Rate of digestion of gluten-derived immunogenic peptides along the gastrointestinal tract of the growing pig model

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Background:

Human gastrointestinal proteases cannot effectively hydrolyse gluten proteins, hence the release of proline- and glutamine-rich peptides, some of which cause immune responses in genetically predisposed individuals. Exogenous enzymes play a role in enhancing the digestion of gluten peptides in the gastrointestinal tract (GIT).

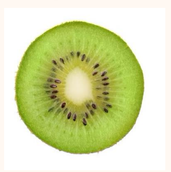
Poor gastric digestion of gluten proteins has been observed *in vivo*. However, to date, there is no information available on the rate of digestion of gluten immunogenic peptides along the GIT.

Objective:

To investigate the digestion of wheat proteins and gluten-derived immunogenic peptides throughout the GIT of growing pigs with and without the presence of the exogenous enzyme actinidin.

Method:

- Fifty-four entire male pigs (21.2 ± 2.1 kg bodyweight) were fed whole wheat soda bread, either supplemented with green kiwifruit (containing actinidin) or yellow kiwifruit (without actinidin, control).



***Actinidia deliciosa* cv. Hayward (with actinidin)**

***Actinidia chinensis* cv. Hort16A (no actinidin)**

- Pigs were euthanised at 0, 20, 60, 120, and 300 min post-feeding (n=6/time point and diet combination) (Figure 1).

Analysis:

All GIT contents were analysed for the degree of hydrolysis of wheat proteins (OPA assay), *a*mount of residual gluten epitopes (competitive ELISA) and *g*luten peptides – *LC-MS/MS.*

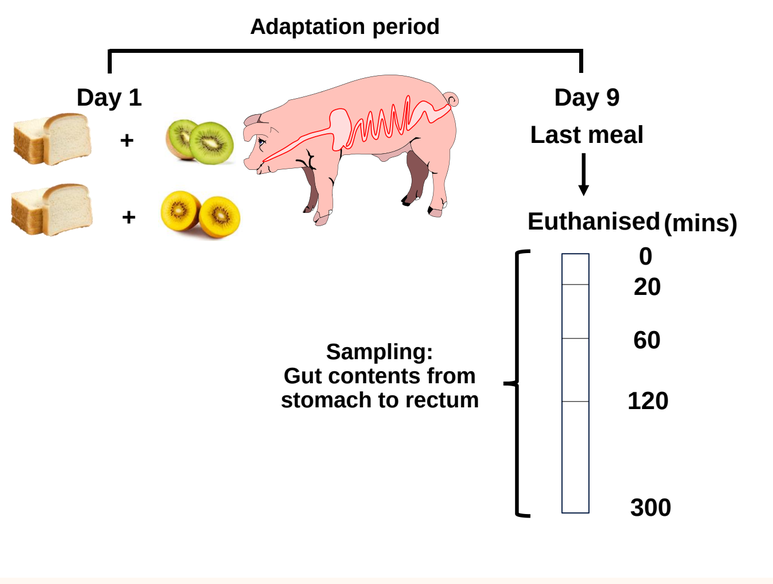


Figure 1. Cartoon of the study

Conclusion:

- Immunogenic gluten peptides are **NOT EFFICIENTLY DIGESTED** in the GIT.
- Consumption of green kiwifruit along with a gluten-containing meal demonstrated the ability to **REDUCE** the presence of these peptides in the GIT.

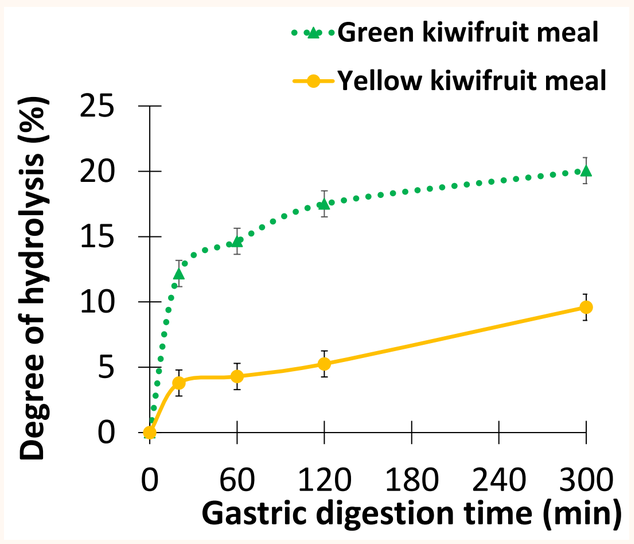


Figure 2. Degree of hydrolysis of wheat proteins in the stomach

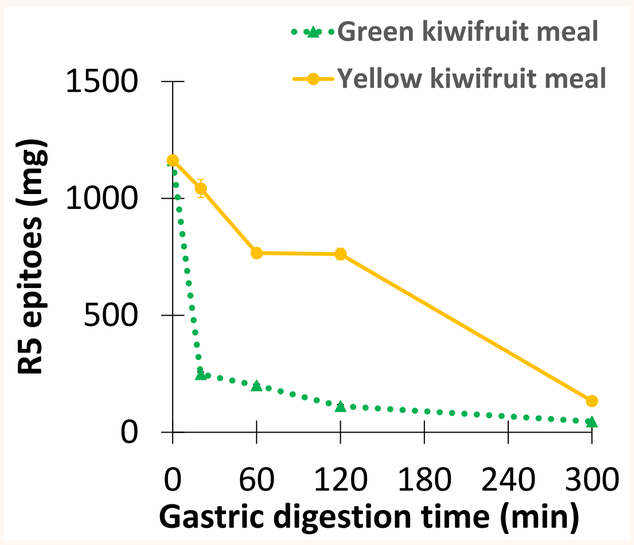


Figure 3. Amount of residual R5 epitopes in the stomach

Key Findings:

- The rate of gastric digestion of wheat proteins (0.07% vs 0.03%/min; P<0.01; Figure 2) and the rate of disappearance of R5 epitopes (+0.3 mg/min; P<0.01; Figure 3) were significantly higher in the pigs fed the actinidin-containing diet.
- Actinidin reduced the presence of R5 epitopes in the small intestine (-2.2 mg/min; P<0.05) and the amount of R5 epitopes released into the large intestine (2.9-fold lower; P<0.01) (data not shown).
- Actinidin supplementation increased the rate of disappearance of R5 epitopes (13.0 vs 6.4 mg/min; P<0.05) (Figure 4) in the entire GIT.
- Pigs fed the actinidin-containing diet had on average 56% lower amounts (P<0.05) of targetted immunogenic peptides in the stomach compared to those fed the actinidin-free diet (Table 1).

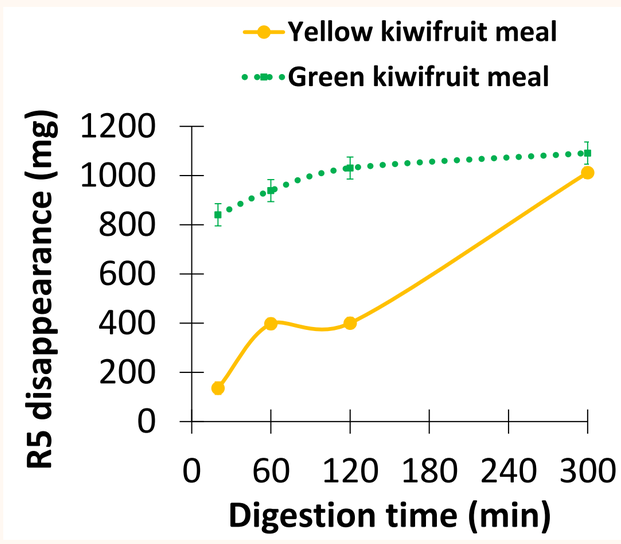


***Figure 4. D*isappearance of R5 epitopes in the entire GIT lumen**

Table 1. Number of immunogenic gluten peptides identified from untargeted LC-MS/MS in the stomach chyme

	Kiwifruit meal	
Time	**Yellow**	**Green**
60 min	**57**	**28**
120 min	**59**	**32**