WAGENINGEN
UNIVERSITY & RESEARCH

Intra- and inter-individual variability in postprandial plasma amino acid kinetics after ingestion of whey and lucerne (alfalfa) protein in healthy young adults.

Marco Mensink[1], Meeke Ummels[2], Ron Wehrens[3], Jasper Engel[3], Nikkie van der Wielen[1,4], Diederik Esser[2] & Jurriaan Mes[2]

Background

- Measuring postprandial blood amino acids (AA) is a relatively easy and frequently used method used to characterize a protein source.
- However considerable individual variation in postprandial AA kinetics can be expected[a] due to, amongst others, differences in an individual's digestion and absorption capacity.
- Data on inter/intrapersonal variability is only scarcely presented.

Objective

Quantify the variation in postprandial AA profiles between and within individuals after consumption of a good (whey protein concentrate, WPC) and moderate (alfalfa or lucerne protein concentrate, LPC) digestible protein source.

Method

- In this randomized, cross-over, double-blind trial 18 healthy adults (7M/11F, age 23±4 yrs., BMI 23+2.4 kg/m^2) consumed a 20 g protein drink on five occasions.
- Three times lucerne (alfalfa) protein concentrate (LPC), two times whey protein isolate (WPI), in random order.
- Blood was collected before and up-to five hours after protein consumption.
- Blood amino acid kinetics of free amino acids were expressed as Area Under the Curve (AUC) and peak height, both corrected for baseline values, and time to peak, using a recently developed AA response fitting package in R (https://github.com/Biometris/aaresponse).[ab]

Results

- Individual postprandial plasma levels for TAA and TEAA are depicted in Figure 3. Clear differences between as well as within individuals can already be seen by visual assessment of the graphs. (Figure 1).

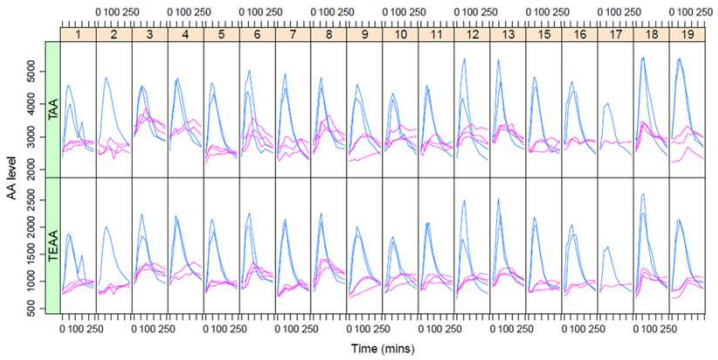

***Figure 1**. Individual total plasma AA (TAA) and essential AA (TEAA) profile for each test day. WPI in blue, LPC in purple.*

Results

- Maximum peak height and incremental Area Under the Curve (iAUC) were as expected significantly greater for WPC compared to LPC for total AA and total EAAs ($p < 0.001$, figure 2).
- The iAUC for total essential AAs of LPC was only 52 % of that of WPC (3548 vs 6754 µM*min).
- For WPC, the inter-individual variability in total indispensable AAs iAUC (SD: 1111) was higher than the intra-individual variability (SD: 605); and likewise for LPC (SD: 703 vs 553 for inter- and intra-individual variability, respectively). This indicates that differences between participants were larger than within participants, in particular for WPC.
- There was no significant correlation between the iAUC of WPC and LPC ($r < 0.20$, $p > 0.05$), suggesting that subjects with a high iAUC for one protein source were not necessarily those with a high iAUC for the other protein source.

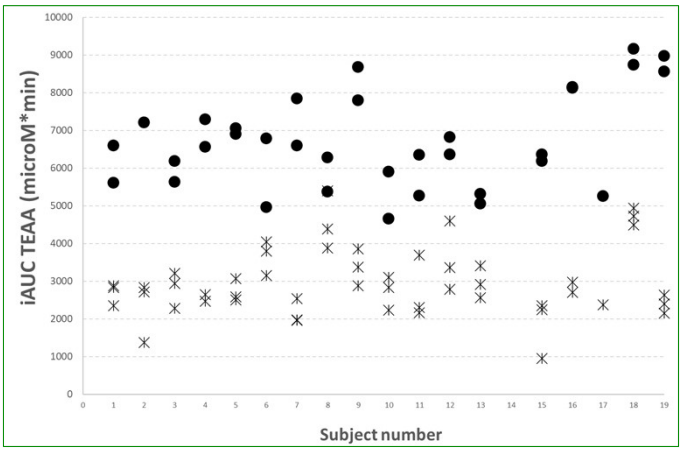

***Figure 2**. AUC for total plasma EAA per individual for each test day; WPI in black dots, LPC in crosses.*

Conclusions

- These results confirm the low (E)AA availability of lucerne (alfalfa) as a protein source compared to whey,
- AA kinetics after ingestion of 20 gram protein showed significant variation between individuals, as well as within individuals, both for a good (i.e. WPC) as well as a moderate digestible protein (i.e. LPC).
- Between individuals variation in postprandial response (i.e. iAUC) was larger than within individual variation in particular for WPC,
- Subjects with a high response for one protein source were not necessarily those with a high response for the other protein source.

Results indicate that variation in postprandial AA kinetics should not be neglected; insights into this variation are warranted to support future optimized personalized protein intake advice.

[1] Division of Human Nutrition and Health, Wageningen University & Research, The Netherlands
[2] Food and Biobased Research, Wageningen University & Research, The Netherlands
[3] Biometris, Wageningen University & Research, The Netherlands
[4] Animal Nutrition Group, Wageningen University & Research, The Netherlands
*Corresponding author. Email: marco.mensink@wur.nl

References
[a] Mes et al. Int J Food Sci Nutr. 2022 Mar;73(2):251-262
[b] Wehrens et al. *in submission*