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

Contributing Station: Department of Food Science
Guelph University
Guelph, Ontario N1G 2W1
Phone (519) 824-4120

Project Leader: Shai Barbut
sbarbut@uoguelph.ca

Accomplishments:

The pale, soft, and exudative (PSE) and deep muscle myopathy problems in poultry meat:

Variations in poultry meat color, texture, and water holding capacity (WHC) have received increased industry attention over the past few years. Some of the reasons include the move towards more deboning (i.e., sale of cut up poultry parts), and further processing where yield and quality are very important to processors. In addition, stiffer competition from other meats and non-meat protein sources has put pressure to improve quality at a reasonable cost. Major problems facing the poultry industry are the utilization of breast meat portions showing the deep muscle myopathy problem and the so-called pale, soft and exudative (PSE) meat, which result in low water retention compared to normal. Problems during processing also arise if additional moisture is incorporated into PSE meat. The added moisture cannot be held within the product during cooking of PSE meat, and results in a lower yield and/or the need to open and drain cook-in-bag products; the latter also results in shorter shelf life and higher labour costs. Overall, processors dealing with PSE meat are looking for ways to utilize the meat with minimum interference to their production. Starch is one of the ingredients that can be used to assist in water binding and enhancing texture. In order to make starches easier to use, more stable in processing, and provide different textures, chemical modification is used by the food industry. Depending on the nature and degree of substitution, the properties of modified starches can vary quite a lot. In one of our recent studies, the effects of regular and modified potato and tapioca starches were evaluated. Addition of starches to the meat resulted in completely different microstructure of the raw and cooked minced products. Whereas potato starch contributed relatively large starch granules to the product while tapioca starch provided smaller granular but with slightly lower water binding and enhanced firmness.

We are also investigating some of the causes for the deep muscle myopathy problem in an attempt to reduce the problem and help the industry in providing the consumer with defect free meat products.

Impact Statements:

Reducing the occurrence of both the PSE and deep muscle myopathy problems can save the industry a significant amount of money currently wasted on condemnation and poor water binding capacity of the meat. This is more pronounced in cut up and further processed poultry products, which are not sold as parts (i.e., not as whole birds) where the consumer can clearly see the defects.

Accomplishments:
Studying the microbiology of poultry carcasses at various points during primary processing operations has helped to verify the importance of some HACCP points while revealing ineffective HACCP points. In the studies we have also looked for an easy sampling method, and recommended using excision 2X5 cm skin areas from different areas (see publication for details).
In addition we have developed some procedures to better utilize PCR for the detection of *Campylobacter jejun* in poultry meat and skin samples.

Impact Statements:
The proposed sampling method (by excision) has proven easy to use and very effective in verifying HACCP points in a commercial poultry plant. We are currently continuing to evaluate various processes and their effect on reducing the microbial load on poultry carcasses. Developing enrichment and centrifugation steps, prior to PCR identification of *Campylobacter jejun,* should be beneficial to the industry in cutting down detection time.

Accomplishments:
Use of micro-encapsulation to acidify meat products:

Semidry and dry fermented sausages have been manufactured for centuries and represent one of the oldest forms of meat preservation. Without understanding the scientific background, our ancestors found that salted meat stuffed into animal casings would keep for months when properly handled and later dried. Only over the past century people have started to understand the basis of the process. Once it was recognized that certain microorganisms are responsible for the fermentation process, these were isolated, identified and later cultured for commercial purposes. The first patent dealing with a starter culture for semi dry sausages was issued in 1940, and the first commercial culture was offered to the meat industry in 1958. Only recently some encapsulated products have appeared on the market. In our research, the use of the traditional lactic acid bacteria (LAB), liquid lactic acid and new encapsulated acid preparations (lactic, citric and glucono-delta-lactone [GDL]) were investigated. Liquid lactic acid caused an immediate pH drop, crumbling of meat particles and some moisture separation. This type of precooking protein denaturation resulted in the lowest springiness value and showed a microstructure with gaps among the cooked meat particles. The encapsulated acids did not produce such problems, and their effects on cook loss and hardness values varied. The nonacidified control (pH 5.60) provided the highest hardness value and low cook loss, because of less disruption to protein gelation during cooking. The slow acid release, during the overnight LAB fermentation, resulted in some binding prior to cooking, but a higher cook loss compared to the encapsulated acids.

Impact Statements:
The use of micro encapsulation for acidifying meat products, at the appropriate stage during manufacturing, is saving the industry time and money currently spent on the traditional fermentation process (1 to 4 days). It can also assure that the right pH is obtained regardless of problems with the meat (e.g., small amount of antibiotic residue), the fermentation process (inadequate temperature), and competition from pathogens such as *staph. aurous*. However, it should be mentioned that the flavor profile of such products is usually not considered as diverse / rich as products produced by the traditional lactic acid bacteria fermentation.

Publications

Barbut, S. 2006. Effects of caseinate, whey and milk powders on the texture and microstructure of emulsified chicken meat batters. J. Food Sci. Techn. 39:660-664.

Barbut, S. 2006. Fermentation and chemical acidification of salami type products – Effect on yield, texture, and microstructure. J. Muscle Food. 17:34-42.

Zhang, L., and **S. Barbut**. 2005. Effect of regular and modified starches on cooked PSE, normal and DFD chicken breast meat batters. Poultry Science. 84: 789-796.

Zhang, L., and S. Barbut. 2005. Rheological characteristics of fresh and frozen PSE, normal and DFD chicken breast meat. British Poul. Sci. 46:687-693.

Oliveira, T. C. R. **S. Barbut**, and M. W. Griffiths. 2005. Detection of *Campylobacter jejuni* in naturally contaminated chicken skin by melting-peak analysis of amplicons in real-time PCR. Int J. Food Micro. 92: 105-111.

Oliveira, T. C. R. **S. Barbut**, and M. W. Griffiths. 2005. A robotic DNA purification protocol and real-time PCR for the detection of *Campylobacter jejuni* in foods. J. Food Prot. 68: 2131-2135.

Barbut, **S**., L. Zhang, M. Marcone. 2005 Effects of pale, normal, and dark chicken breast meat on microstructure, extractable proteins, and cooking of marinated fillets. Poultry Science. 84: 797-802.

Barbut, S. 2005. Effect of enhanced fluorescent light on acceptability of meat cuts. J. Muscle Food. 16:77-86.

Gill, C.O., M. Badoni, L.F. Moza, and **S. Barbut,** and M.W. Griffiths. 2005. Microbiological sampling of poultry carcasses portions by excision, rinsing or swabbing. J. Food Prot. 68:2718-2720.