

**(CONFIDENTIAL, NOT FOR PUBLICATION)**

**Project No.** SDC311 (Replacing S292) (Replaced by S1027)  
**Title:** The Poultry Food System: A Farm to Table Model  
**Period Covered:** 08-2005 to 09-2006  
**Date of Report:** 29-Sep-2006  
**Annual Meeting Dates:** 09-Sep-2006

**Annual Meeting Site:** Verona, Italy  
September 9, 2006

**Cooperating Station:** Department of Food Science and Human Nutrition  
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**2006 PROGRESS REPORT:**

**OBJECTIVE 4:** Production and Processing Factors Impacting the Safety of Poultry Products

**Thermal inactivation of bacteria in raw poultry offal (SC)**

Raw poultry offal was recovered from a poultry processing plant and separate samples were subjected to increasing more severe heat treatments after which samples were plated on BHI. Isolated cells were recovered from the highest temperature (most severe heat) treatment and subjected to thermal inactivation studies.

**Development of thermo-formed structural materials from rendered poultry meal (SC)**

Feather meal and other poultry meat and bone meals were ground and mixed with glycerol then heat-pressed to formed structural materials similar to plastics. These films and sheets performed in physical tests to allow their use in a various applications for non-food uses, including molds and containers.

**Heat inactivation of Listeria on RTE meats (SC, NC)**

The surface heating rate ( $\gamma$ ) and final surface temperature ( $\alpha$ ) during in-package pasteurization were determined for different thickness levels of two types of bologna having different (13% and 18%) fat content. Three different thickness levels (4, 12, and 20 mm) corresponding to 1, 3, and 5 slices of bologna were each vacuum-packaged separately in a clear polymer pouch after placing thermocouples on the surface. Refrigerated samples were immersed into a water bath set to one of four pre-determined temperatures (60, 70, 80, and 90° C) and time and temperature data were recorded for 10 min. Surface- heating rate was fastest in the thinnest (4mm) and slowest in the thickest (20mm) samples for all four pasteurization temperatures. Surface- heating rate was slower in bologna with higher fat content compared to lower fat bologna. Final surface temperature attained after 3 min was lower with increased thickness levels for all pasteurization temperatures. Thus meat sample thickness and fat content significantly affect surface heating rate and final surface temperature during in-package pasteurization of bologna.

## **National Egg Products School (In Collaboration with AR, NC, SC, and TX)**

The 2005 National Egg Products School was held in November in Auburn, AL. The school offered “hands on” laboratory experiences to assist participants in understanding the functionality characteristics of egg products. The 2006 school had faculty from Auburn University, North Carolina State University, and the University of Arkansas. The National Egg Products School Advisory board is made up of representatives from industry, trade organizations, government and academia.

### **Impacts:**

#### **Thermal inactivation of bacteria in raw poultry offal (SC)**

Determination of the thermal inactivation profiles of the most heat resistant bacterial isolates in raw poultry offal will assist the rendering industry in producing high quality protein meals for value-added applications.

#### **Development of thermo-formed structural materials from rendered poultry meal (SC)**

The tightening regulations on use of animal by-products in animal feed may impact the poultry industry in the future as it is already impacting the beef industry. By finding new uses for these by-products the value to the poultry industry will be increased while disposing of a organic material with high microbial load.

#### **Heat inactivation of Listeria on RTE meats (SC, NC)**

The USDA issued a rule in October of 2003 that certain RTE meat and poultry products must implement one of three risk-based alternatives with written program and verification through testing to control *L. monocytogenes*. A post-lethality treatment is included in two of the three alternatives. A practical approach of in-package pasteurization as a post-lethality treatment to target surface *L. monocytogenes* would reduce the risk of its presence. Thus, factors affecting the surface heating rate, such as product thickness, need to be clearly understood to eliminate the pathogen its related costs to the industry.

### **National Egg Products School:**

The National Egg Products School provides breaking plant personnel quality assurance supervisors, and middle management within the egg breaking industry current information on what constitutes egg product quality, how to measure it, and important issues facing the egg industry in the region.

### **WORK PLANNED FOR NEXT YEAR:**

#### **OBJECTIVE 4. Production and Processing Factors Impacting the Safety of Poultry Products**

##### **Number 1: Preslaughter Activities**

**(FROM NCSU) Effects of Nutrition on Pathogens in Poultry (NCSU - Sheldon, Ferket, Williams, Fernanda Santos; Clemson - Dawson):** Influence of grain particle size and insoluble fiber content on *Salmonella* colonization and shedding in turkeys fed a corn-soybean meal diet (NC and SC) will continue to be evaluated. The effects of Immustim® and Protimax® on *Campylobacter jejuni* and *Salmonella* Typhimurium populations in broilers (NC and SC) will be evaluated. Using the poultry production resources located at North Carolina State University, turkeys will be reared according to the above outlined treatments and then subsequently processed and split cecal and fecal samples analyzed at NCSU and Clemson for the presence of *Campylobacter* and *Salmonella* intestinal colonization, respectively.

##### **Number 2: Broiler and Egg Processing**

**(FROM NCSU) Strategies to Control *Campylobacter*, *Salmonella*, and *Listeria monocytogenes* at the Processing Plant (Brian Sheldon – NCSU; Paul Dawson – Clemson; Scott Russell – UGA; Curtis - AL):** Effect of carcass washers on *Campylobacter* and *Salmonella* contamination in large broiler processing plants will be examined (NC, AL, and GA). As a means of estimating the prevalence of contamination across a multitude of

broiler processing plants located in the Southeastern United States, carcasses from multiple plants located in each of these states will be monitored for these two pathogens and the data shared among the cooperating states. Multiple collaborative publications from this cooperative project are anticipated. *Listeria monocytogenes* will be subtyped from a poultry further processing plant over a period of months to determine if the source of *L. monocytogenes* contamination is from the raw product or from an endemic source inside the plants such as the floor drains (AL, GA, SC, and NC). Similar to the first project described above, the incidence of contamination collected from each cooperating state will be shared among the group with the goal of producing a comprehensive summary. The elimination of *L. monocytogenes* in packaged, ready-to-eat poultry products by combining heat with lysozyme and/or nisin and MAP will be investigated (NC, SC, and GA). Efficacy of conveyor belt materials containing inhibitors for controlling food-borne pathogens in the processing environment will be evaluated (NC and GA). NC and GA will be conducting studies to determine if the risk of microbial cross-contamination using conveyor belts containing a microbial inhibitor can be reduced. Data will be compared from the separate studies and the optimum belt treatments identified and further evaluated during in-plant trials conducted within each state.

#### **Number 4: Packaging:**

**(FROM NCSU) Eliminating *Listeria monocytogenes* in Packaged, Ready-to-Eat Poultry Products by Combining Heat with Lysozyme and/or Nisin and MAP (Brian Sheldon and Paul Dawson – Clemson; Kevin Keener - IN):** NC, SC, and IN will continue investigating the application of non-thermal plasmas for the treatment of surface contamination of poultry products (raw, partially cooked, and fully cooked) and packaging films. Experiments will determine non-thermal plasma's ability to reduce bacterial contamination based on plasma gas composition (nitrogen, oxygen, helium), surface type (skin, muscle, non-food), and type and level of pathogen contamination (*Salmonella*, *Listeria*, *Campylobacter*).

#### **Bio-based coatings to reduce bacteria on poultry meats (SC-Dawson, NC-Sheldon)**

SC and NC will continue previous research on using bio-based and edible coatings as carriers of antimicrobials to reduce surface populations of bacteria. Gelatin and other protein film coatings will be used as carriers of various antimicrobials and tested as contact coatings for raw and cooked poultry meats.

#### **Education:**

Continue participating in the planning and implementation of training innovations for the National Egg Products School.

#### **PUBLICATIONS (2005-2006):**

##### **A. Journal Articles:**

McCormick KE, Han IY, Acton JC, Sheldon BW, and Dawson PL. 2005. In-package Pasteurization Combined with Biocide-impregnated Films to Inhibit *Listeria monocytogenes* and *Salmonella Typhimurium* in Turkey Bologna. *J Food Sci* 70(1):M52-7.

Min, B.J., Dawson, P.L. and Shetty, K. 2005. Antioxidant and bioactive films to enhance food quality and phytochemical production during ripening. *Korean Journal of Food Science and Animal Resources*. 25:60-65.

Greene, A.K., P. L. Dawson, editors A.K. Greene, P.L. Dawson, D. Nixon, and J.R. Atkins. 2005. Safety of Animal Fats for Biodiesel Production: A Critical Review of Literature. Published by Advanced Technologies for Fuels Canada. Mr. Rodney Semotiuk, President & CEO, ATF Advanced Technologies and Fuels Canada, Inc., 80 Aberdeen Street, Suite 400, Ottawa, ON K1S 5R5.

Dawson, P.L. 2005. Post Processing Treatments for Ready-to-Eat Meats: High Pressure and Surface Thermal Processing. Symposium manuscript based on presentation given at the USDA Food Safety Conference, Myrtle Beach, SC. *Journal of the Association of Food and Drug Officials*. (AFDO) 69(4): 9-

21.

Courtenay, M., Ramirez, L., Cox, B., Han, I., Jiang, X. and Dawson, P. 2005. ServSafe handwashing methodology compared to rinsing and alcohol-based sanitizers. *Food Service Technology* 5:77-84.

**B. Abstracts:**

B.J. Min, I.Y. Han and P.L. Dawson. 2005. Antibacterial Effect of Nisin-adsorbed Silica and Corn Starch Powder against *Listeria monocytogenes*, International Association of Food Protection Meeting in Baltimore, MD, 9/2005.

Anita Chen, Sunil Mangalassary, Inyee.Y. Han, and Paul L.Dawson. 2005. Eliminating *Listeria monocytogenes* in packaged, ready to eat (RTE) turkey bologna by combining in-package pasteurization with antimicrobial agents. Governors School for Science and Mathematics Research Forum.

Mangalassary, S., I. Han, and P. Dawson. 2005. Effect of nisin carry over into the plating medium on *Listeria monocytogenes* enumeration and efficacy of chymotrypsin for inactivation of nisin on ready-to-eat meat surfaces. Poultry Science Association Meeting, Auburn University, Auburn, AL.

Paul L. Dawson, Lina Ramirez-Lopez, and Inyee Han,. Thermal Process Preliminary Calculations: Enumeration of Thermally Resistant Bacteria in Raw Rendering Materials, Animal Co-Products Research Conference, Clemson University 4/2006. . 2006

E. Crane, B. Ballieu, K. Horm, H. Johnson, A. Spokowski, J. Trevino, R. Yost, P. Dawson. 2006. The Effect of Cleaning on Survival of E. coli on Common Food Preparation Surfaces Focus on Creative Inquiry, April 2006, Clemson University.

B.J. Min, I.Y. Han and P.L. Dawson. Effects of antimicrobial edible films against *Listeria monocytogenes* in a liquid and solid system. Institute of Food Technologists Meeting in Orlando, FL. 6/2006/

Sunil Mangalassary, Inyee Han, and Paul Dawson. Carry-over effect of nisin in antimicrobial treatment of ready-to-eat meat. Institute of Food Technologists Meeting in Orlando, FL. 6/2006/

E. Crane, B. Ballieu, K. Horm, H. Johnson, A. Spokowski, J. Trevino, R. Yost, P. Dawson. 2006. The Effect of Cleaning on Survival of E. coli on Common Food Preparation Surfaces. Institute of Food Technologists Meeting in Orlando, FL. 6/2006/

**C. Books and Book Chapters:**

Dawson, P.L., S. Mangalassary, and B.W. Sheldon, 2006. Thermal Processing of Poultry Products. *In: Thermal Food Processing: New Technologies and Quality Issues*. D. Sun, ed. CRC Press, Boca Raton, FL (Ch. 7, p. 197-233).

Dawson, P.L. and Spinelli, N. 2005. Poultry Flavors. In "Food Flavor". Feng Chen, Editor.

**D. Manuscripts Approved:**

P. Dawson, I. Han, B. Cox, C. Black and L. Simmons. 2006. Residence time and food contact time effects on transfer of *Salmonella* Typhimurium from tile, wood and carpet: Testing the five-second rule. *Journal of Applied Microbiology* (accepted).

Seydim, A., Guzel-Seydim, Z., Acton, J.C., and Dawson, P.L. 2006. Effects of Rosemary Extract and

Sodium Lactate on Quality of Vacuum Packaged Ground Ostrich Meat. J. Food Science (accepted).

S. Antony, J.R. Rieck, J.C. Acton, I.Y. Han, E.L. Halpin, and P.L. Dawson. 2006. Effect of dry honey on the shelf life of packaged turkey roll slices. Poultry Science (accepted).

R. Dhananjayan\*, I.Y. Han\*, J.C. Acton\* and P.L. Dawson. 2006. Growth depth effects of bacteria on ground turkey meat patties subjected to high carbon dioxide or high oxygen atmosphere. Poultry Science (accepted).

**E. Symposia Presentations:**

Dawson, P.L. 2005. Innovative methods to handle waste. Food Industry Association of South Carolina, April. Hilton Head, SC.

Dawson, P.L. 2005. Improving the Safety of Ready-to-Eat Meats: High Pressure Processing and In-package Pasteurization. USDA Food Safety Conference, Myrtle Beach, SC.

Dawson, P.L. and Greene, A.K., 2005. Animal Co-Products research at Clemson University. Food Protein Research Foundation. May. Chicago, IL.

Dawson, P.L. and Greene, A.K., 2005. SRMs to Biodiesel: A Biosafety Workshop. Ottawa, Canada by teleconference June 21, 2005 Emerging issues in Animal Tallow.

Dawson, P.L. 2005. Safety of Ready-to-Eat Meat: Using Antimicrobials to Eliminate Listeria. International Poultry Products Symposium. Auburn University.

**F. Proceedings:**

**G. Popular and Trade Publications:**

Dawson, P.L. Research Review. Poultry USA. Watt Publishing, January, 2005

Dawson, P.L. Research Review. Poultry USA. Watt Publishing, September, 2005

Dawson, P.L. Research Review. Poultry USA. Watt Publishing, January, 2006

Dawson, P.L. Research Review. Poultry USA. Watt Publishing, May, 2006