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Pipecolate, specific biomarker of lysine deficiency

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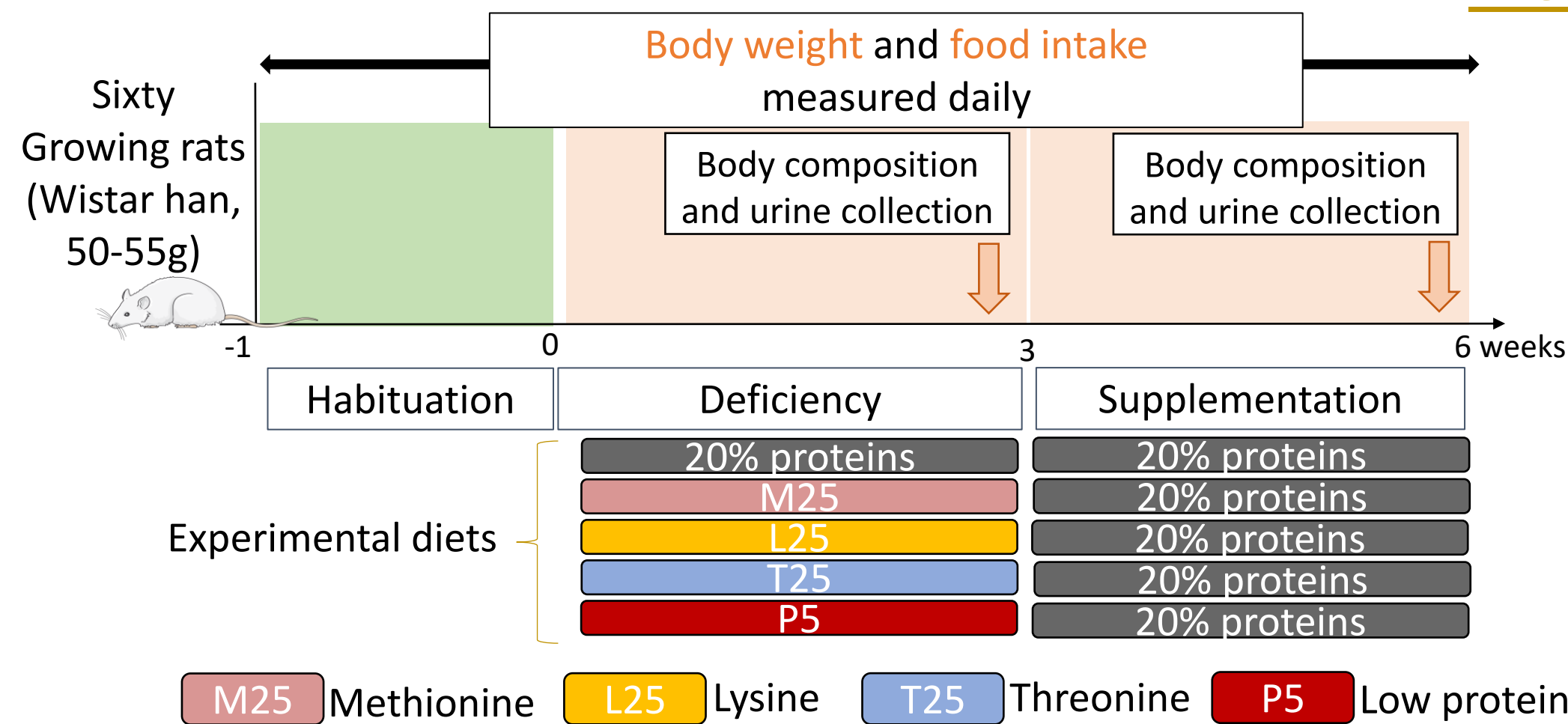
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Background & Objective

- The consumption of poor-quality protein increases the risk of essential amino acid (EAA) deficiency, particularly for lysine, threonine and methionine. Thus, it is necessary to be able to detect easily EAA deficiency.
- We have previously identified pipecolate and taurine as potential biomarkers for lysine and threonine deficiency, respectively (Moro et al. 2023, J nutr, 153:2571-2584).
- The purpose of this study was to develop metabolomic approaches to identify specific biomarkers for an EAA deficiency.

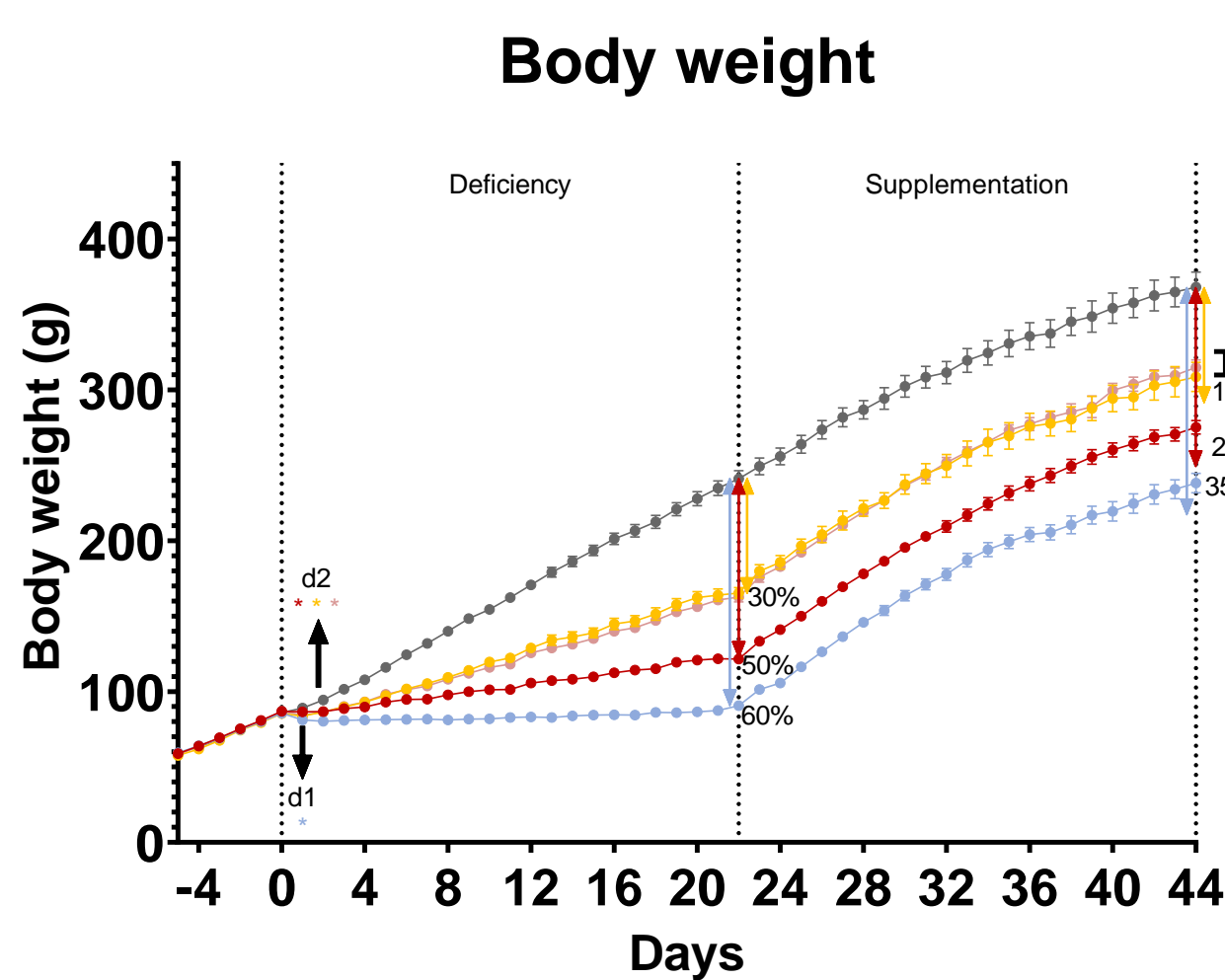
Methods



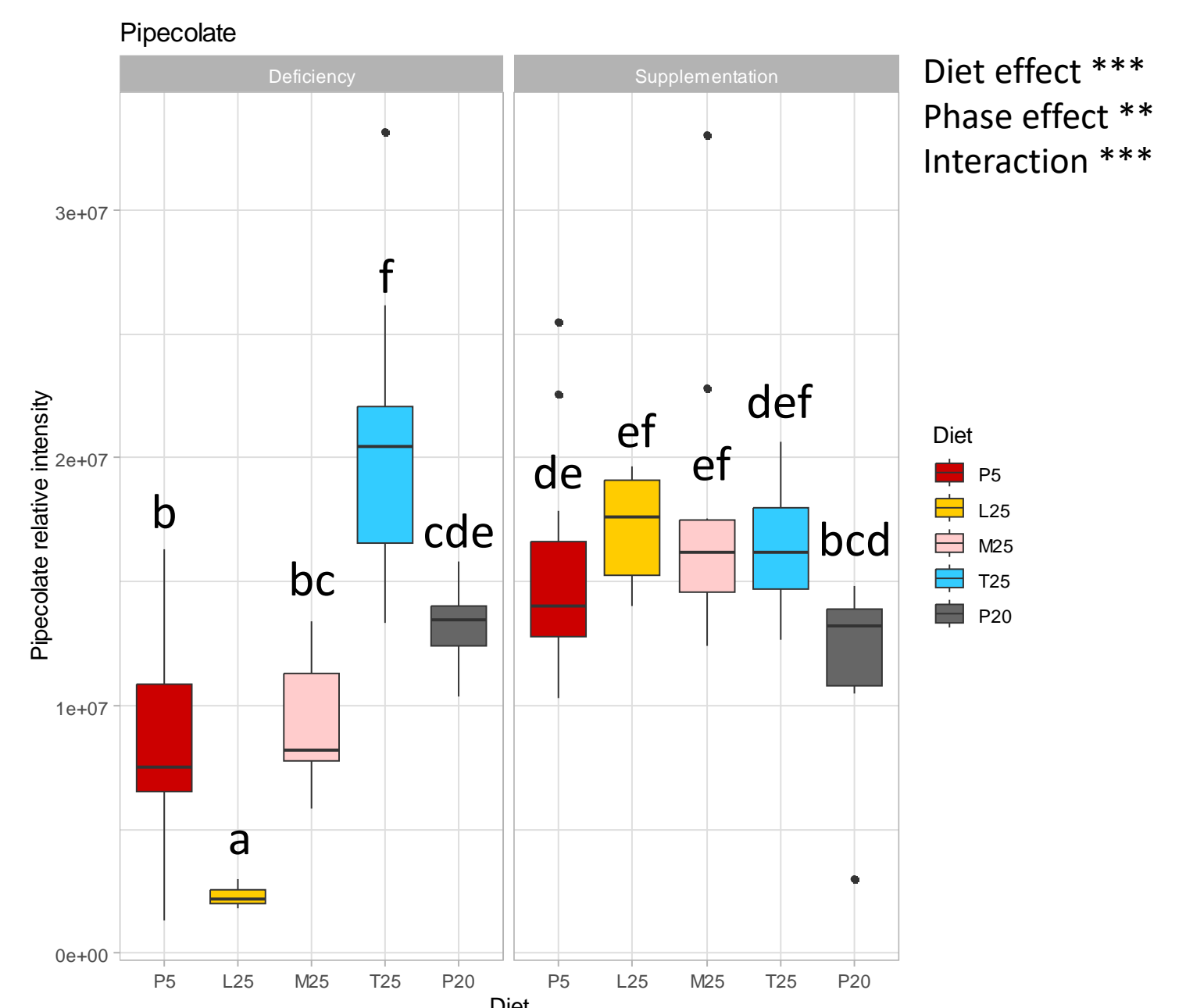
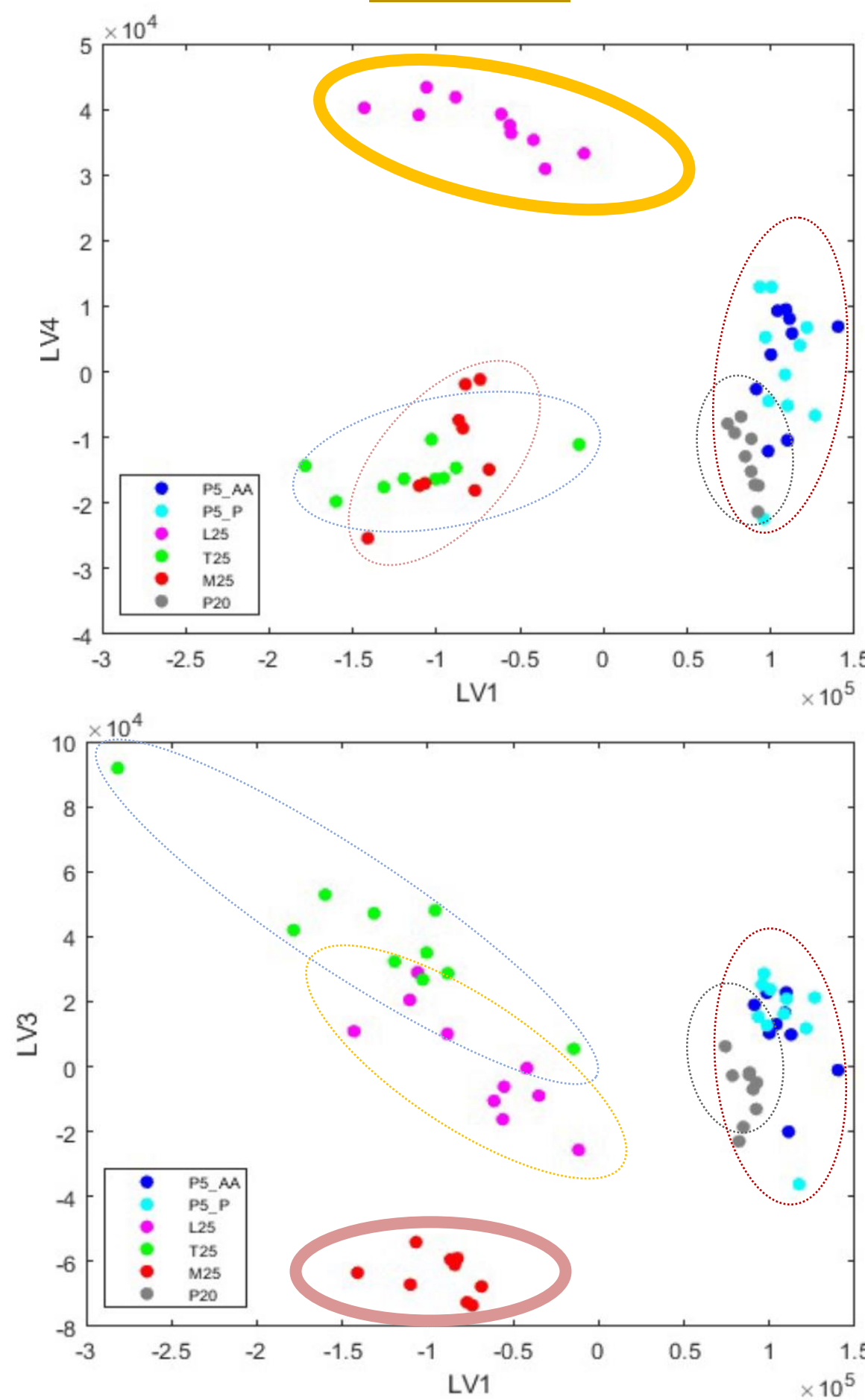
- Body weight and food intake (FI) were measured daily.
- 24h-urine was analyzed LC-MS metabolomic.
- Body composition was determined by EchoMRI.

- Body weight was analyzed by repeated measures, mixt model and other variables by one-way ANOVA.
- Metabolic features were analyzed by PLS-DA and individually test for diet effects by ANOVA.

Results



Our results confirmed that protein and EAA deficiency induced growth retardation and supplementation permits to restore growth, but a delay of length, lean body mass and specific organs weights remains after supplementation.



Urinary metabolites from lysine degradation pathway, particularly pipecolate and N-N-N-Trimethyllysine, signed lysine deficiency.

- The urinary metabolome allowed to discriminate between the deficient and no deficient diet, and we were able to identify specific signatures for methionine and lysine deficiency.
- The best model retained 4 latent variables with LV3 allowing the discrimination of methionine deficient diets and LV4 allowing the discrimination of lysine deficient diets.
- Further analyses are required to investigate the specific signature for threonine intake.

Conclusion

- Our results showed that EAA deficiencies influence the urinary metabolome.
- We identified specific urinary metabolomic for lysine and methionine deficiency.
- We confirmed that pipecolate is a urinary biomarker that specifically signs lysine deficiency.
- Our results showed that the deficiency/supplementation method could be applied to identify specific EAA biomarkers.
- The urinary biomarkers identified could be easily applied to detect EAA or protein status.

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