12. Use of diets' rheological parameters to predict digesta retention time throughout the gastrointestinal tract of growing pigs

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Digesta transit behaviour along the gastrointestinal tract (GIT) is influenced by its physicochemical characteristics. For feed formulation purposes, measuring these in whole diets may be useful to predict transit behaviour, despite the properties may be subject to change upon exposure to gastrointestinal processes. It was examined to what extent physicochemical characteristics (rheological parameters-RP and water binding capacity-WBC) of diets can explain digesta mean retention time (MRT) in the GIT of growing pigs. A database from 3 experiments including MRT values for the stomach, small (SI), and large (LI) intestine, of liquid and solid digesta, and RP obtained by oscillatory rheology plus WBC of the 22 diets, was used. First, significant ($P<0.05$) independent RP to describe MRT were selected based on variance inflation factors (VIF<10) and forward-backward-stepwise-MaxR selection methods, for each segment and digesta phase. Then, regression models for MRT of solids, liquids, and standardized phase differences in each segment, including combined RP+WBC vs only WBC as predictor variables, and diet as random effect, were compared based on relative likelihood (RL). Although the relevant RP in the combined model varied among segments and digesta phases, gastric MRT of solids increased with RP associated with gel strength. WBC alone did not correlate with solids MRT in stomach ($p=0.327$) or proximal SI ($p=0.138$); nor with liquids MRT ($p=0.161$) in this last segment. However, even if WBC positively correlated with liquids MRT ($R=0.391$; $p<.001$) and negatively with the phase difference ($R=-0.660$; $p<.001$) in the stomach, variation in MRT could be better explained by a model including combined RP+WBC (RL=3e-06). In conclusion, combined RP improved digesta MRT predictions in pigs compared with models that only consider WBC.

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