The Effect of Resistant Starch Type II on Satiety Hormones of Fasting Dogs

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Introduction

In previous research which produced corn-based dog food kibbles by extrusion, the level of resistant starch increased with decreasing amounts of thermomechanical energy (Peixoto et al., 2017). Increased resistant starch has been demonstrated to improve canine colonic fermentation with elevated butyrate production (Ribeiro et al., 2019), and to slow the rate of digestion (Murray et al., 2001). Beyond the benefit identified for the colonocyte with increased butyrate, the slower digestion of starch has beneficial health implications for glucose metabolism. Satiety has also been linked to the ingestion of fermentable fibers and resistant starches in monogastric animals (Bosch et al., 2009; Da Silva et al., 2014).

Hypothesis & Objective

It was our hypothesis that increasing levels of resistant starch (RS) due to processing at lower thermomechanical energy would result in increased cell signaling for satiety. The study objective was to determine the effect of diets with graded levels of RS on plasma hormones associated with hunger and satiety.

Materials and Methods

- The experimental diet contained 65.4% corn and 20% chicken meal and met the nutrient profile for adult dogs at maintenance (AAFCO, 2019). The diet was extruded at three cooking levels to produce low, medium and high RS diets (LRS, MRS, HRS, respectively).
- Twenty-four (9 male, 15 female) adult Beagle dogs were fed the LRS, MRS and HRS foods in a 3x3 William's Latin square design (n=24) for three periods of 28 days each. Blood was collected on days 27 and 28 at 0700 following an overnight fast. Plasma was separated and frozen at -70°C until analyses.
- Starch fractions were determined with an assay kit (K-DSTRS; Megazyme Inc., Ireland).
- Satiety hormones were measured in dog plasma using an ELISA kit (Milliplex Map Canine Gut Hormone Magnetic Bead Panel - Endocrine Multiplex Assay; MilliporeSigma, Burlington, MA, U.S.A.).
- Hormone data are reported as pg/mL and were converted to natural log (base e) to approximate normal distribution before statistical analysis.
- These data were analyzed as a mixed model (GLIMMIX; SAS 9.4, Cary, NC) with differences noted at $P < 0.05$. A Tukey post-hoc adjustment was applied.

Results

Table 1. Satiety hormones (mean ± standard error of the mean) in plasma of fasting dogs fed the low (LRS), medium (MRS) and high (HRS) RS diets.

	LRS	MRS	HRS	*P* (F)
[1]Starch fractions				
TS, %	54.3 ± 0.94	52.6 ± 0.94	52.2 ± 0.94	0.3046
RDS, %	45.9 ± 1.53	42.2 ± 1.53	41.1 ± 1.53	0.1456
SDS, %	2.02 ± 1.072	2.98 ± 1.072	6.41 ± 1.072	0.0610
RS, %	0.650^{b} ± 0.0926	0.940^{ab} ± 0.0926	1.057^{a} ± 0.0926	0.0506
[2]Satiety Hormones				
Ghrelin, ln	1.565 ± 0.0229	1.597 ± 0.0226	1.582 ± 0.0227	0.1295
Leptin, ln	5.28 ± 0.2299	5.51 ± 0.2290	5.38 ± 0.2299	0.1263
GIP, ln	1.068 ± 0.1176	1.035 ± 0.1176	1.052 ± 0.1168	0.9221
GLP-1, ln	0.974 ± 0.1556	1.144 ± 0.1343	1.046 ± 0.1292	0.3291
Glucagon, ln	1.330 ± 0.0284	1.337 ± 0.0283	1.336 ± 0.0283	0.7221
Insulin, ln	4.07^{b} ± 0.1616	4.31^{ab} ± 0.1599	4.46^{a} ± 0.1599	0.0237
PP, ln	3.97 ± 0.1522	3.96 ± 0.1507	4.06 ± 0.1507	0.6649
PYY, ln	4.63 ± 0.0555	4.66 ± 0.0551	4.67 ± 0.0551	0.6029

[1]TS= total starch, RDS= rapidly digested starch, SDS= slowly digested starch, RS= resistant starch.
[2]GIP= , GLP-1= glucagon-like peptide 1, PP= pancreatic polypeptide, PYY= peptide YY.
Satiety hormones measured as pg/mL and converted to natural log (base e).

- There was a tendency (P= 0.06) for greater SDS in the HRS diet. The HRS had almost double RS compared to the LRS diet.
- The satiety hormones ghrelin, leptin, GIP, GLP-1, glucagon, PP and PYY were not different among treatments.
- Insulin was the only hormone which increased in fasted dogs fed the HRS in comparison to LRS.

Conclusion

The experimental diets did not affect plasma hormones associated with satiety at fast.

Acknowledgement

We would like to thank Hill's Pet Nutrition for financial support of this project.