

## Research Summary

### **The effect of rate and extent of starch digestion on performance, physiology and behaviour of broilers and laying hens**



#### Purpose of the Study

Past research has demonstrated that the inclusion of starch that is more slowly digested in broiler diets improved feed efficiency and growth. The reason for this is still unknown, but understanding it could help us formulate more accurate diets to achieve the best performance. One possible explanation is that as starch is more slowly digested, it reaches the distal sections of the small intestine, affecting the microbial community and activating enteroendocrine L-cells, which would reduce passage rate, increase digestibility and increase satiety through the secretion of hormones such as GLP-1 and PYY, which affect feed intake.



The goal of this study was to assess the effect of starch characteristics on broiler and laying hen performance and physiology.

#### What we did

5,916 Ross 308 broilers and 720 Lohmann LSL-Lite hens were used for this study. We formulated the appropriate semi-purified wheat starch-soy bean meal-porcine meal-based diets. To create the remaining five experimental diets, 20, 40, 60, 80 or 100% of the wheat starch was replaced by semi-purified pea starch, which is more slowly digested. All six diets were fed ad libitum. Data was collected assessing performance, L-cell activation and feeding behaviour.

## What we found

*Performance.* Low levels (25%) of pea starch improved feed efficiency in broilers and laying hens. Pea starch linearly increased egg production in laying hens and may have shifted the allocation of resources from fat to muscle in broilers.

*Presence of L-cell activators.* Pea starch increased the presence of starch in the distal small intestine and short-chain fatty-acids while lowering pH, suggesting a shift in microbial population and the presence of L-cell activators.

*Indirect evidence of L-cell activation.* Pea starch increased digestive tract weights and contents. An increase or no effect on total passage time was observed. However, the suggestion of proximal digestive tract passage time increasing in laying hens was found. Feed intake decreased in male broilers, increased in laying hens and did not change in female broilers. No effect on broiler feeding behaviour was found, while hens showed evidence of hunger with pea starch.

*Direct evidence of L-cell activation.* No effect of pea starch on gene expression or GLP-1 and PYY serum values was found in broilers. Serum PYY was maximized at 34% pea starch level in laying hens, while GLP-1 increased linearly with pea starch.



## In conclusion

The benefit of including low levels of slowly digested starch was confirmed in broilers and laying hens. The mechanism responsible is still unclear. Broilers did not seem to respond to the presence of L-cell activators when slowly digested starch was fed, but laying hens showed evidence of L-cell activation. These results suggest that chicken L-cell physiology might differ from that known in mammals.



## Who we are



**Dr. Eugenia Herwig** is a Post-Doctoral Fellow working with Dr. Karen Schwean-Lardner. This research was for her Ph.D. Thesis (Completed in July 2018).



**Dr. Karen Schwean-Lardner** is an Associate Professor at the University of Saskatchewan. Her research focuses primarily on the management and welfare of laying hens, broiler chickens, and turkeys.



**Dr. Hank Classen** is a Distinguished Professor Emeritus at the University of Saskatchewan. His research focused on poultry nutrition and management.

This research was funded by the NSERC, Canadian Poultry Research Council, Aviagen, Chicken Farmers of Saskatchewan, Saskatchewan Egg Producers, Saskatchewan Turkey Producers, Prairie Pride, Sofina, SHEP, Poultry Industry Council and The University of Saskatchewan.