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Nutritional quality of proteins from two beef co-products as determined in the growing pig

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INTRODUCTION and OBJECTIVE

- The increasing demand for food and especially for protein, intensifies the search for **alternative protein sources**.
- The valorization of **co-products** not yet used as human foods, such as from meat production, is from this point of view promising.
- The present study aimed to evaluate the **nutritional quality** of two protein ingredients extracted from **the beef fat rendering process**.

METHODOLOGY

Diets :

- Two diets (iso-proteic) based on 10% protein :
 - Water Recovered Protein (WRP)**
 - Greasy Greaves Recovered Protein (GGRP)**
- Protein-Free (PF) diets : for endogenous N and AA flow determination

Experimental design : as recommended by FAO (2014)

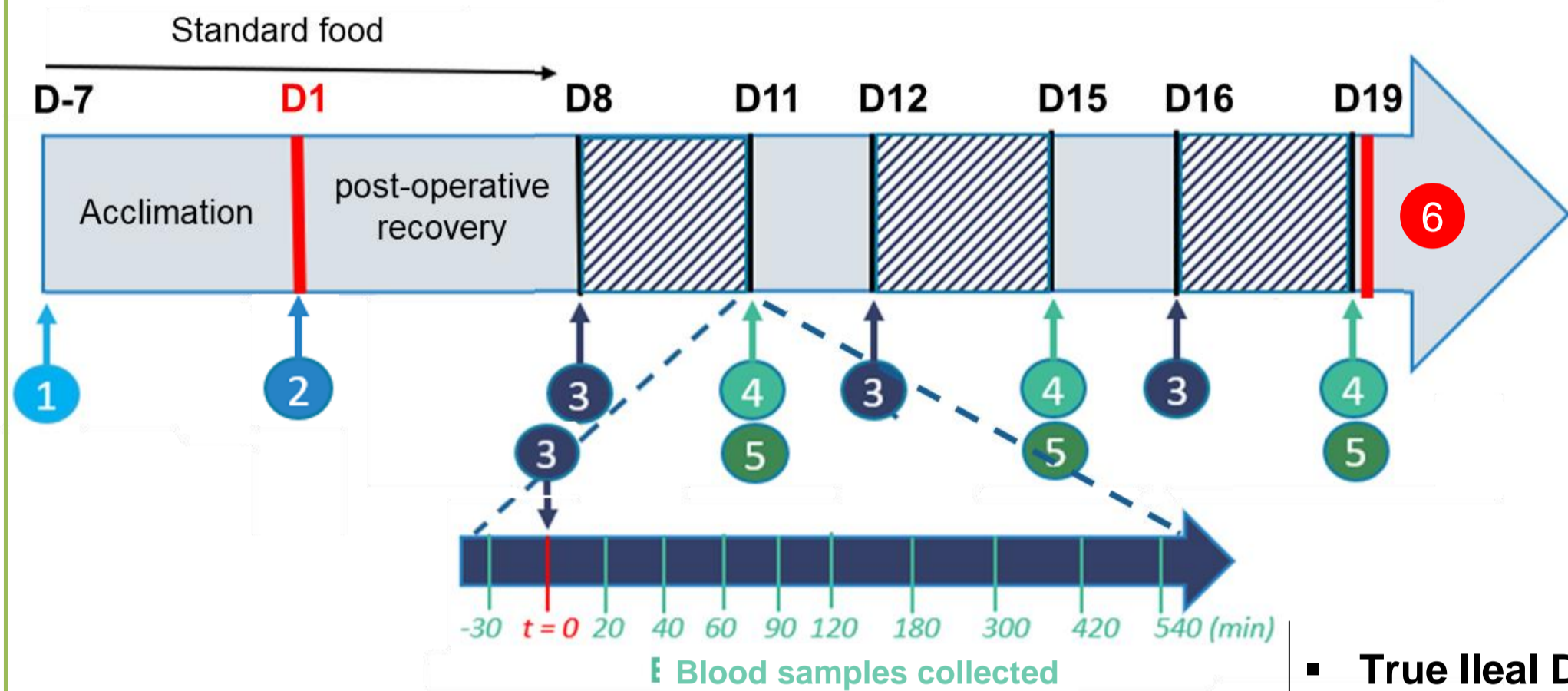
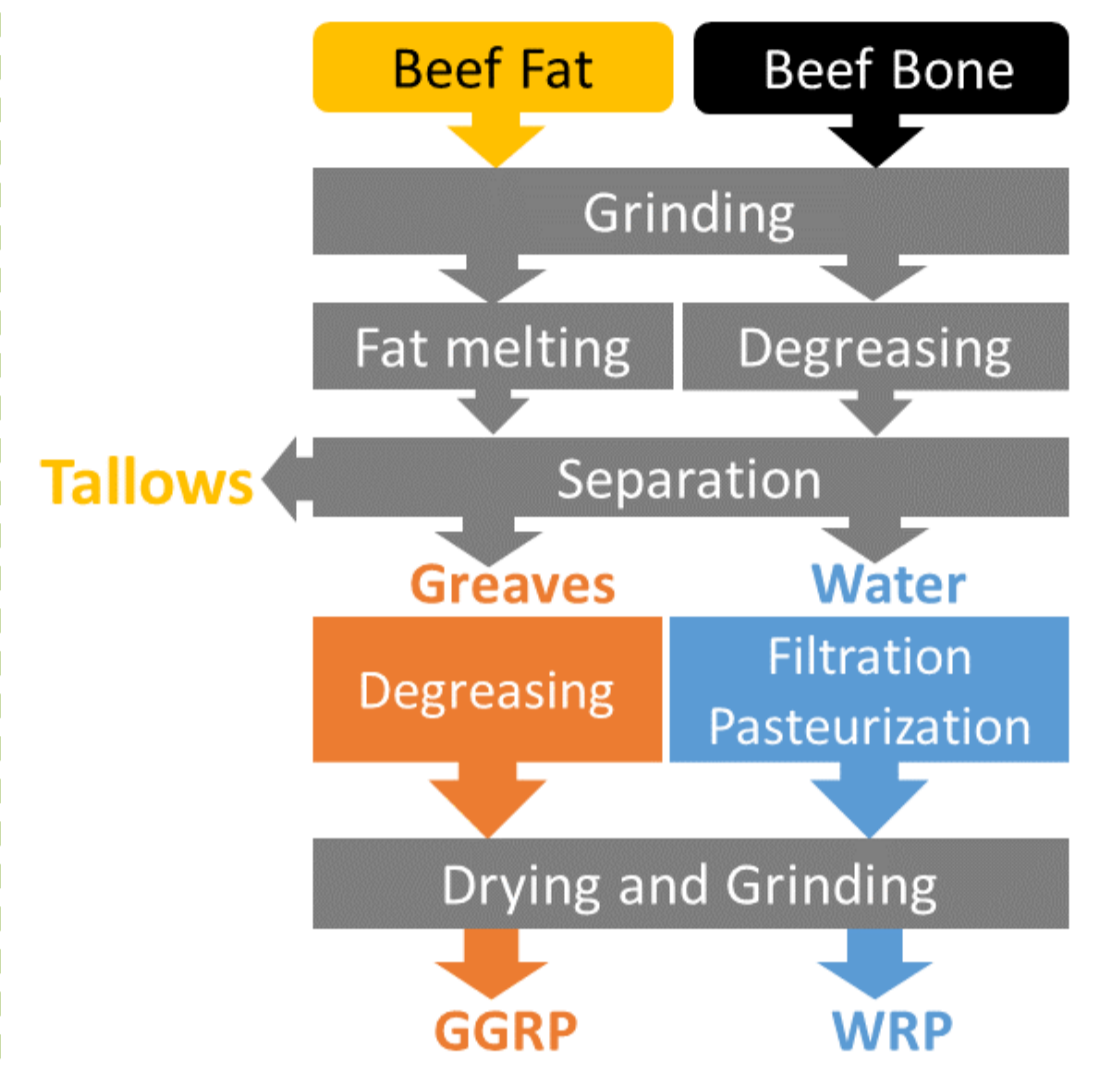


Diagram of the production process for GGRP and WRP



- Isolation in individual cages
- Surgery - ileal cannula and catheter (jugular vein)
- Meal habituation, 2.5 days, cross-over
- Collection of ileal digesta (for 9 hours)
- Blood collection (10 samples for 9 hours)
- Sample analyse; Total nitrogen (N, Dumas), Amino acid (acid hydrolysis & Cation exchange chromatography) and Tryptophan content (basic hydrolysis & HPLC, fluorimetry), Marker (TiO₂, ICP-OES)

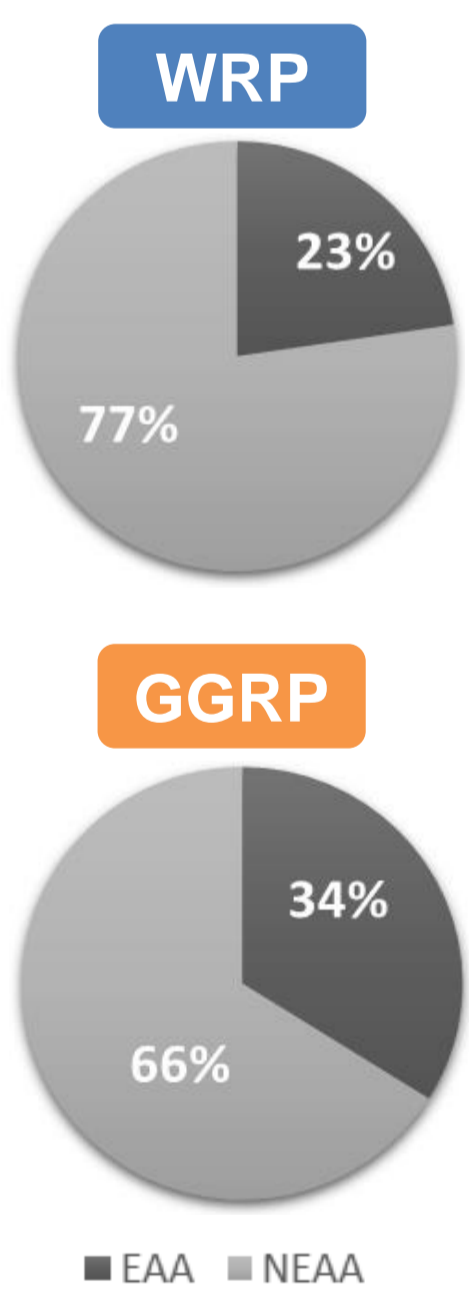
$$\text{True Ileal Digestibility (TID \%)} = 100 \times \frac{\text{dietary AA intake} - (\text{AAFI}_{\text{digesta}} - \text{AAFI}_{\text{endogenous}})}{\text{dietary AA intake}}$$

$$\text{Amino Acid Flow (AAFI)}_{\text{endogenous}} = \frac{\text{AA}_{\text{PF digesta}} \times \text{Marker}_{\text{PF diet}}}{\text{Marker}_{\text{PF digesta}}}; \text{AAFI}_{\text{digesta}} = \frac{\text{AA}_{\text{digesta}} \times \text{Marker}_{\text{diet}}}{\text{Marker}_{\text{digesta}}}$$

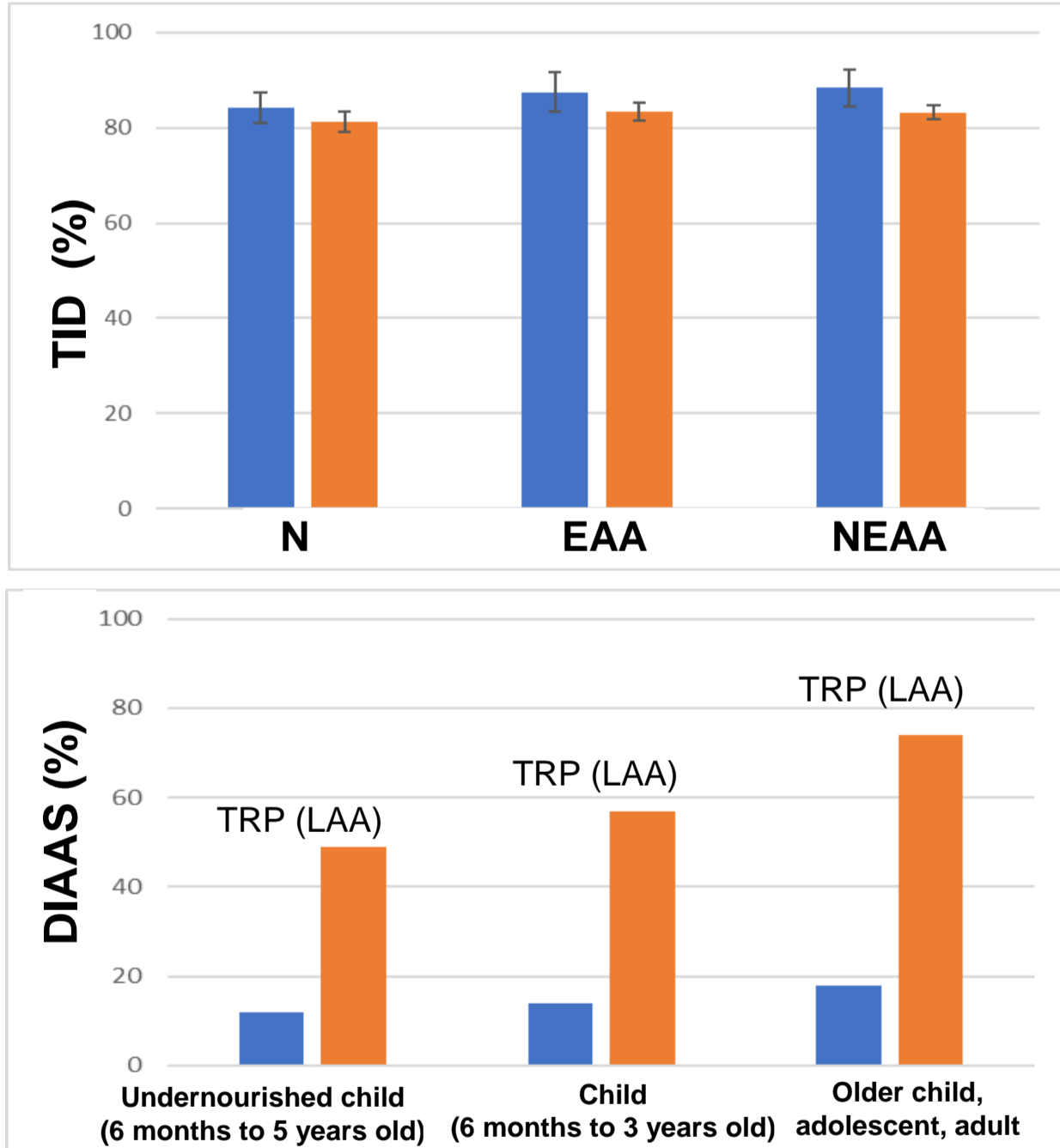
$$\text{Digestibility Ileal Amino Acid Score (DIAAS \%)} = \text{MIN} [100 \times \frac{\text{mg of the digestible dietary EAA in 1 g of the test protein}}{\text{mg of the dietary EAA in 1 g of the reference protein}}]$$

RESULTS

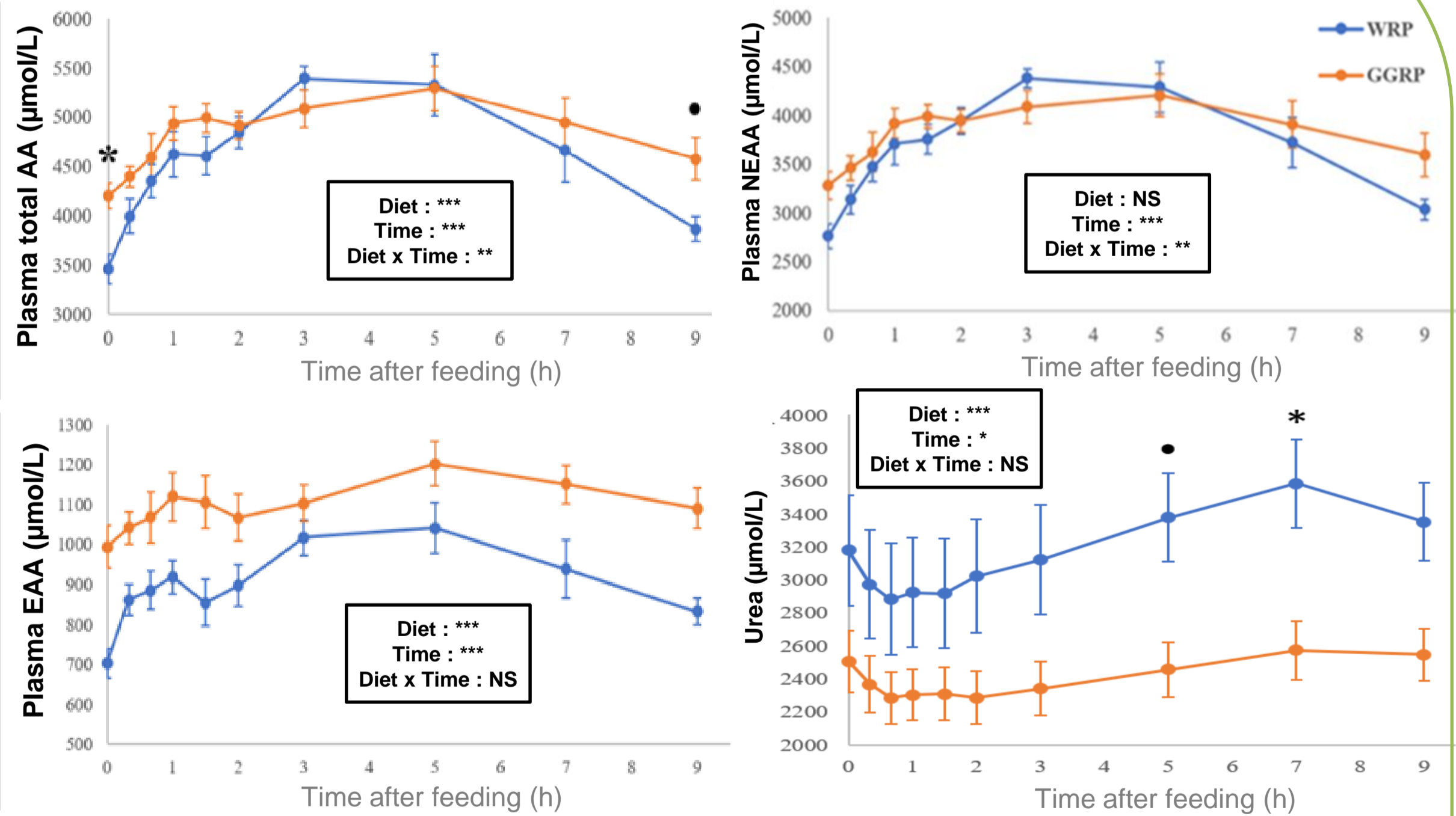
AA distribution of the diets



TID and DIAAS of WRP and GGRP



Postprandial AAs and Urea concentration in plasma of pigs fed WRP and GGRP



N : Nitrogen; EAA : Essential Amino Acids; NEAA : Non-essential Amino Acids; AA : Amino Acids; LAA : limiting amino acid; TRP: Tryptophan p < 0.001 (***), p < 0.01 (**), p < 0.05 (*) and p > 0.05 (NS) or p < 0.1 (*).

WRP is made up of less EAA than GGRP. WRP and GGRP proteins are **moderately digestible** (TID ~ 80%). The first limiting AA is tryptophan (TRP) for both protein ingredients. The DIAAS measurement classifies GGRP as a **good quality protein** but solely for older children, adolescents and adults population.

The **kinetics of AA** release differs between proteins, with postprandial plasma AA concentration reaching its maximal value earlier for WRP (3 hours) than for GGRP (5 hours). The difference in plasma urea concentration, indicates a greater level of **hepatic AA catabolism** and an **EAA deficits** for WRP than GGRP, in line with the greater imbalance in terms of EAA profile for WRP than GGRP.

CONCLUSION

- GGRP has a nutritional quality suitable to meet the needs of older children, adolescents and adults, while WRP should be supplemented with other protein sources rich in EAAs to fulfill the AA requirements.
- Postprandial kinetics of plasma AA and urea highlighted the higher efficiency of GGRP for protein muscle synthesis.