BIOCHEMICAL CHARACTERICTICS OF POULTRY VISCERA PRODUCTS TREATING BY RENDERING, FERMENTATION AND ACIDULATION

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INTRODUCTION

Poultry processing offal consist of broiler chicken heads, feet and viscera. One bird's complete viscera includes intestine, proventriculus, lungs, and trachea (Russell et al., 1992). The yield of poultry processing waste varies with the age of the broiler. Crawley et al. (1980) reported that the yield of poultry processing waste of 6, 7 and 8 weeks of age broilers were 13.7%, 15.15% and 14.73% respectively and the viscera was the major part(5.96 %, 8.06% and 7.81%) of the poultry processing waste. Viscera is unstable and easily deteriorates and produces an odor. It is often an industry problem and is a possible source of environmental contamination.

To decreased the odor and deterioration, poultry processing waste must be treated rapidly and it is usually rendered. To limit the moisture content energy is required which is an added expense. Other processing techniques such as fermentation or added acid have been suggested in a few reports. Russell et al.(1992) indicated that fermentation was effective in decreasing pH, altering the odor and viscosity. Divakaran (1986, 1987) reported that acidulation (3 % sulfuric acid) can prevent the rapid onset of putrefactive changes and did not result in any specific toxic metal residues in the final dried product. Mcnaughton et al. (1977) said that poultry offal rendered at 121°C, 15 psi/g, for 15 min had high feed efficiency and lysine availability. Tibbetts et al. (1987) reported poultry offal silage is an acceptable feed ingredient that can comprise up to 20 % of the diet for growing and finishing swine. The purpose of this study was to utilize three different methods (rendering - 121°C, 15 psi and 30 min, fermentation - Lactobacillus acidophius, and acidulation - 3% conc. phosphoric acid) to produce poultry viscera products and to investigate change of the nutrient contents (chemical contents, amino acids, minerals, pH value and energy) of three different treatments of poultry viscera products.

MATERIALS AND METHODS

I. PREPARATION OF FRESH POULTRY VISCERA

A total 19.8 kg (2.2 kg x 3 treatments x 3 repeats) of fresh poultry viscera (intestine, proventriculus, lungs, and trachea) was collected from a commreical chicken slaughter plant (Park Farms - Canton, Ohio) and transported under refrigeration to the Meat laboratory, Department of Animal Science, The Ohio State University. The fresh poultry viscera was coarsely ground once through a 5 mm plate and mixed thoroughly by hand prior to prepare for rendering, fermentation and acidulation.

II.TREATMENT OF POULTRY VISCERA

In the rendering treatment, the ground poultry viscera was heated at 121°C, 15 psi for 30 min in an autoclave and dried at 100° C for 12 hr, ground with a meat blender, packaged in GLAD-LOCK zipper freezer bags and stored under refrigeration (4-7°C) for determination of nutrient contents. In the fermented treatment, a 1% starter culture (Lactobacillus acidophilus) and different carbohydrates (sucrose and corn meal) at levels of 3%, 5%, 7% and 10% were used and this mixture was incubated at 35-37°C for 24 hr. The pH value was measured during storage. The fermented sample with 3% sucrose was used as a standard fermented sample in this experiment because it produced a stable product during storage and could be produced at a lower cost. In the acidulated treatment, the ground poultry viscera was mixed with 3% phosphoric (conc.) acid (by weight of the raw material) and stored at room temperature(22-25°C) for 18 days.

III.METHODS

The pH of the samples was determined by using a pH meter. The moisture, ash, crude fat and protein of the samples were also measured (Ockerman, 1985). Hydrolysis and preparation for amino acid analysis of the samples were made according to the method of Burgos et al.(1974) as modified by Piez and Morris (1969). The material was hydrolyzed by autoclaving 10 hr with 10 ml of 3 N HCl for each 40 mg of protein. The samples were measured by an amino acid auto analyzer (Beckman 119CL) and expressed in mgs/100mgs of sample and the minerals of the sample was determined by the AOAC's method (1984). A 10 g sample was chared and ashed according to the ash procedure (AOAC, 1984), the ash was dissolved in 50 ml HCl (1:3 = $HCl:H_2O$) and Atomic absorption spectrophotometer was used to determine the minerals which were expressed in microgram/gram of solid. The energy of poultry viscera products were estimated by this formula: ME_n=(31.02 x crude protein) + (78.87 x crude fat). All data was analyzed by the Statistical Analysis System (SAS, 1986).

RESULTS AND DISCUSSION

The change of pH value of the fermented samples containing different amounts(3%, 5%, 7% and 10%) of carbohydrates (sucrose and corn meal) during storage are shown in table 1. The pH value of fermented sample with different amounts(3%, 5%, 7% and 10%) of sucrose remained stable during storage(28 days) at room temperature (22-25°C). This result agrees with the result of Urlings et al.(1993) who reported that the addition of ≥ 3% of fermentable carbohydrate (dextrose) was necessary to keep the fermented product stable for a period of 21 days. Urlings et al. (1993) also indicated that raw, inedible poultry byproducts mixed with sugarbeet pulp and dextrose and inoculated with L. plantarum and Enteroccous faecium resulted in a drop of pH in the byproducts to approximatelly 4.0 to 4.5 within 48 hr. This result is similar to the current experiment's result (3.91 to 5.30 within 24 hr). The pH value of all samples increased with storage time and the pH values of samples with corn meal (except 10%) were unstable during 28 days of storage. From these results, the fermented sample with 3% sucrose was selected as a desirable fermented sample in this test. The acidulated samples had a low initial pH value of 2.55 when 3% phosphoric acid was added but this increased to 5.80 during storage (18 days) at room temperature (22-25°C) and only kept a stable quality for a period of 14 days. These results are similar to a mixture (1:1) of sulfuric acid and phosphoric acid (3% by weight of the raw material) in slaughterhouse by-products (blood and offal) and this was found to prevent spoilage and did not adversely affect crude protein composition (Divakaran, 1987). Tatterson and Windson (1974) indicated that fish waste with 3% by weight of 98% formic acid was found to be a stable product and resulted in no indication of bacterial spoilage for a long time.

Crude protein, crude fat, ash and moisture of fresh samples, after rendering, after fermentation and after acidulation are shown in table 3. The results of fresh and rendered samples were different from some reported research (Wisman et al., 1958, Acker et al., 1959, Russell et al., 1992, Burgos et al., 1974). They found that the crude protein and ether extract of dried and fresh poultry offal were 14.9%-20.5%, 8%-15.9 % and 56.5-62.7%, 26.2%, respectively. The results of fermented samples also were different from that of Russell et al. (1992). They indicated that fermented poultry offal contained 57.3% moisture, 19.1% fat and 12.9% protein. These differences are probely due to different raw materials used in their research (poultry offal- head, feet, backbone and viscera) and in this experiment (only poultry viscera). Energy value of fresh poultry viscera samples after rendering, after fermentation and after acidulation can be found in table 2.

Analysis of amino acids of the three viscera products were described in table 4. The lysine and methionine of the products after rendering were 7.27% and 2.68%; after fermentation were 6.74% and 1.94%; and after acidulation were 6.77% and 1.89%. From the data (table 4), these products are a good source of lysine but methionine is not sufficient. This result agrees with Ensminger et al.(1990) who said that animal by products are an excellent sources of lysine and abundant in tryptophan. The current research also found that Threonine, Alanine, Proline and Leucine of rendered samples showed significant differences between fermented and acidulated samples. Since 3% phosphoric acid was added in the acidulated samples, highest phosphorus content (1.28%, dry matter base) was found in all acid treated samples. Lower calcium content of all samples (0.016%- 0.23%) were also obtained in this research (table 5). The result of rendered samples was different from the result of McNaughton et al. (1977) because the poultry offals (head, feet, and viscera) was used in their research but only poultry viscera was used in this expermint.

CONCLUSION

The results of this research would indicate that poultry viscera products are a good source of protein and lysine but are not a good source of calcium because these raw materials did not contain any bone. In this experiment, it was found that fermentation was effective in decreasing pH, odor and viscosity and this conclusion is the same as that reported by Russell et al.(1992). However, the actual nutrient value and acceptability of these
products on animals also need to be further evaluated.

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