California Animal Nutrition Conference
May 2-3 2018

Enzymatically digested food waste as feed for growing-finishing pigs

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ABSTRACT

Enzymatic digestion is a technology that can be used to convert food waste from supermarkets into pasteurized liquid pig feed. The objective of this experiment was to examine the growth performance, visceral mass, carcass characteristics, meat quality, and fatty acid profile of growing and finishing pigs fed with enzymatically digested food waste. Fifty-six crossbred pigs (approximately 32.99 kg BW) were randomly assigned to one of 2 dietary treatments with 7 replication pens and 4 pigs per pen. A 3-phase feeding program was used with d 0 to 28 as Phase 1, d 28 to 53 as Phase 2, and d 53 to 79 as Phase 3. The 2 dietary treatments were control diet based on corn-soybean meal diet and a liquid diet produced from enzymatically digested food waste that was only supplemented with vitamin-mineral premix and salt. All diets met the estimates for nutrient requirements of growing-finishing pigs based on the NRC (2012). The pigs were fed control or liquid diet in phases 1 and 2 while all pigs were fed with control diet in phase 3. Bodyweights of all pigs on d 0, 28, 53, and 79; daily feed allotments; and DM of all diets were recorded to calculate ADG, average daily dry matter intake (**ADDMI**), and Gain:Feed. At the end of the feeding program, one pig with the BW closest to the average BW from each pen was slaughtered to measure the viscera mass and carcass characteristics. Longissimus muscle (**LM**) was excised from the posterior of the 10th rib to measure meat quality and back-fat samples were collected for fatty acid profiles. All data were analyzed with PROC MIXED of SAS with pen as experimental unit and the statistical model included diet as fixed effect and block as random effect. Pigs fed with liquid feed had lower ($P < 0.05$) BW on d 28, 53, and 79 and ($P<0.05$) ADG on phase 1 than pigs fed with control feed. This observation was likely due to the reduced ($P < 0.05$) ADDMI on phases 1 and 2. Pigs fed with the liquid diet tended to increase ($P = 0.082$) Gain:Feed by 4.1% on phase 3 and also had heavier ($P < 0.05$) gastrointestinal tract including stomach, small intestine, and large intestine than the pigs fed with the control diet. Hot carcass weight was lower ($P < 0.05$) in pigs fed the liquid diet due to the smaller ending live weight; however, no differences were observed in carcass yield and other carcass measurements. The liquid feed tended to decrease ($P = 0.087$) subjective firmness (2.43 vs. 2.86), but did not impact pH, marbling score, and objective color L*, a*, and b* in the LM. Pigs fed with the liquid feed contained more ($P < 0.05$) pentadecanoic acid and margaric acid, and greater ($P < 0.05$) myristoleic acid, palmitoleic acid, oleic acid, vaccenic acid, gondoic acid, EPA, and DHA in their back-fat than the pigs fed the control diet. Feeding control diet increased more ($P < 0.05$) palmitic acid, arachidic acid, linoleic acid, linolenic acid, and eicosadienoic acid in the back-fat of the pigs than in the back-fat of the pigs fed with liquid feed. In conclusion, the high moisture content in the enzymatically digested food waste limits the growth performance of growing pigs. However, it is believed that this byproduct could be similar to or even exceed the nutrient contents in corn-soybean meal diet after increasing DM content. Feeding enzymatically digested food waste to growing and early finishing pigs did not affect their meat quality and may benefit pork products by providing more beneficial fatty acids to pork consumers.

INTRODUCTION

- **Food waste is defined as food that is lost or wasted throughout the supply chain (FAO, 2018)**
- **Enzymatic digestion breaks down food waste into simpler chemical compounds which can be easily digested**
- **Enzymatically digested food waste contains balanced amino acid profile and high fat content for growing-finishing pigs (Jinno et al., 2017)**

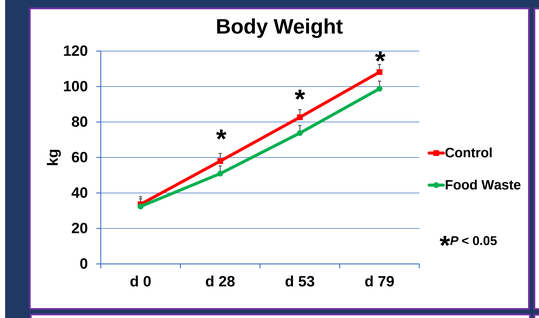
OBJECTIVE

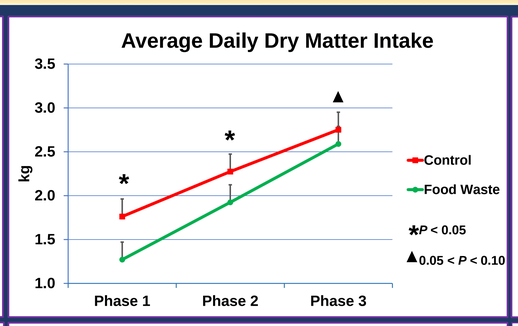
To examine the growth performance, visceral mass, carcass characteristics, meat quality, and back-fat fatty acid profile of growing-finishing pigs fed with enzymatically digested food waste

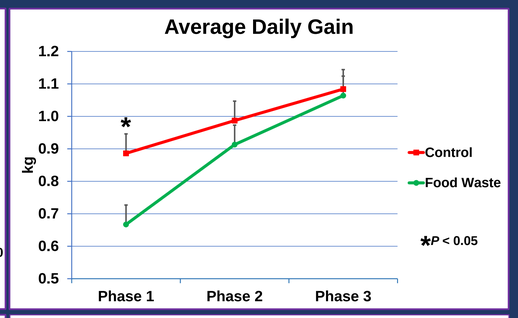
MATERIALS AND METHODS

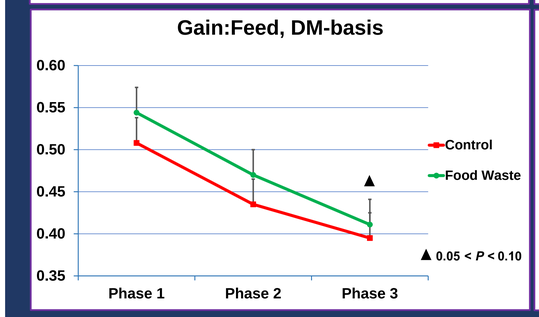
- **56 crossbred pigs: 32.99 kg BW, 7 replicate pens per treatment (2 barrows and 2 gilts per pen)**
- **2 dietary treatments: corn-soybean meal diet (Control) or liquid enzymatically digested food waste**
- **3-Phase feeding program**
  - **Phase 1: d 0 to 28; pigs fed with control or food waste**
  - **Phase 2: d 28 to 53; pigs fed with control or food waste**
  - **Phase 3: d 53 to 79; all pigs fed with control**
- **Slaughter: 1 pig per pen (7 pigs/treatment)**
- **Measurement: average daily gain, average daily dry matter intake, Gain:Feed, visceral mass difference, carcass characteristics, meat quality, and back-fat fatty acid profile (FAP)**
- **Statistical analysis: All data were analyzed by ANOVA using the PROC MIXED of SAS with the pen as the experimental unit**

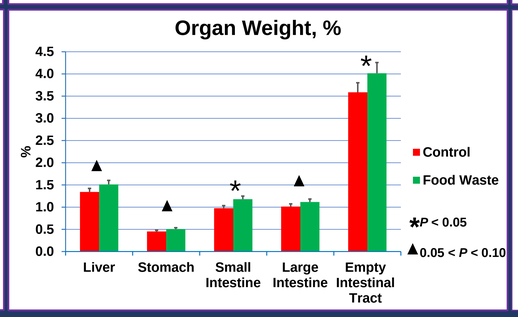
RESULTS

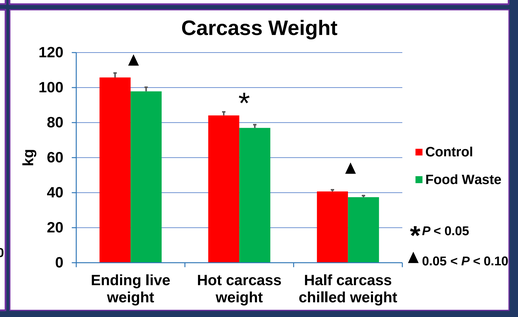












Carcass characteristics	Control	Food waste	SEM	*P*-value
Carcass yield, %	79.57	78.70	0.93	0.32
Loin eye area, cm^2	49.25	47.45	3.08	0.44
10th rib backfat, cm	2.34	1.76	0.24	0.15
Estimated carcass lean, %	52.65	55.57	1.34	0.19

Longissimus muscle	Control	Food waste	SEM	*P*-value
Moisture, %	74.28	74.53	0.20	0.41
Shear force, kg	3.16	3.23	0.23	0.76
Cook loss, %	26.28	28.16	4.29	0.60
pH	5.45	5.42	0.08	0.44
Drip loss, %	3.37	4.26	0.68	0.39
Objective color				
L*	56.85	56.94	1.26	0.96
a*	8.19	7.94	0.69	0.63
b*	15.61	15.40	1.00	0.79
Subjective evaluations				
Color	1.98	2.12	0.24	0.58
Marbling	1.67	1.67	0.35	1.00
Firmness	2.86	2.43	0.18	0.09

Back-fat FAP	Control	Food waste	SEM	*P*-value
Moisture, %	10.41	11.24	1.14	0.54
Crude fat, %	86.00	85.19	1.55	0.60
Saturated fatty acids, % of crude fat				
Myristic	1.03	1.04	0.03	0.81
Pentadecylic	0.04	0.11	0.01	<0.01
Palmitic	19.29	16.63	0.73	0.02
Margaric	0.26	0.47	0.04	<0.01
Stearic	9.81	8.84	0.99	0.18
Arachidic	0.19	0.16	0.02	0.01
Behenoic	0.03	0.04	<0.01	0.73
Unsaturated fatty acids, % of crude fat				
Myristoleic	0.01	0.06	0.01	<0.01
Palmitoleic	1.51	1.91	0.14	<0.01
Oleic	30.32	33.77	0.93	<0.01
Vaccenic	2.02	2.41	0.09	<0.01
Linoleic	16.74	12.87	0.50	<0.01
Linolenic	1.30	1.03	0.07	<0.01
Gonodic	0.58	0.71	0.14	<0.01
Eicosadienoic	0.66	0.55	0.04	0.02
Arachidonic	0.22	0.22	0.01	0.87
EPA	0.01	0.08	0.03	0.02
DHA	0.01	0.15	0.05	<0.01

CONCLUSIONS

- **High moisture in enzymatically digested food waste may limit the utilization of this product in growing-finishing pigs**
- **Feeding enzymatically digested food waste do not impact the meat quality of finishing pigs**
- **Pigs fed with food waste contained greater amount of beneficial fatty acids in their back-fat**

REFERENCES

- FAO. 2018. Food Loss and Food Waste. http://www.fao.org/food-loss-and-food-waste/en/. Accessed on April 20th, 2018.
- Jinno C, Morash D, McNamara E, King A, and Liu Y. 2017. Chemical Composition of Enzymatically Digested Food Waste Byproducts. J. Anim. Sci. 95(Suppl.4):57.

ACKNOWLEDGEMENT

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