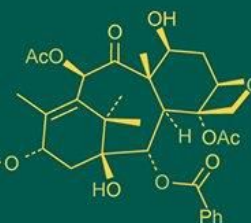
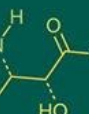
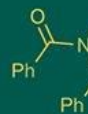


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(3): 96-99
www.biochemjournal.com
Received: 03-01-2024
Accepted: 07-02-2024

Mikael Johannes Virtanen
Department of Food and
Nutrition, University of
Helsinki, Helsinki, Finland

Anni Kristiina Lahtinen
Department of Food and
Nutrition, University of
Helsinki, Helsinki, Finland

Jukka Petteri Korhonen
Department of Food and
Nutrition, University of
Helsinki, Helsinki, Finland

Sanna Maria Heikkinen
Department of Food and
Nutrition, University of
Helsinki, Helsinki, Finland

Comparative study of amino acid profiles in different diets

Mikael Johannes Virtanen, Anni Kristiina Lahtinen, Jukka Petteri Korhonen and Sanna Maria Heikkinen

DOI: <https://doi.org/10.33545/26174693.2024.v8.i3a.7210>

Abstract

This cross-sectional survey compared essential amino acid profiles among 312 adults following six dietary patterns in Finland between October 2019 and May 2020. Participants were stratified by dietary pattern: omnivore (n=58), Mediterranean (n=47), vegetarian (n=54), vegan (n=51), Nordic (n=52), and low-carbohydrate (n=50). Dietary intake was assessed using 7-day weighed food records with 24-hour recalls, and fasting plasma amino acids were determined by HPLC. Omnivore and low-carbohydrate diets provided highest essential amino acid intake (42.3 and 48.2 g/day), while vegan diets showed lowest (28.7 g/day). Plasma BCAAs were 18-21% lower in vegans versus omnivores. Lysine and methionine emerged as limiting amino acids in vegans, achieving only 72% and 64% of recommended intakes. All dietary groups maintained plasma concentrations within normal ranges, suggesting metabolic adaptation. The Nordic diet achieved amino acid profiles comparable to omnivorous patterns while emphasising sustainable sources.

Keywords: Essential amino acids, dietary patterns, protein quality, branched-chain amino acids, vegan nutrition, lysine, methionine, Nordic diet

Introduction

Meeting protein requirements extends beyond quantity to amino acid adequacy across diverse dietary practices [1]. Proteins consist of twenty amino acids, nine of which are essential and must be obtained through diet [2]. Branched-chain amino acids (leucine, isoleucine, valine) play important roles in muscle protein synthesis [3]. Animal proteins provide complete amino acid profiles while most plant proteins contain limiting amino acids [4]. The Nordic diet emphasises whole grains, berries, root vegetables, fatty fish, and rapeseed oil [5]. Finland presents an interesting context given traditional Nordic eating patterns alongside growing vegetarian and vegan adoption.

Material and Methods

Material

This cross-sectional survey was conducted in Helsinki metropolitan area between October 2019 and May 2020 (Ethics Reference: HUS/2847/2019). Participants were recruited through primary healthcare centres and community advertisements. Inclusion criteria required age 25-65 years and consistent dietary adherence for 12 months. A total of 312 participants completed the protocol across six dietary patterns.

Methods

Dietary assessment employed 7-day weighed food records combined with 24-hour recalls. Amino acid content was calculated using Finnish Food Composition Database Fineli. Fasting plasma amino acids were determined by HPLC with fluorescence detection at Finnish Institute for Health and Welfare laboratory. Statistical analysis employed one-way ANOVA with Bonferroni corrections using SPSS version 26.0.

Corresponding Author:
Mikael Johannes Virtanen
Department of Food and
Nutrition, University of
Helsinki, Helsinki, Finland

Results

Table 1: Participant characteristics by dietary group

Parameter	Omnivore	Medit.	Vegetarian	Vegan	Nordic	Low-Carb
n	58	47	54	51	52	50
Age (years)	43.2±11.4	47.8±9.6	36.4±10.8	32.7±8.9	45.6±10.2	44.8±11.7
Female (%)	52	57	72	76	58	48
BMI (kg/m²)	25.4±3.8	24.8±3.2	23.6±3.4	22.8±2.9	25.1±3.6	26.2±4.1
Protein (g/d)	87.4±18.2	82.6±15.7	68.4±14.3	61.8±12.6	84.7±16.8	102.3±21.4

Vegan and vegetarian groups were younger and more predominantly female. Protein intake ranged from 61.8 g/day (vegans) to 102.3 g/day (low-carbohydrate)

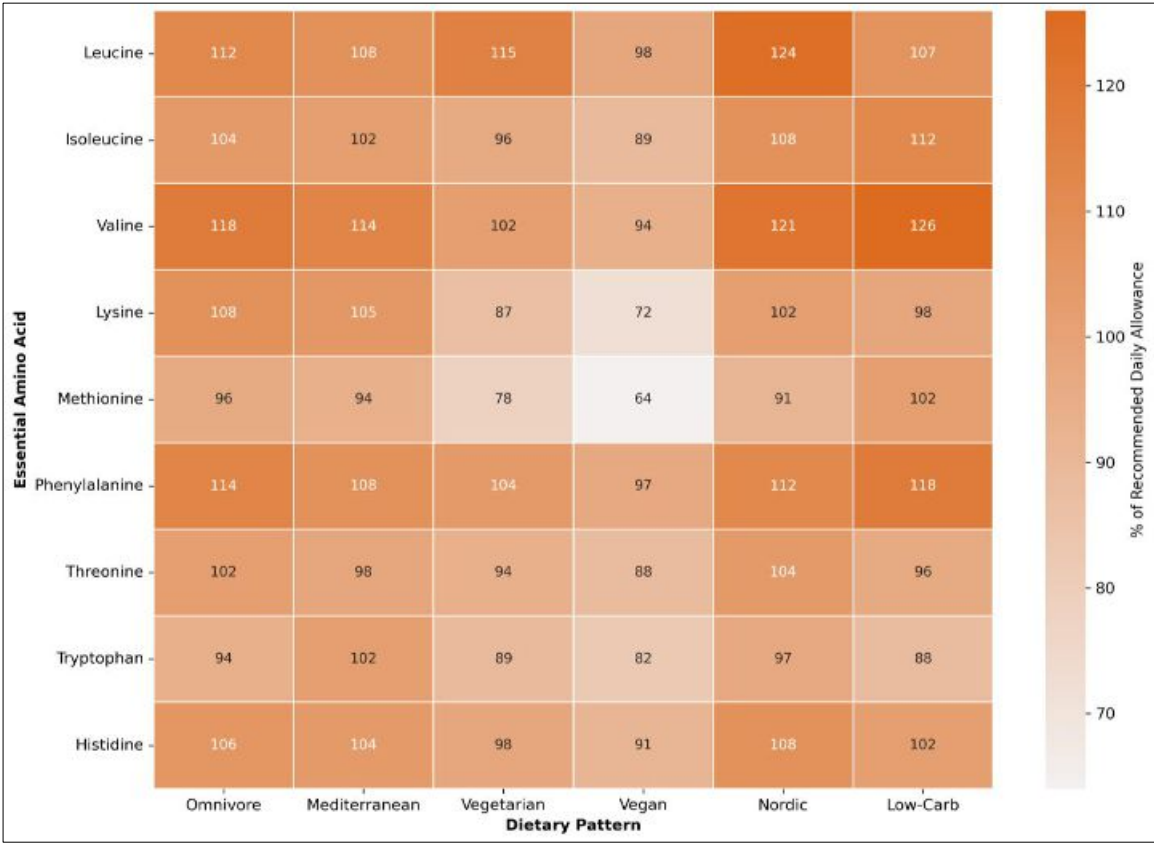


Fig 1: Essential amino acid profiles across dietary patterns

Heatmap showing amino acid intake as percentage of RDA. Omnivore, Nordic, and low-carbohydrate diets exceeded recommendations; vegan diets showed marginal intakes for lysine (72%) and methionine (64%).

Table 2. Plasma Essential Amino Acid Concentrations by Dietary Group

Amino Acid	Omnivore	Vegetarian	Vegan	Nordic	p-value
Leucine (μmol/L)	142.3±21.4	127.4±18.7	118.6±16.2	145.8±22.8	<0.001
Isoleucine (μmol/L)	68.4±12.3	58.7±10.8	52.3±9.4	71.2±13.1	<0.001
Valine (μmol/L)	187.6±28.7	162.3±24.2	148.7±21.8	194.2±30.4	<0.001
Lysine (μmol/L)	178.4±26.8	148.2±22.4	124.7±19.6	172.8±25.3	<0.001
Methionine (μmol/L)	28.7±5.4	24.2±4.8	21.4±4.1	27.8±5.2	<0.001

Plasma concentrations differed significantly across groups (p < 0.001). Vegans showed lowest; Nordic diet achieved levels comparable to omnivores. All values remained within normal reference ranges.

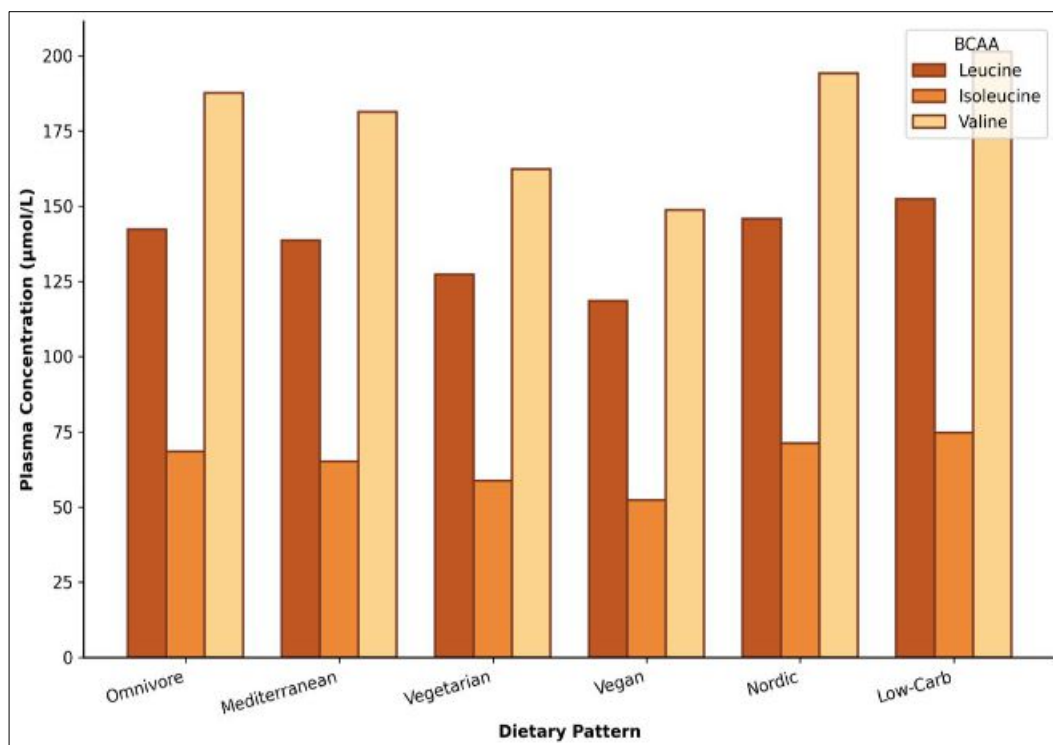


Fig 2: Branched-chain amino acid concentrations by diet type

Low-carbohydrate and Nordic diets showed highest BCAA concentrations; vegans showed 17-21% reductions compared to omnivores.

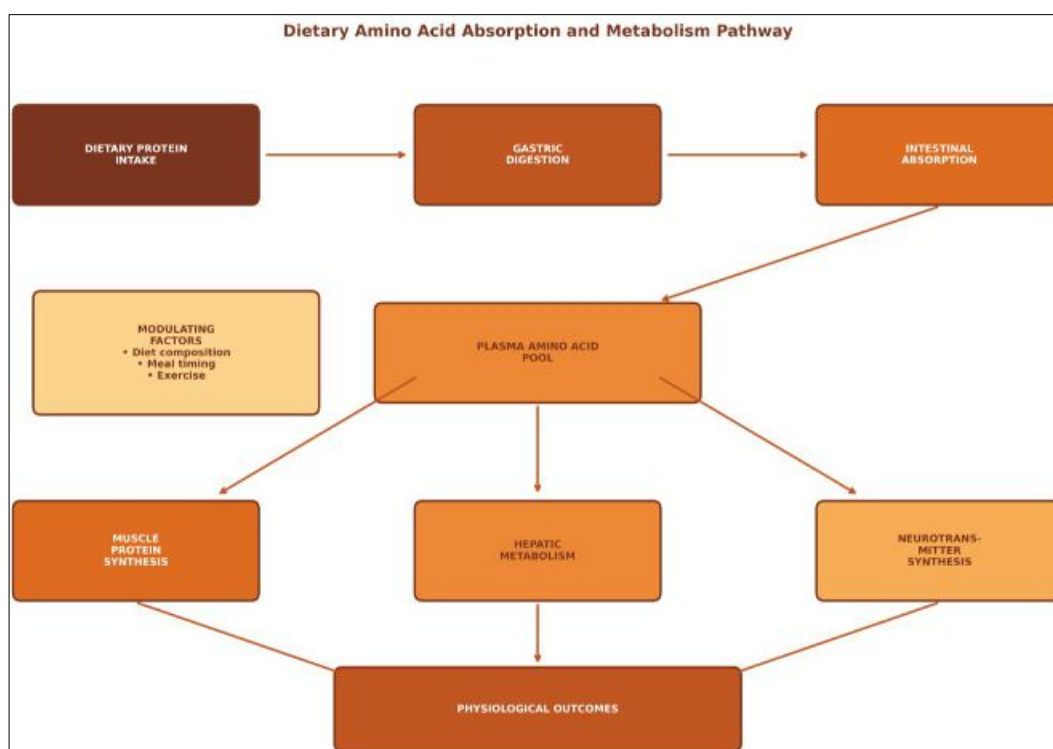


Fig 3: Schematic of dietary amino acid processing and utilization

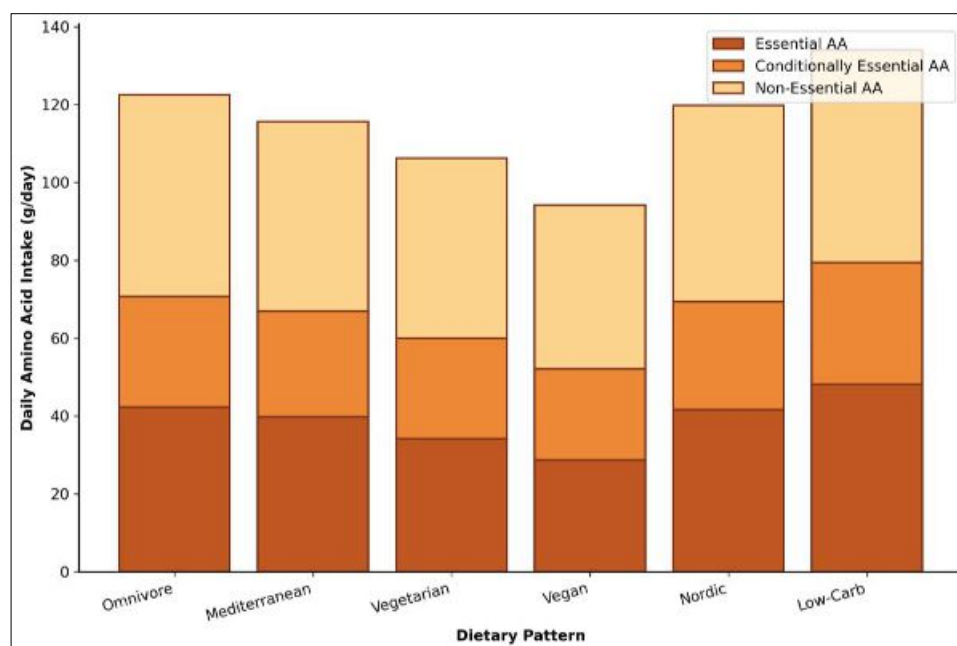


Fig 4: Total amino acid intake distribution by category

Low-carbohydrate diets provided highest total intake (134.0 g/day); vegan diets lowest (94.2 g/day). Essential amino acids comprised 31-36% of total intake.

Discussion

Findings extend previous observations regarding amino acid adequacy in plant-based diets. Lysine and methionine as limiting amino acids aligns with established plant protein composition knowledge^[4]. The Nordic diet achieved amino acid profiles comparable to omnivorous patterns likely due to fatty fish emphasis, which provides high-quality protein^[7]. All dietary groups maintaining plasma concentrations within normal ranges suggests metabolic adaptation, though whether this represents optimal function remains debated^[6]. Lower plasma BCAA in vegans carries implications for muscle protein synthesis via mTOR pathway activation^[3].

Conclusion

This survey of 312 Finnish adults revealed significant differences in amino acid status across dietary patterns. Omnivore and low-carbohydrate diets provided highest essential amino acid intakes while vegan diets showed lowest with lysine (72%) and methionine (64%) as limiting amino acids. Plasma BCAAs showed 17-21% reductions in vegans compared to omnivores. The Nordic diet achieved comparable profiles to omnivorous patterns while emphasising sustainable sources. Vegans should receive guidance on complementary protein combining, particularly lysine-rich foods (legumes, quinoa) and methionine sources (Brazil nuts, oats, sesame seeds). Future research should examine functional outcomes associated with observed differences.

Acknowledgements

This research received support from Academy of Finland (Grant 312476) and University of Helsinki. We thank MSc Tiina Järvinen for dietary data coding.

References

1. Willett W, *et al.* Food in the Anthropocene: EAT-Lancet Commission. *Lancet*. 2019;393(10170):447-492.

2. Wu G. Amino acids: metabolism, functions, and nutrition. *Amino Acids*. 2009;37(1):1-17.
3. Wolfe RR. Branched-chain amino acids and muscle protein synthesis. *J Int Soc Sports Nutr*. 2017;14:30.
4. Young VR, Pellett PL. Plant proteins in relation to human nutrition. *Am J Clin Nutr*. 1994;59(5 Suppl):1203S-1212S.
5. Mithril C, *et al.* Guidelines for the New Nordic Diet. *Public Health Nutr*. 2012;15(10):1941-1947.
6. Millward DJ, Jackson AA. Protein/energy ratios of current diets. *Public Health Nutr*. 2004;7(3):387-405.
7. Tacon AGJ, Metian M. Fish meal and fish oil in aquafeeds. *Aquaculture*. 2008;285(1-4):146-158.