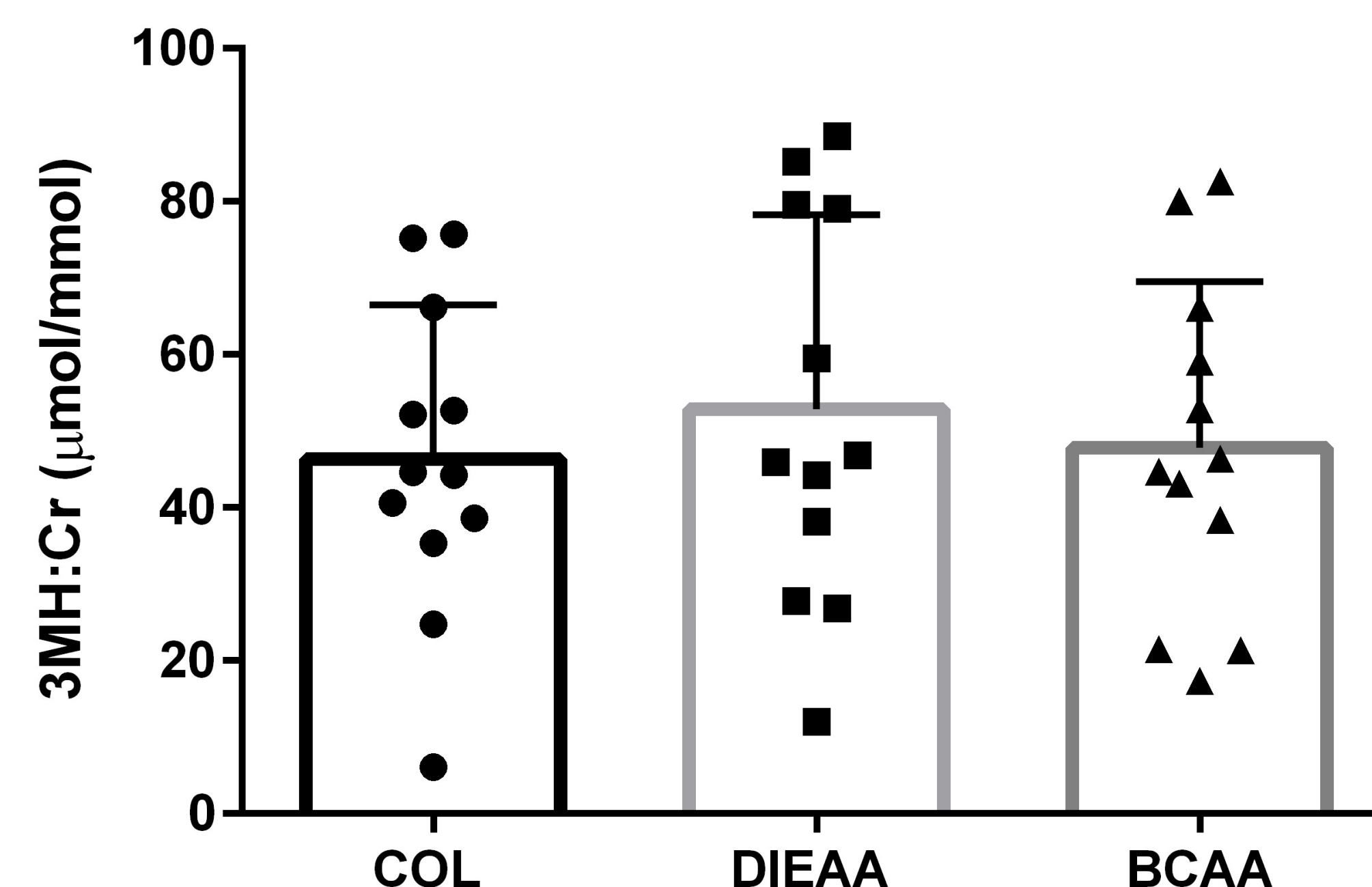


Figure 3: 3-methylhistidine:creatinine ratio. Data are mean ± SD. Main effect of P = 0.584

Conclusions

Dileucine-enriched essential amino acids supported greater whole-body anabolism than BCAA or COL after resistance exercise independent of any attenuation in estimates of MPB in healthy young adults.

These findings suggest that dileucine is an efficient way of providing leucine to the body for supporting whole-body growth in individuals performing resistance exercise.

Our research provides the first insights regarding the enrichment of an essential amino acid mixture with dileucine peptides to enhance post-exercise anabolism.