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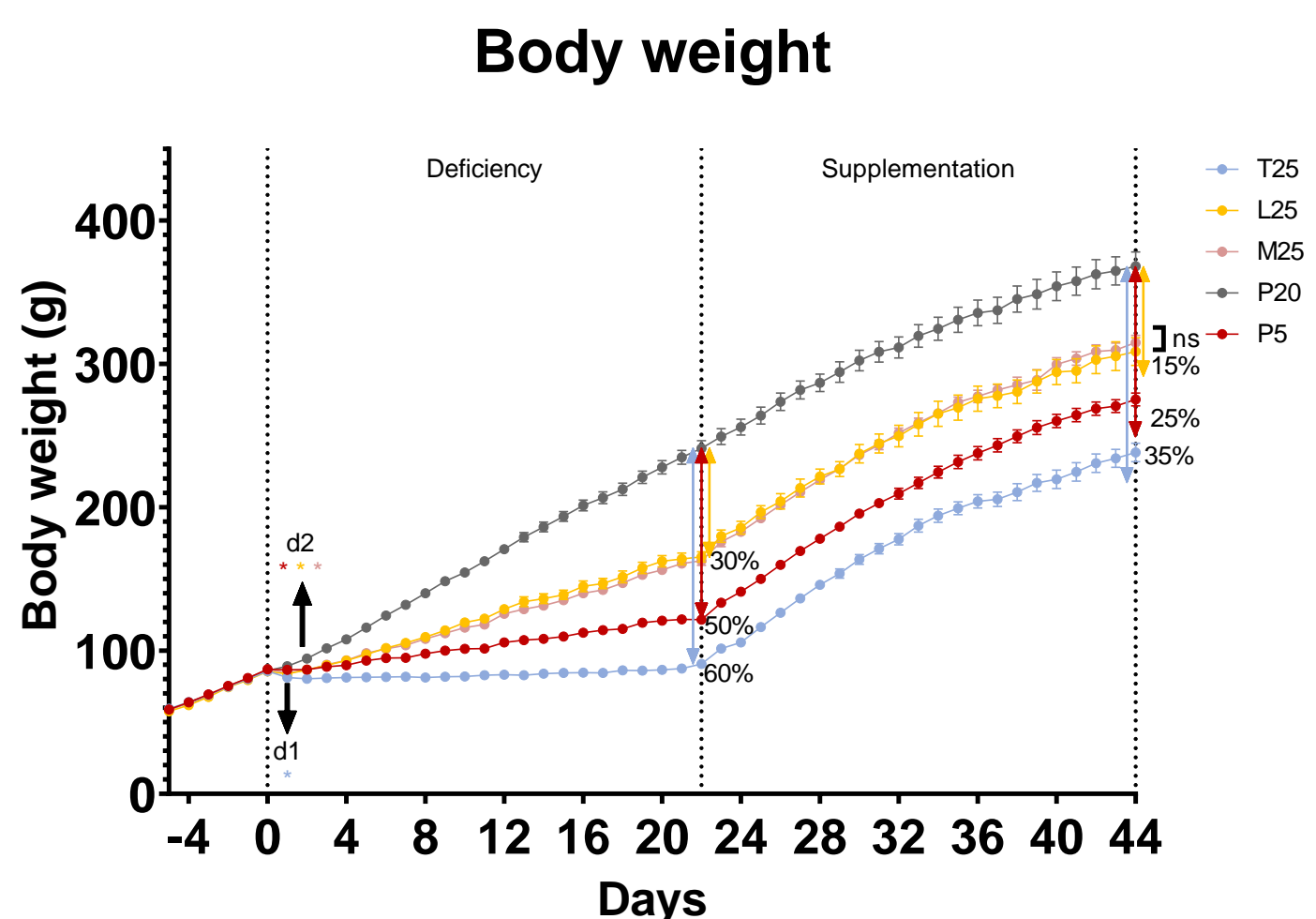
Methods
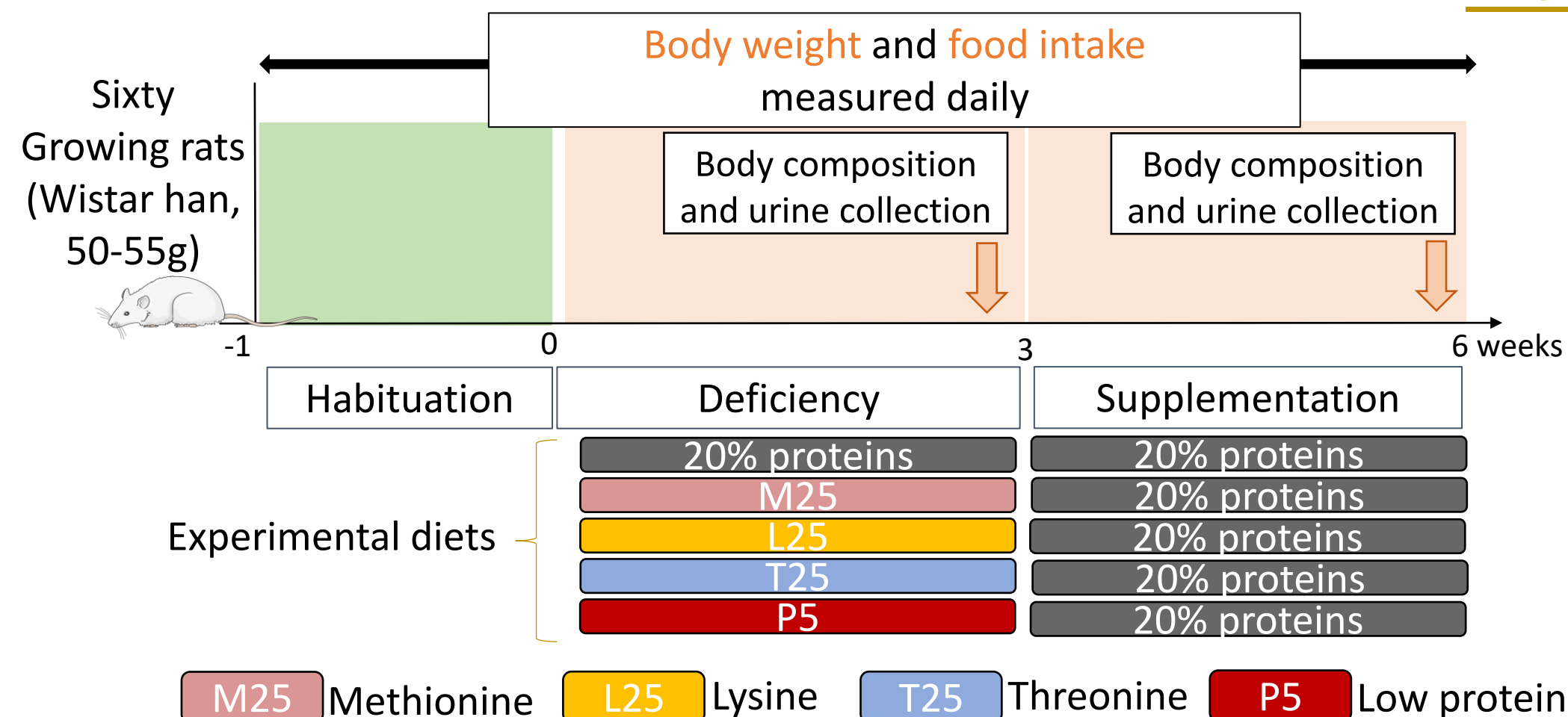
- Body weight and food intake (FI) were measured daily.
- 24h-urine was analyzed LC-MS metabolomic.
- Body composition was determined by EchoMRI.

🔍 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.

M25 Methionine | L25 Lysine | T25 Threonine | P5 Low protein

Results

Body weight

Diet effect ***
Phase effect **
Interaction ***

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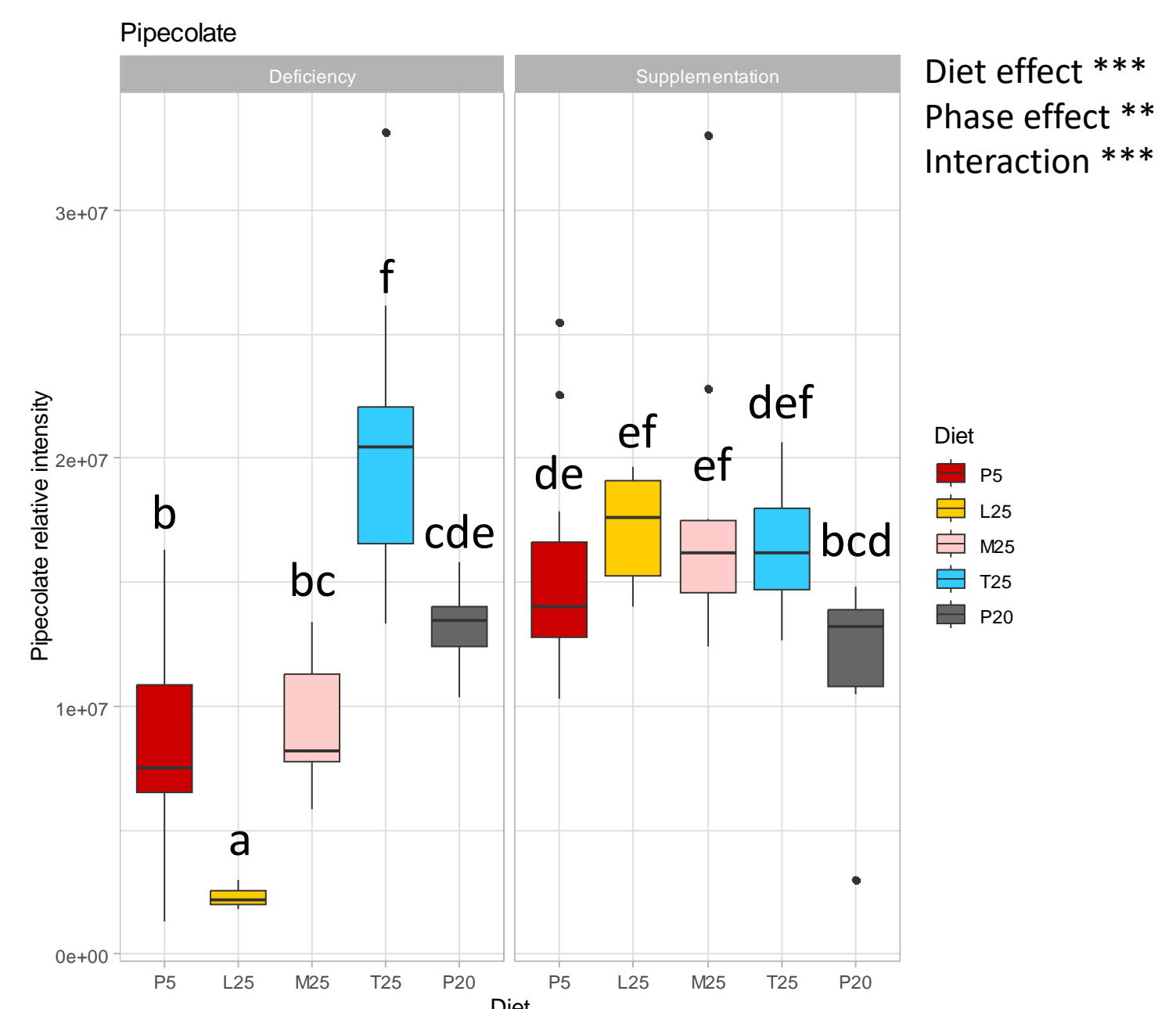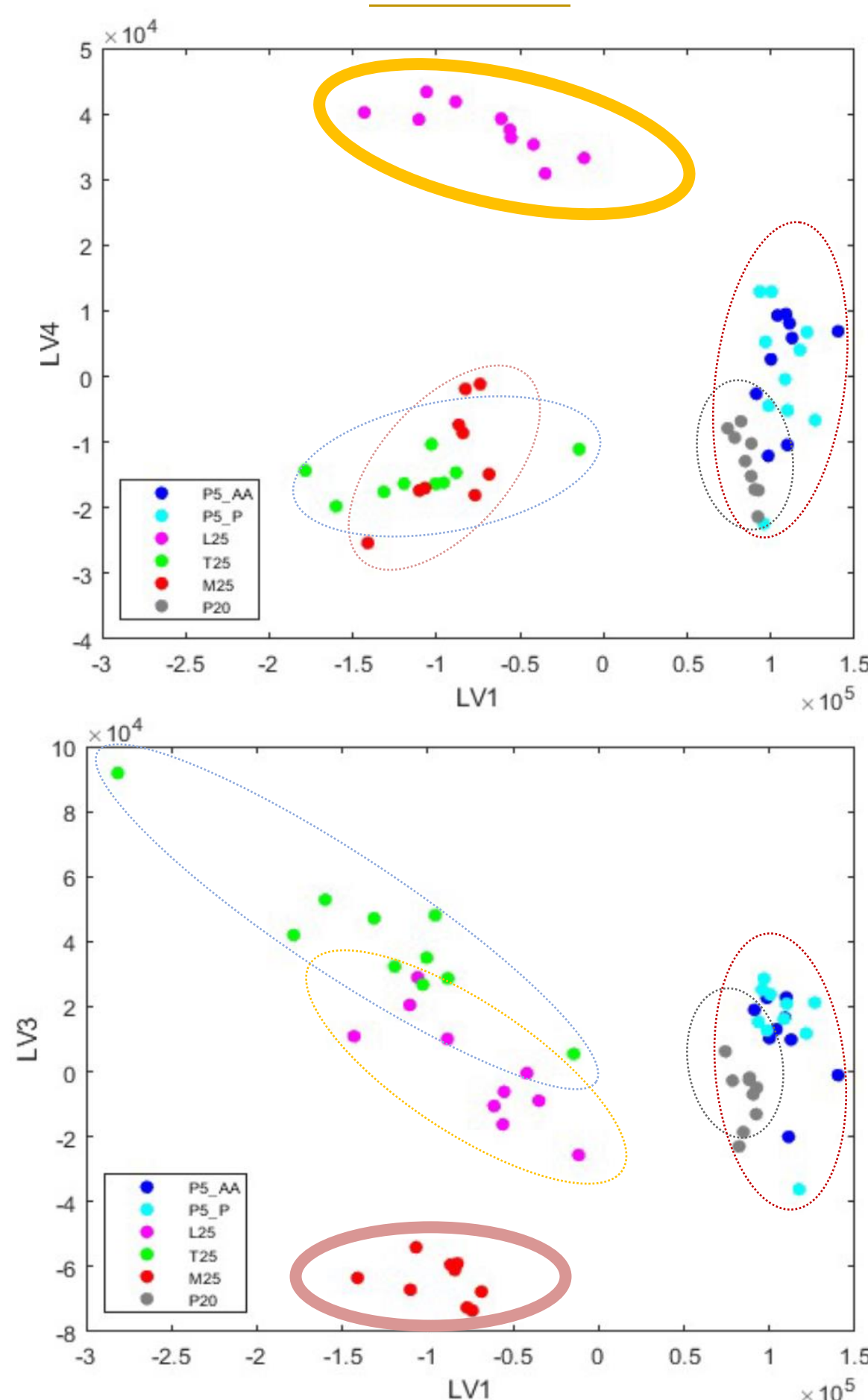
➢ Urinary metabolites from lysine degradation pathway, particularly pipecolate and N-N-N-Trimethyllysine, signed lysine deficiency.

➢ 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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