Chemical Composition and In Vitro Fermentation Characteristics of Legumes Using Canine Fecal Inoculum

Zac T. Traughber[1], F. He[1], J. M. Hoke[2], G. M. Davenport[2], M. R. C. de Godoy[1]

[1] Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, USA 61801

[2] Archer Daniels Midland Company, Decatur, IL, 62526

Background

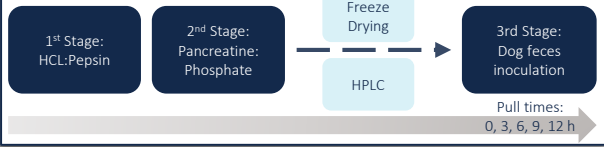
- Legumes are a popular grain-free alternative used as carbohydrate and protein sources in canine diets.
- 3-stage *in vitro* models mimic gastrointestinal digestive and fermentative processes.
- Legume digestibility has been evaluated in canine diets.
- Currently, limited information on fermentative characteristics in a canine model.

Objectives

1. To determine the chemical composition of select legume sources.
2. To quantify and compare the fermentative profile of select legumes using canine fecal inoculum.

Materials and Methods

- Five legume varieties: whole yellow peas (**WYP**), green lentils (**GL**), black bean grits **(BBG**), navy bean powder (**NBP**), garbanzo beans (**GB**), were evaluated and compared to a control, beet pulp (**BP**).
- Fecal inoculum derived from 4 female beagles on Dog Chow.
- Triplicate samples of each substrate (0.5g) were subjected to a 6-hour digestion with HCL-pepsin and an 18-hour digestion with a pancreatin-phosphate buffer to mimic in vivo conditions.
- Following *in vitro* digestion, samples were lyophilized and fermented in fecal inoculum for 0, 3, 6, 9, or 12 hours.
- pH was immediately recorded, and gas and short-chain fatty acid concentrations were determined through gas chromatography.



Results

- Excluding fiber, substrates have similar macronutrient compositions.
- Free sugars: Sucrose, Stachyose; Hydrolyzed sugars: Glucose.
- Most changes occurred following 9, 12 h of fermentation.
- Substrates have similar fermentative profiles to **BP**.
- Net negative changes in pH were observed in all substrates.
- **BP** had greater H_2 production after 9, 12 h and greater CH_4 after 12 h.
- **WYP, GL, BBG**, have similar SCFA production values as **BP**
- Substrates tended to have greater BCFA production values than **BP**.

Table 1. Chemical Compositions of Select Legumes

%	WYP	GL	BBG	NBP	GB
Moisture	9.1	10.3	8.3	8.0	8.3
		------- Dry matter basis -------			
GE, kcal/g	4.5	4.5	4.5	4.4	4.7
Ash	2.7	2.6	3.8	3.2	3.2
CP	23.0	27.1	25.9	20.8	22.8
AHF	2.4	2.5	3.1	3.9	6.9
IDF	33.2	31.6	19.4	16.9	23.7
SDF[1]	1.7	0.1	5.8	7.5	2.2
TDF	34.8	31.8	25.2	24.4	25.5
Total starch	56.4	57.5	39.6	45.0	--
Resistant	4.0	2.6	3.5	3.9	--
Non- resistant	52.4	54.9	36.1	41.1	--

Figure 1. pH Change of Select Legumes using Canine Fecal Inoculum

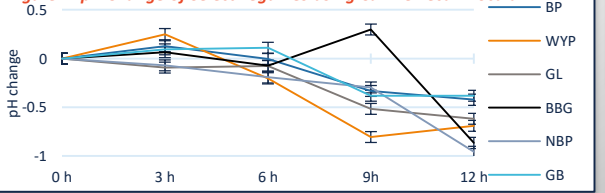
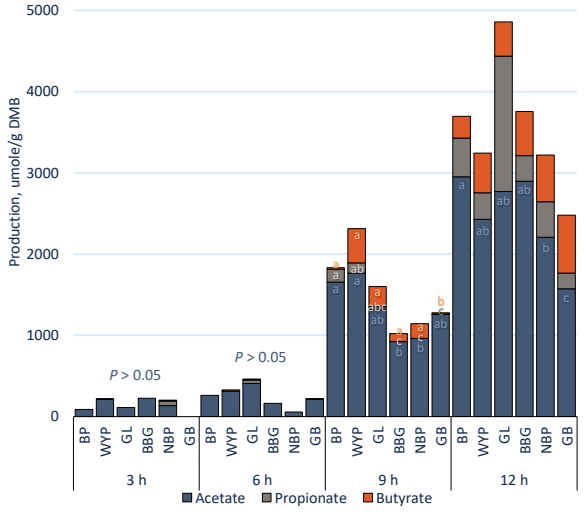


Figure 2. Short-Chain Fatty Acid Production of Legumes using Canine Fecal Inoculum



Conclusions

Legumes are good sources of dietary protein; however, they are also fiber-rich ingredients that appear to be slowly fermentable in vitro, which may have beneficial implications on the ratios of saccharolytic to proteolytic fermentation towards the distal colon in vivo.

Acknowledgements

Graduate Students of the Godoy ICAN Program

Archer Daniels Midland Company Pet Nutrition Team