COMPARISON OF METHANE GAS EMISSIONS FROM FRESH AND COOKED CHICKEN, PORK, BEEF, AND TURKEY

T. Price[1*], J. Warren[2], G. Mafi[1], and R. Ramanathan[1],

[1]*Department of Animal and Food Sciences, Oklahoma State University, Stillwater, OK, USA*,

[2]*Department of Plant and Soil Sciences, Oklahoma State University, Stillwater, OK, USA*,

*mdenzer@okstate.edu

I. OBJECTIVES

Meat is a nutrient-dense food, and it is estimated that in the United States, Canada, Australia, and New Zealand, approximately 22% of total meat and poultry production is discarded annually. Meat waste can result from a variety of factors, including cooking or serving a larger portion than is consumed, expiration or over-purchase in the home or in food service, or a lack of marketability due to discoloration. There have been various studies to determine greenhouse gas emissions throughout the meat animal and poultry production life cycles, but currently, there is limited knowledge on the impact of meat waste on greenhouse gas production. Therefore, the objective of this study was to evaluate levels of methane production from raw and cooked meat proteins during 7-d in vitro storage. Individual fresh raw ground loaves of chicken, pork, beef, and turkey, all of similar composition respective to species, were purchased from a local retailer; aging time was not considered for this study to reproduce consumer purchasing habits. Methane production from both raw and cooked samples was determined on day 0 and day 7 of storage.

II. MATERIALS AND METHODS

To determine the methane production from raw meat, 5 g of meat samples from day 0 were incubated at room temperature for 24 h in a sealed vial (to simulate if samples were discarded outside). For the preparation of cooked meat samples, poultry patties were cooked to 73°C, and beef and pork were cooked to 71°C; following cooking, 5-g samples were incubated identically to raw meat. For 7-d storage, both raw and cooked meat were kept in an airtight zip-lock bag (to imitate home storage conditions) and placed in a refrigerator. Following 7 d of storage, all raw and cooked samples were incubated for 24 h at room temperature in a sealed vial to determine final greenhouse gas production. A gas chromatographer with a headspace analyzer was utilized to determine gas formation within the vial; for each storage and species combination, 8 treatment combinations in duplicates were measured, and data were analyzed using the Proc GLM procedure of SAS (SAS Institute Inc., Cary, NC).

III. RESULTS

Cooked meat had greater ($P < 0.05$) methane gas production than raw meat, and the duration of storage time increased methane production. Within species, pork and turkey had the lowest ($P < 0.05$) methane production in comparison with beef. More specifically, cooked beef had significantly higher ($P < 0.05$) greenhouse production than any other cooked or raw species. The bacteria that produce methane are referred to as methanogens; their preferred environments are anaerobic, which were simulated during incubation, and can be found in landfills. They can be vital in the breakdown of organic matter, and these results indicate that cooked products could have a higher susceptibility to methanogen growth. The current research assumes significance as the Environmental Protection Agency reported that 15.1% of human methane production in 2018 originated from municipal waste.

IV. CONCLUSION

Developing strategies to preserve nutrient-dense animal proteins is critical in limiting meat waste and for decreasing human methane production.

Keywords: food waste, greenhouse gases, meat, methane