Chemical Composition of Enzymatically Digested Food Waste Byproducts

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Abstract

Fruit, vegetable, meat, and dairy food waste was collected from supermarkets and processed using enzymatic digestion, pasteurization, and stabilization. The screened and separated final byproduct was 90% liquid food waste (LFW) and 10% solid food waste (SFW). Chemical composition of the LFW and SFW was determined as a first step for their use in diets of pigs. Thus, 11 batches of each of LFW and SFW were collected and analyzed for dry matter (DM), crude protein (CP), amino acids (AA), ash, ether extract (EE), crude fiber (CF), acid detergent fiber (ADF), neutral detergent fiber (NDF), acid detergent lignin (ADL), fructose, glucose, sucrose, maltose, stachyose, verbascose, starch, macro-minerals, micro-minerals, and fatty acids. On a DM basis, LFW contained 22.05% DM, 22.05% CP, 36.58% EE, 0.48% Ca, 0.33% P, 7.50% glucose, 5.14% fructose, 3.38% ADF, 5.81% NDF, and 65.46% unsaturated fatty acids. SFW contained 28.98% DM, 19.53% CP, 34.43% EE, 2.69% Ca, 1.12% P, 5.61% glucose, 3.71% fructose, 17.27% ADF, 25.51% NDF, 63.63% unsaturated fatty acids on a DM basis. Concentrations of these components in LFW were compared with those in SFW using t-test in SAS. Results indicated that DM, ash, CF, Ca, P, Mg, S, Cu, Zn, Mn, starch, ADF, NDF, ADL, hemicellulose and cellulose were greater ($P < 0.05$) in SFW than in LFW. Concentrations of all indispensable AA and all dispensable AA except for glycine were greater ($P < 0.05$) in LFW than in SFW. While both LFW and SFW contain enriched nutrients for non-ruminant animals, the high concentration of fiber components in SFW will limit the use of this byproduct in nursery pigs. However, the combination of LFW and SFW will dilute the fiber content, and thereby balance nutrients for both nursery and growing pigs. The relatively high concentration of fat will probably limit the inclusion rate of both byproducts in late-finishing pig diets. Further research will be conducted to evaluate the growth performance of nursery and growing-finishing pigs by feeding the combination of LFW and SFW.

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Introduction

- Approximately 60% of food waste is generated by consumers (Griffin et al., 2009)
  - 28% of food waste are composted and donated
  - Over 72% are landfilled
- Traditional feed ingredients such as corn and soybean meals are becoming more expensive over time
- Complex diets are often fed to livestock animals (e.g. pigs) to take advantages of less expensive feed ingredients
- Processed food waste may potentially be a nutritious animal feed ingredient (Lundy and Parrella, 2015)

Objective

- To determine the chemical composition of the enzymatically digested food waste

Materials & Methods

- Food waste collected from local grocery
- Food waste underwent enzymatic digestion, pasteurization, and stabilization to become a liquid sludge with two layers (Pandey et al., 2015)
  - Liquid on top layer (90% of total yield volume)
  - Solid on bottom layer (10% of total yield volume)
- 22 sampled collected from 11 batches of digested food waste, including 11 liquid samples and 11 solid samples
- Samples were stored at -20°C before analysis
- Chemical composition analysis: proximal analysis, amino acids, macro-minerals, micro-minerals, carbohydrates, fatty acid profiles
- T test was used to compare the chemical compositions between liquid and solid portion of the enzymatically digested food waste

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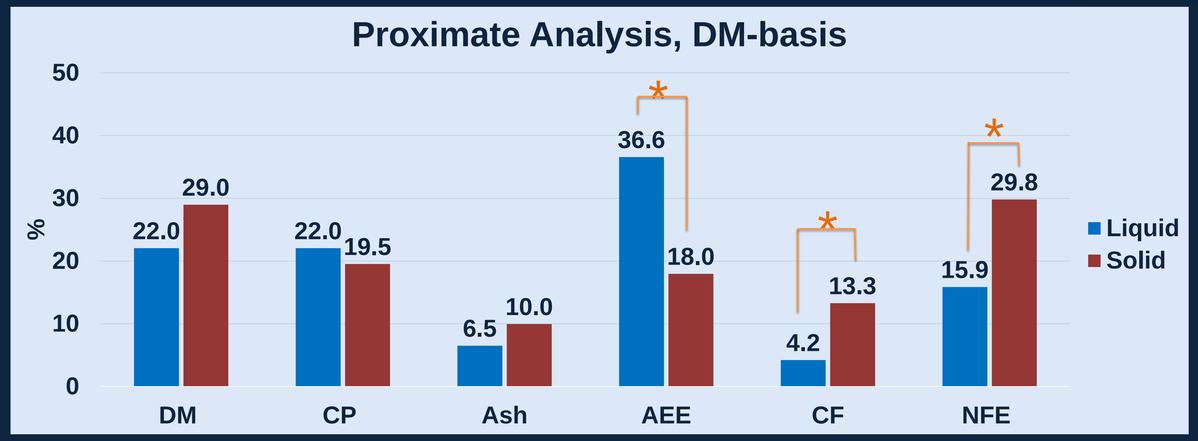
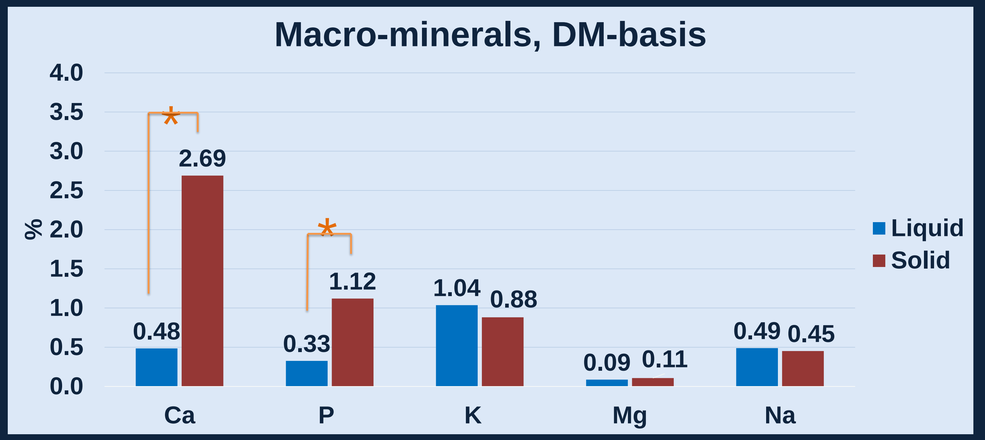
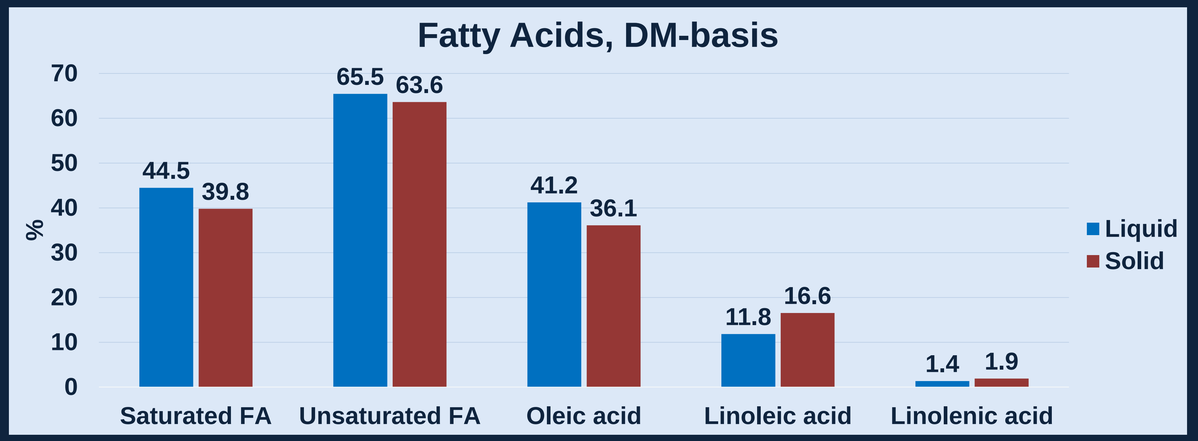
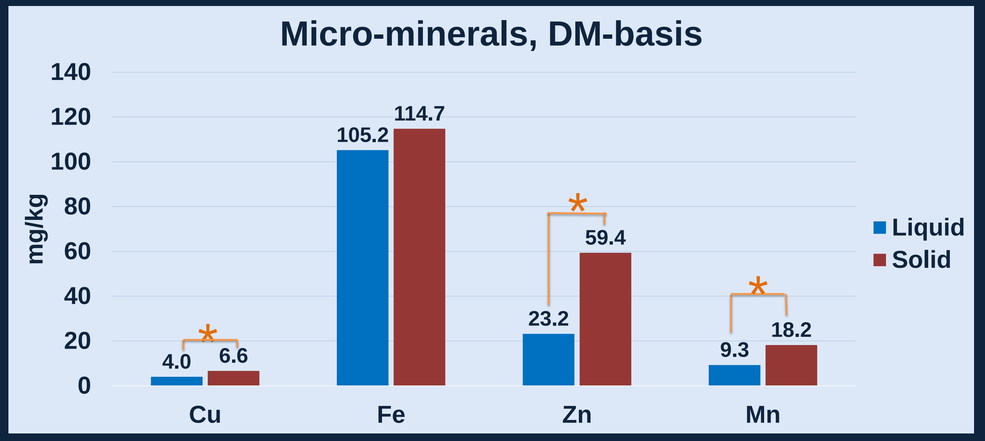
Results









DM: Dry Matter;
CP: Crude Protein;
AEE: Acid-Hydrolyzed Ether Extract
CF: Crude Fiber
NFE: Nitrogen-Free Extract

* $P < 0.05$

Values represent 11 observations

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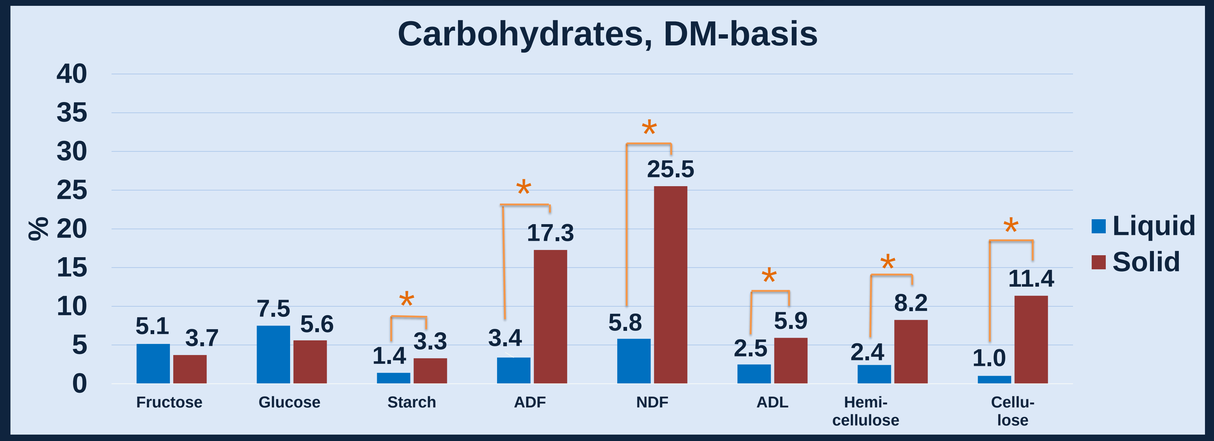

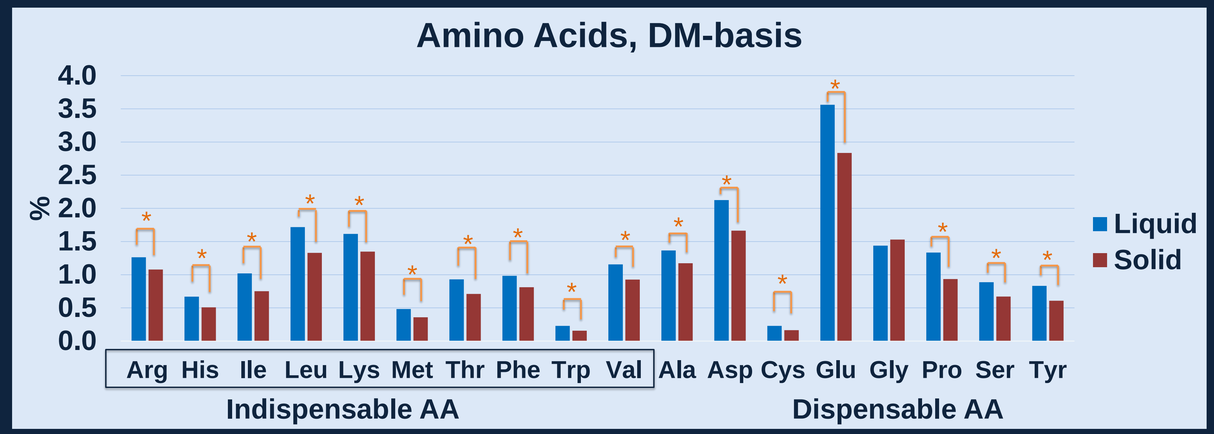

Values represent 11 observations. ADF, acid detergent fiber; NDF, neutral detergent fiber; ADL, acid detergent lignin,

* $P < 0.05$

Conclusions

- Both liquid and solid food waste contain enriched nutrients for non-ruminant animals; however, the high concentration of fiber components in solid food waste will limit the use of this byproduct in nursery pigs
- The combination of liquid and solid food waste will dilute the fiber content, and thereby balance nutrients for both nursey and growing pigs
- Further research will be conducted to evaluate the growth performance of nursery and growing-finishing pigs by feeding the enzymatically digested food waste without separating the liquid and solid portions

References

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