Summary of: Energy, amino acid, and phosphorus digestibility and energy prediction of thermally processed food waste sources for swine

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Key Points:

- ·The digestibility of energy and nutrients of fish waste, supermarket waste, and vegetable waste was investigated.
- ·Both fish and supermarket waste were excellent sources of digestible energy, metabolizable energy, and digestible amino acids
- ·These food waste sources could be used to partially replace corn and soybean meal in swine diets to reduce environmental impact

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In the United States, food waste accounts for 21.6% of the discarded municipal solid waste, and only 5% of food waste generated is diverted away from landfills annually. As a result, there is increasing interest in utilizing food waste as animal feed because of its environmental benefits, low cost, and diversion from low-value landfill disposal to higher-value animal feed products. Feed costs accounts for about 65%-75% of the total cost of pork production. Increased use and prices of grains and lipids in biofuels have contributed to increased interest in lower cost alternative feed ingredients for commercial swine diets. In addition, lifecycle analyses suggest that feed accounts for a major proportion of the environmental footprint (carbon, water, and land use) of pork production. However, recycling food waste sources into swine feeding programs is constrained by the lack of data on the digestibility of energy and nutrients and risk of disease transmission.

To meet the daily energy and digestible nutrient requirements of pigs, information on the digestible energy (DE) and metabolizable energy (ME) content, standardized ileal digestibility (SID) of amino acids, and standardized total tract digestibility (STTD) of phosphorus is needed for all feed ingredients being used. The objectives of this study were first, to determine the concentration of DE and ME, the SID of amino acids, and STTD of phosphorus of three sources of thermally processed food waste, and second, to compare in-vivo determined values with those derived from in-vitro digestibility determinations and prediction equations based on chemical composition of the food waste sources for swine.

Diets were formulated to contain 30% food waste derived from fish waste (FW), supermarket waste containing bakery, fruits and vegetables, meat and deli foods from a single supermarket (SMW), and fruit and vegetable waste (FVW). Thirty-six growing barrows with initial body weight of 16.37 ± 1.9 kg were randomly assigned to one of the treatment or control diet containing 96.9% corn. To determine DE and ME content, STTD of phosphorus, and SID of amino acids the three dehydrated sources of food waster were subsampled and submitted to the University of Missouri Agricultural Experiment Station Chemical Laboratories. The samples were chemically analyzed to determine the in vitro dry matter digestibility and nutrient profiles of the three sources. Feces and urine samples from the in barrows were also submitted for analysis to determine in vivo dry matter digestibility and nutrient profiles.

The concentration of gross energy in FW and SMW was greater than in FVW, which was likely due to the greater concentration of crude protein and lipids in both of these sources. FW contained the highest concentration of crude protein, minerals, lysine, tryptophan, and methionine. After adjustment for basal endogenous losses, standardized total tract digestibility of phosphorus of SMW and FVW were greater than in FW. The energy and nutrient concentration of the FW source evaluated in this study was similar to that of commercial fishmeal currently used in swine nursery diets. The SMW was a mixture of different types of foods which resulted in a greater crude protein content than in FVW, but less than FW. It also had the greatest lipid content. As expected, the FVW source had the least energy, crude protein, lipid, and mineral content because fruits and vegetables are known to contain relatively low amounts of these nutrients and a greater concentration of fiber compared with fish and meat.

FVW had the lower digestible energy than FW and SMW (2,570 vs 5,5057 vs 5,071 kcal/kg, respectively). It also had lower metabolizable energy than FW and SMW (2,460 vs 4,922 vs 4,922 kcal/kg, respectively). In vitro procedures are a rapid low-cost way to estimate the nutritional value of food waste and were used to estimate digestibility of dry matter and energy in SMW, FW, and FVW. However, significant error exists depending on the chemical characteristics of each food waste source. In vitro estimation of digestible energy were highly accurate for FW (Observed = 5,058 kcal/kg DM vs. Predicted = 4,948 Kcal/kg DM), SMW (Observed = 5,071 kcal/kg DM vs. Predicted = 4,978 Kcal/kg DM), and FVW (Observed = 2,570 kcal/kg DM vs. Predicted = 2,814 Kcal/kg DM).

In conclusion, results from the present study indicate that both FW and SMW are excellent sources of digestible and metabolizable energy, and digestible amino acids (such as lysine, tryptophan, and methionine) for pigs and could be used to partially replace corn and soybean meal in swine diets to reduce environmental impact. Specific prediction equations can be used to provide reasonable estimates of digestible energy or metabolizable energy content, respectively of food waste sources.

Find the full paper at:
Fung et al. 2019. Transl. Anim. Sci. .3:676–691 doi: 10.1093/tas/txz028