Pipecolate, specific biomarker of lysine deficiency

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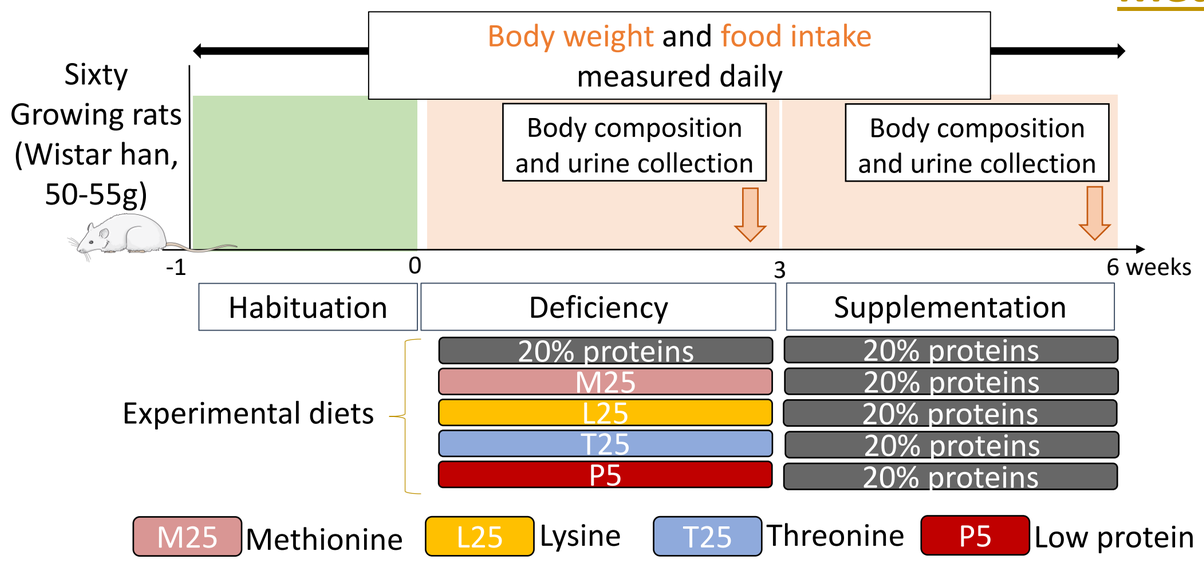
Background & Objective

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

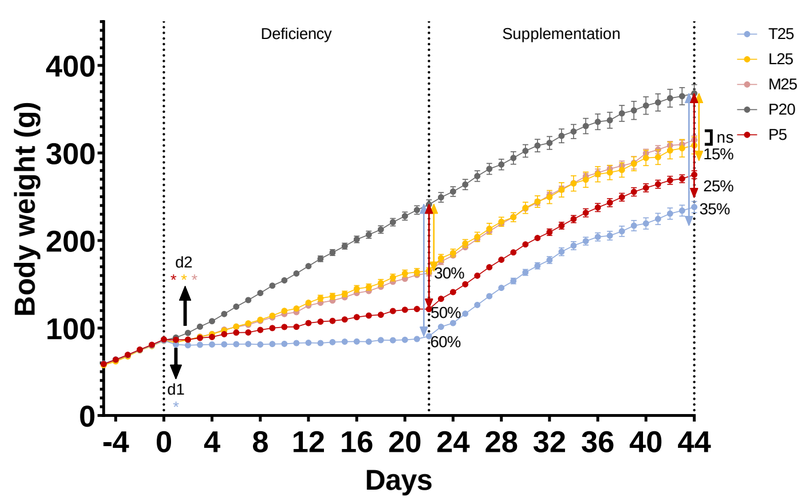


- Body weight and food intake (FI) were measured daily.
- 24h-urine was analyzed LC-MS metabolomic.
- Body composition was determined by EchoMRI.

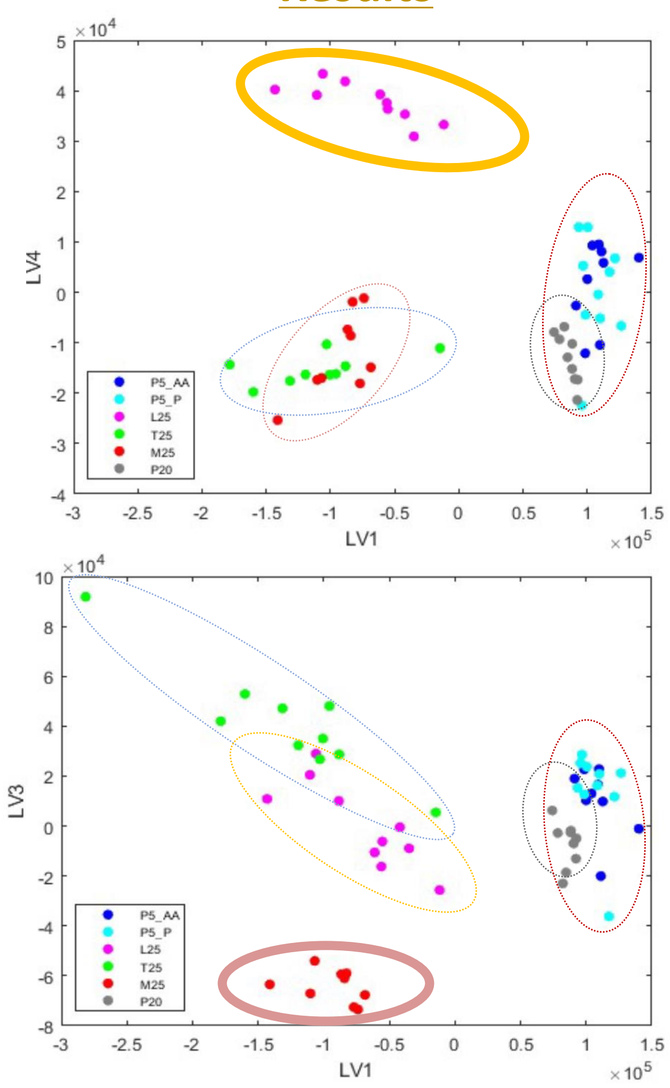
Body weight was analyzed by repeated measures, mixt model and other variables by one-way ANOVA.

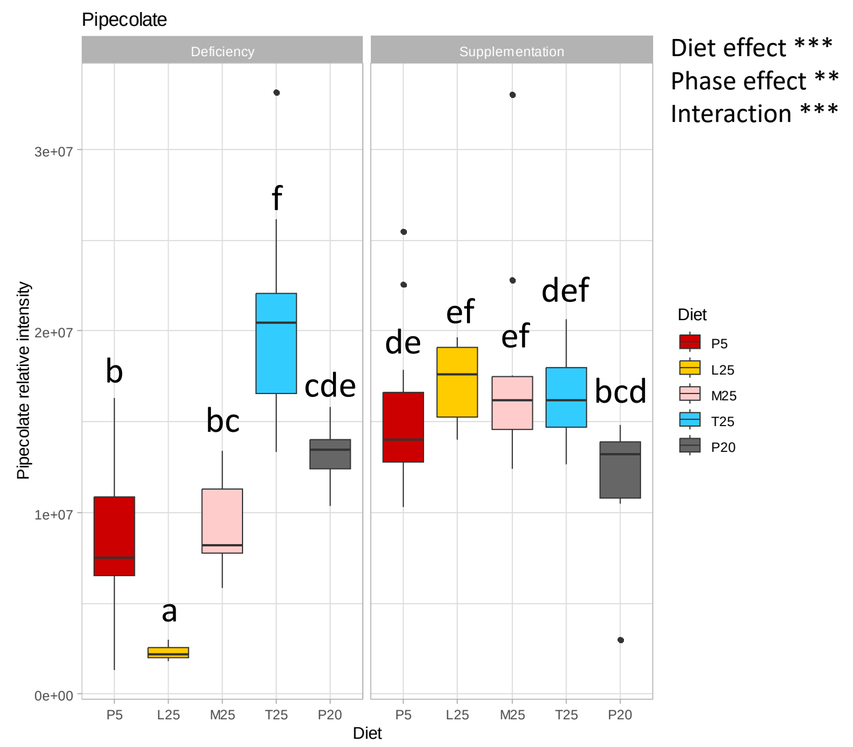
Metabolic features were analyzed by PLS-DA and individually test for diet effects by ANOVA.

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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