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MICROBIOLOGICAL ASSESSMENT OF DEHYDRATED EDIBLE RESTAURANT WASTE (DERW) AND FECES FROM SWINE FED DIETS CONTAINING DIFFERENT AMOUNTS OF DERW.

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KEYWORDS: microbiology, swine, feces, garbage.

BACKGROUND

Varying amounts of microbial contamination may be found on surfaces of freshly dressed carcasses. Carcass contamination results from direct or indirect contact with the animal's hide, legs, gut contents, fecal material or contaminated equipment. Since the microbiological condition of the live animal is extremely important for the safety of the ready to sell product in relation to food-borne infections, management of the animals and quality of the feed must be taken into consideration when determining the safety of the product (Huis in't Veld et al.,1994). Therefore, it is important to determine the microbial flora of the animals digestive tract in order to determine the presence of potential pathogens which may contaminate the carcass.

The use of edible human food byproducts, such as kitchen waste and garbage, as a feed for swine is not new. However, for health and safety reasons, many states have banned garbage feeding of swine. Those states that allow it mandate that the garbage be cooked before feeding in order to eliminate any pathogens found in the garbage. Technology now exists whereby these edible wastes can be converted into a dry, stable product that could be easily incorporated into many swine feeding programs. Previous analysis showed the chemical composition of DERW to be (%): dry matter 92.1, crude protein 22.4, crude fat 23.2, crude fiber 2.3, and ash 5.4 (Myer et al. 1994). Chloride (1.3%) and sodium (0.9%) contents were high which may limit the amount of DERW that could be included in swine diets.

OBJECTIVE

The objective of this experiment was to study the microbial flora of DERW and of feces collected from pigs fed corn-soybean meal diets with varying amounts of DERW (0,5,10,and 20%) to determine if pathogenic organisms may be present that could contaminate the carcass.

METHODS

Dehydrated edible restaurant waste was made from fresh edible waste obtained from food service operations of two hotels at a resort in central Florida. The waste was mostly leftover food and plate scrapings. A subsample was taken and dried using a Jet Pro dryer. Drying temperature was maintained at 175 to 200 °C in which the product temperature reached 75 to 95 °C. Transit time through the dryer was about 3 minutes.

A digestion trial was conducted utilizing four crossbred barrows fed four levels of DERW. The pigs were kept in stainless steel metabolism cages for four weeks. During the digestion trial, pigs were fed 0.75 kg of the experimental diets twice a day for the first 7 days of the trial and the amount of feed was increased weekly until the pigs were consuming 2 kg of feed/day during the last week. Each pig was fed each diet for one week. Feces from each animal were collected daily and frozen for further analysis. The experimental diets were formulated to be equal in calories, crude protein, calcium, phosphorus and sodium. All diets contained corn and soybean meal with different amounts of DERW (0,5,10, and 20%). Samples of DERW were also evaluated over a period of two weeks to determine the effects of storage and environmental conditions on the microbial load. Feed samples were kept in sealed paper bags which were stored in an enclosed facility at 80-90 °F.

Ten grams of feces per diet and DERW were weighed in sterile stomacher bags and diluted with 90 grams of Butterfield's phosphate solution. The samples were further diluted to 10^7 and plated on selective medias. The drop plate method was used to determine the microbial load present in the samples (Swanson et al. 1992). Two 10μl drops of each dilution were placed symmetrically around the perimeter of a petri dish. This evaluation gave counts ranging from 10^2 to 10^8. Total plate counts for both DERW and the fecal samples were determined on Plate Count Agar media.

Gram negative enteric bacteria were determined using Eosin Methylene Blue Agar (Difco), and Bacto Desoxycholate Agar (Difco). Presumptive *Listeria* population was determined by using Modified Oxford Media (Difco). The *Yersinia enterocolitica* population was determined using Yersinia Selective media (Difco). The *Staphylococcus aureus* population was determined using Baird-Parker Agar (Difco) with tellurite polymyxin egg yolk added to the medium. Xylose Lysine Desoxycholate media (Difco) was used to determine the population of enteric bacteria. Fecal streptococcus was determined using Kenner Fecal Streptococci Agar (Difco) with 1% TTC added. Presumptive *Salmonella* was determined using Bismuth Sulfite Agar (Difco). Molds and yeast concentrations were determined using Rose Bengal Agar (Difco) with Supplement C added to the media. Results were recorded after the appropriate incubation times. Data was analyzed using the general linear models program (PROC GLM) of SAS (SAS Institute, 1985).

RESULTS AND DISCUSSION

Microbial analysis of DERW indicated limited microflora present. The low level was probably due to the heat treatment the DERW was exposed to during processing. Table 1 summarizes the effect of storage length on the total microbial population of DERW. Over a period of 2 weeks, the microbial population increased as the environment and conditions became more favorable for bacterial proliferation. There was a significant increase in microbial population from week 0 to week 2 ($p<0.05$) although the counts remained minimal and within the same log number.

Total microbial counts from the feces of pigs fed the four experimental diets were grouped by diet and are reported in table 2. There was a significant difference ($p<0.001$) in fecal total plate count for all four diets. The diet containing 0% DERW showed the highest total plate count (4.9×10^6 cfu/g) while the diet containing 5% DERW had the lowest total plate count (1.3×10^6 cfu/g). The diet with 20% DERW, however, contained the highest total microbial count when compared to the other two diets containing DERW.

The individual microbial counts for all four diets were similar ($p<0.05$), except for *Listeria*, *Streptococcus faecalis, Salmonella*, and *Klebsiella* which varied within diets. Organisms found were normal for the gut microflora of most animals. Willingale and Briggs (1955) reported enteric bacteria, *Staphylococcus aureus*, *Clostridium*, and *Salmonella*, and *Shigella* are normal fecal flora of swine. These microorganisms may increase the chances of carcass contamination and food-borne illnesses, however, results from our experiment showed low numbers of these microorganisms present in DERW.

CONCLUSION

The addition of DERW in swine diets showed no effect on the microbial flora of swine, and actually appeared to have an advantage over other feeds because of its low moisture content and thus lower water activity. Low water activity slows bacterial growth. The high heat treatment to which the DERW was exposed should enhance the safety of the product. Therefore, the recycling of garbage and kitchen food waste (in the form of DERW) for swine feeding seems to have no detrimental effects on the normal gut microflora of swine.

Table 1. Effects of storage time on the total microbial population of Dehydrated Edible Restaurant Waste (DERW)

Time	Total Plate Count[a]
Week 0	2.93×10^{2b}
Week 1	3.81×10^{2c}
Week 2	5.47×10^{2d}

[a] Average number of colony forming units/g of sample.
[b,c,d] Values with different superscripts are significantly different ($p<0.05$).

Table 2. Total microbial counts in feces from pigs fed Dehydrated Edible Restaurant Waste (DERW)[a]

%DERW in diet	Total plate count[b]
0	4.9×10^{8c}
5	1.3×10^{6d}
10	2.9×10^{7e}
20	8.7×10^{7f}

[a] Fecal samples remained frozen for a period of 2 months prior to analysis.
[b] Average number of colony forming units/g of sample.
[c,d,f,e] Values with different superscripts are significantly different ($p<0.05$).

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