

Protein digestion kinetics of protein sources in pigs

H. Chen, P.A. Wierenga, A.J.M. Jansman



1. Introduction

Currently, the nutritive value of protein sources in diets for pigs is based on the composition and concentration of indispensable amino acids, and their digestibility up to the end of the ileum. These values, however, do not provide information on the digestion kinetics in the gastrointestinal tract (GIT). The kinetics of protein digestion may affect the postprandial appearance of amino acids and peptides in blood and their post-absorptive metabolism. For example, in humans fast digested dietary proteins such as whey protein show a faster postprandial appearance of amino acids in blood compared to more slowly digestible sources such as casein (Boirie et al., 1997).

The objective of this study was to evaluate protein digestion kinetics for various protein sources in pigs.

3. Results

- The postprandial concentrations of FAA showed two types of responses: a peak-like appearance (WG and PP) or a plateau-like appearance (SBM, RSM and IPM) (Fig 1).
- Peak-like appearance showed a relatively fast increase of FAA in the plasma after feeding while the disappearance of FAA from the plasma was fast as well. Plateau-like appearance showed a slower increase of concentration of FAA in plasma after feeding and the concentration stayed at its maximum for a longer period of time.
- Up to 120 min after feeding, WG had the highest AUC compared to other protein sources ($P < 0.001$) (Fig 2).

2. Material and Methods

Twenty boars (initial weight 32 ± 3.5 kg) were suited with an ear-vein catheter and housed individually in metabolic cages. Five experimental diets containing soybean meal (SBM), rapeseed meal (RSM), wheat gluten (WG), plasma protein (PP) or insect protein meal (IPM) as the only protein source were used. Diets were provided twice a day at a level of 2.5 times the maintenance requirement for energy. Blood samples were collected at 30 and 60 min before feeding and 30, 60, 90, 120, 150, 180, 240, 360 and 480 min after the provision of the morning meal. Postprandial concentrations of free amino acids and peptides (FAA) in the plasma were determined using the ninhydrin method. As a measure of quantitative postprandial appearance of FAA in blood, the area under (AUC) the curve was calculated using the trapezoidal method. The effect of protein source on AUC was analysed by ANOVA using the GLM procedure of SAS (version 9.3). A probability level of less than 5% was considered to be significantly different

4. Conclusion

WG and PM can be regarded as fast while SBM, RSM and IPM can be considered as more slowly digestible protein sources in growing pigs.

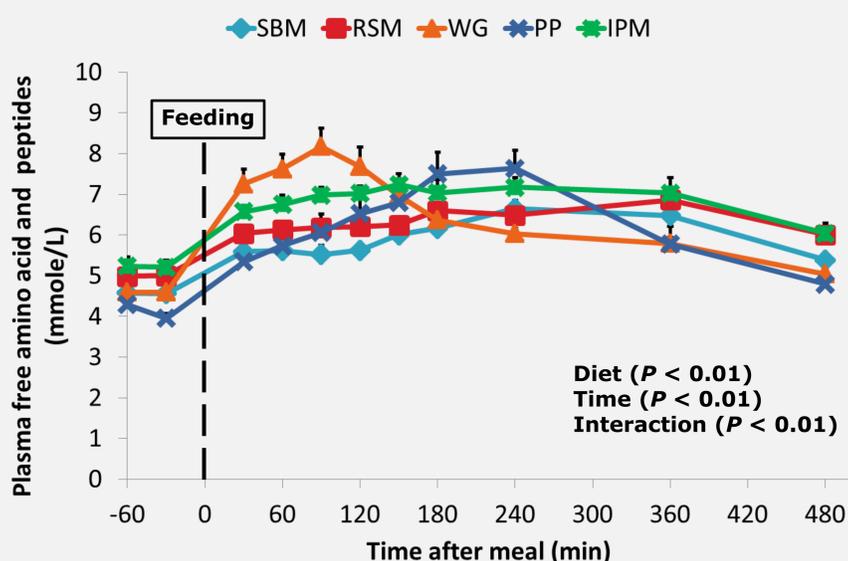


Figure 1. Postprandial concentration of free amino acids and peptides in the plasma of pigs fed diets containing soybean meal (SBM), rapeseed meal (RSM), wheat gluten (WG), plasma protein (PP) or insect protein meal (IPM) as the only dietary protein source.

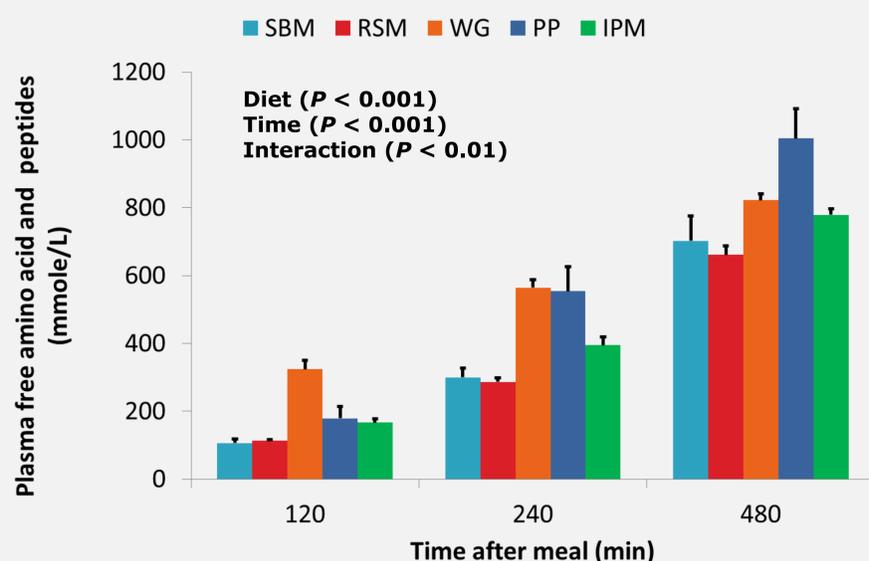


Figure 2. Quantitative postprandial appearance of free amino acids and peptides in systemic blood of pigs fed diets containing soybean meal (SBM), rapeseed meal (RSM), wheat gluten (WG), plasma protein (PP) or insect protein meal (IPM) as the only dietary protein source.

Reference

Boirie, Y., M. Dangin, P. Gachon, M.P. Vasson, J.L. Maubois, and B. Beaufrère, 1997. Slow and fast dietary proteins differently modulate postprandial protein accretion. Proceedings of the National Academy of Sciences 94, 14930-14935.



H. (Hsuan) Chen
Wageningen University, Animal Nutrition Group
Contact: hsuan.chen@wur.nl
M +31 (0)6 26591056
www.anu.wur.nl

Acknowledgements

The authors gratefully acknowledge the financial support from the Wageningen UR "IPOP Customized Nutrition" programme financed by Wageningen UR, the Dutch Ministry of Economic Affairs, Agriculture & Innovation, WIAS graduate school and Nutreco and Darling Ingredients International.