

238 Effects of dietary inclusion of essential oil blends on broiler performance, carcass characteristics and sensory quality of meat. H. Schulze¹, P. Plumstead*¹, H. Bento¹, V. Ravindran², and G. Ravindran², ¹Danisco Animal Nutrition, Marlborough, United Kingdom, ²Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand.

Extracts of essential oils (EO) such as thymol, carvacrol, and cinnamaldehyde that occur naturally in oregano, thyme, and cinnamon have previously been shown to have positive effects on broiler performance. However, it was not known if these EO compounds affect the sensory characteristics of the broiler meat produced. The present study examined the effects of feeding 3 different blends of EO (Danisco Animal Nutrition, United Kingdom) on broiler performance, carcass characteristics and sensory quality of the meat. Ross 308 broiler chickens were grown to 35 d of age using a 4 × 2 factorial arrangement of treatments. There were 2 genders (male/female) and 4 dietary treatments consisting of a Control diet with/without 1 of 3 different blends of EO (EOB1, EOB2, EOB3). A pen of 30 birds was the experimental unit and each sex × dietary treatment combination was replicated 6 times. Body weight (BW) and feed intake was determined at 10, 21 and 35 d of age and the feed conversion ratio (FCR) calculated. At 35 d of age, 6 birds per pen were slaughtered to evaluate the dressing percentage, breast meat yield, and sensory characteristics of the breast meat. All 3 blends of EO evaluated in the present study significantly ($P < 0.05$) improved FCR from 0–10 d of age. The BW gain and feed intake from 0–35 d was significantly ($P < 0.05$) increased when EOB2 was added to the Control diet. There was no effect of dietary EO treatment on dressing percentage, breast meat yield, or sensory characteristics of the breast meat. These results suggested that the EO blends evaluated can significantly improve broiler performance without negatively affecting the sensory quality of the meat produced.

Key Words: essential oils, broiler, performance

239 Effect of feed restriction on core body temperature dynamics in meat-type chickens. R. A. Renema*¹, M. J. Zuidhof², D. S. Peters², J. Berezowski², and C. Oullette¹, ¹Dept. of AFNS, University of Alberta, Edmonton, AB., Canada, ²Ag Research, Alberta Agriculture, Edmonton, AB., Canada.

Feed intake affects the heat increment of the chicken. Ad libitum fed birds have a higher core body temperature than feed restricted birds, and are predicted to have less range in their daily temperature cycling than feed restricted birds. Bird:bird core temperature variation in response to feeding level is not well understood and has implications for calculations of growth efficiency. A total of 30 female broilers from an experimental yield strain (Aviagen, Inc.) were raised on a broiler breeder growth profile until 6 wk of age, and surgically implanted into the abdominal cavity with a live broadcasting temperature reader (mean/bird = 1,700 temperatures/d) in a 20 min procedure. The indwelling remote temperature sensors are cylindrical, approximately the size of an AA battery. Birds were housed individually in cages containing temperature data loggers recording local temperatures for each bird. Following 4 wk on a nutrition study, birds were acclimated to a base ration for 4 d and randomly allocated to 1 of 2 feeding level treatments: Ad libitum (full fed) or Feed restricted (fed calculated maintenance requirement daily for 7 d). Maintenance level based on book 125 kcal/kg metabolic BW. Treatments switched in a second, 7 d period. Data from the first day of each wk was discarded to allow birds to clear previous feed.

Core body temperature was significantly reduced in feed restricted birds ($P < 0.0001$). Ad libitum fed birds averaged 40.05 C while feed restricted birds averaged 39.81 C. Local microclimate temperature, which was included as a random variable in the mixed model, significantly affected the response to feed restriction, demonstrating the need for thorough data collection in this type of analysis. There was some variance in response to feed restriction, although all Feed restricted birds underwent a decrease in core temperature. Live, constant temperature recording is a practical way to collect and quickly apply data in nutritional studies.

Key Words: feed restriction, ad libitum feeding, body temperature

Symposium: Use of Multimedia Educational Tools in Poultry and Egg Processing Initiatives for Teaching, Extension, and Outreach

240 Multi-media educational tool for poultry meat and egg processing instruction. J. L. Emmert*¹, C. M. Owens¹, C. Z. Alvarado², S. R. McKee³, and S. F. Bilgili³, ¹University of Arkansas, Fayetteville, ²Texas Tech University, Lubbock, ³Auburn University, Auburn, AL.

Considering job availability and recent mergers, there is a high demand for students and personnel with basic knowledge in poultry processing, product technology, and food safety. However, educational opportunities in these areas can be limited. Full or partial courses may be offered at 4 year academic institutions in departments of poultry science, animal science, or food science; however, the number of institutions with faculty expertise in these areas is decreasing. Workshops and company-based training may also provide this education, but the offerings can be limited. On-the-job training is another source of education, but it is informal and general. Therefore, there is a tremendous need for a widely available curriculum that can be implemented or adapted by institutions and companies to produce students and workers capable of meeting the increasing challenges that will be faced in the areas of poultry processing, products, and food safety. The overall objectives of this project

were to 1) develop standardized curriculum modules for the areas of egg science and technology, poultry meat science and technology, and food safety, 2) use a multi-media approach, making use of computer-based technology, and 3) target developed curriculum materials to 4-year agricultural institutions and industry. A multi-media poultry meat and egg processing curriculum with broad applications that addresses a national and international education need was developed by a team of faculty at multiple institutions. The developed modules are versatile and can be used alone or with other course material thereby enhancing program quality and supplementing available resources. Single or multiple modules, delivered on a CD, including a presentation window, graphics, and video, can be incorporated into classrooms as lectures or used independently by individuals for self-learning. These materials could also be used to supplement university-hosted industry workshops on poultry processing related areas that are presented in English and/or Spanish. Furthermore, these materials provide strong reference materials for individuals for use beyond the learning phase.

Key Words: education, poultry processing, instruction

241 Virtual chicken and other virtual teaching tools. P. A. Curtis*, *Auburn University, Auburn, AL.*

The Virtual Chicken is a 3-D animation of the reproductive system of a hen, showing the formation of an egg as it passes through the oviduct. Viewers see the oviduct in the context of the larger anatomy, explore the oviduct and follow the path of the formation of an egg. The DVD and online supporting materials are available free of charge and may be requested at <http://www.virtualchicken.org>. Requesters/Users of the virtual chicken DVD and CD with PowerPoint Presentations fall into the following categories: University and College Professors, Extension Educators, Poultry and Egg Company Professionals (use Virtual Chicken as a teaching resource), Biology High School Teachers, Agriscience High School Teachers, 4-H School Enrichment Programs in both national and international locations (Australia, Denmark, Italy, The Netherlands, Poland, Scotland, Nigeria, Canada, United States: Alabama, Arkansas, Georgia, Texas, Pennsylvania, Florida, North Carolina, Washington (state), Washington, DC, Vermont, Maryland, Missouri, Iowa, Nebraska, Mississippi). A video or audio history including methodology of the project is available online at <http://www.ag.auburn.edu/poul/virtualchicken/>. Virtual Chicken is a teaching tool developed for use in outreach programs to students of all ages. An integrated poultry operation is also under development in a virtual world. The first phase of this endeavor is to research, develop and design the framework for a poultry processing plant virtual existence. Design expectations for our 6-month Short Phase include, but are not limited to, layout of virtual space, outdoor gathering space and amphitheatre, welcome area, dress out room and microbiology laboratory. Learning modules will be developed for events that can not be easily seen in a real-world visit to poultry operation locations. Providing information of proper scientific procedures, such as streaking a plate, will compliment the microbiology laboratory environment. Individuals could be called to gather for virtual meetings, training programs, roundtable discussions, or lectures and experience a new virtual learning environment.

Key Words: teaching, outreach, technology

242 Online processing plant tours as teaching tools for food science and poultry science courses. J. M. Regenstien*, *Cornell University, Ithaca, NY.*

A USDA Challenge Grant to Cornell and the University of Wisconsin-Madison was used to develop a video library of food processing plant operations including poultry. The inspiration for the project was the increasing difficulty of getting students into food processing plants to see these plants in operation and the desire to improve learning outcomes by using more active visuals. The assets will be short videos of 5 to 30 s showing unit operations and general overviews of food processing facilities. The assets are being supplied by the food industry, mainly suppliers. Model active learning materials featured on the site will suggest ways that instructors can use the site to optimize learning by engaging the student. A set of active learning materials for poultry are based on input obtained from a group of American poultry faculty. Three active learning models have been developed. The assets will be searchable and users may also create their own collection of assets on line. The video library of food processing plant operations can be used in courses at all academic levels of food science and poultry science. We are looking for feedback using an online feedback form from the poultry community

to improve these materials as the site is migrated to a permanent server at Cornell. Additional assets are always welcome.

Key Words: USDA challenge grant, poultry processing, active learning

243 Online and face-to-face classes: A comparative evaluation of eight large scale introductory food science classes. J. R. Rupnow*, J. King, and D. Bentz, *University of Nebraska, Lincoln.*

There has been much discussion within the higher education community about whether there is a significant difference or not when comparing online learning to traditional classroom learning. This study examines the differences between online distance education and traditional classroom learning for an introductory undergraduate food science course. The University of Nebraska's FDST 131 Science of Food course is designed as a Basic and Applied Science, General Liberal Education course. The course is cross-listed with the departments of Food Science and Technology, Nutritional Science and Dietetics, and Chemistry. Using the Alemoni twenty-nine question Course/Instructor Evaluation Questionnaire (CIEQ) instrument, student's responses were recorded for: general attitude, method of instruction, course content, interest and attention, and instructor. Data were collected over 4 consecutive semesters and 1,900 student responses were compared for 2 locations, the University of Nebraska-Lincoln (UNL) and the University of Nebraska-Omaha (UNO) and 2 methods of instruction, traditional classroom (face-to-face) and online (Web) delivery. It was found that learner attitudes were not significantly different in face-to-face vs. Web-delivered courses. Faculty should feel comfortable in transferring their teaching from face-to-face to online web delivery since learning was not significantly different by teaching modality. Basic science material is still a challenge in holding students' interest regardless of teaching modality. However, in this study students taking traditional face-to-face learning reported somewhat higher course interest responses than students learning by Web delivery. Instructor immediacy may be a factor in differentiating face-to-face and online students due to the method of delivery.

Key Words: online teaching, distance education, food science

244 iPod technology in graduate agricultural courses: A comparison of adopters and nonadopters. C. Z. Alvarado*, M. T. Brashears, and K. K. Fritz, *Texas Tech University, Lubbock.*

This descriptive research aimed to identify relationships between demographic and personal variables and adoption of iPod technology in college of agriculture graduate courses. Sixty-one graduate students enrolled in iPod-enabled courses were provided iPods during the 2007 spring semester. Students completed data collection instruments including the Group Embedded Figures Test (GEFT), California Critical Thinking Disposition Inventory, Computer Skills Inventory and a researcher-designed demographic instrument. The latter collected information such as gender, race, academic department and iPod usage during the semester. Researchers determined 34 of the 61 participants failed to adopt the iPod as an educational resource. T-tests determined significant differences in participants' GEFT scores, total GRE, and the value of an iPod as an educational resource score. The mean score for nonadopters GEFT was 10.06 (n = 34) while adopters recorded a 13.15

(n = 27). This suggests nonadopters of iPod technology are typically categorized as field-dependent learners and adopters are more likely to be field-independent learners. Adopters scored approximately 85 points higher on the combined quantitative and analytical sections of the GRE with adopters recording a mean score of 972.96 and nonadopters scoring 887.65. Educators should look to use iPod-enabled courses as another method of delivering course content to students who prefer to receive it in that manner. Nonadopters should be identified and provided additional chances to adopt through informing them about the attributes of the innovation or providing other options more suited to their learning style. Continued research on the most effective delivery method as well as continued research on identifying barriers to adoption may also influence research on other classroom technologies.

Key Words: iPod, education, graduate course

245 Bilingual modules for online education in poultry processing, further processing and food safety in the United States and Latin America. M. X. Sánchez-Plata*, *Department of Poultry Science, Texas A&M University, College Station.*

Several initiatives have been implemented to facilitate training in poultry processing beyond the traditional classroom settings. Texas A&M University has developed and successfully offered a Masters of Agriculture online-only degree in poultry science. This program was established with the purpose of reaching audiences that are currently involved in

the poultry industry with the willingness to enrich their professional development with an advanced degree without having to allocate a 2 to 3 year period for their academic work. So far, up to 5 students have completed or are in their final stages of completing their requirements for degree completion in this student-driven program. Overall, the program has received positive evaluations and alumni participating have indicated their willingness to recommend it to future participants. The next stage in diversifying the reach of TAMU programs includes the implementation of a series of online training modules in the fields of poultry processing, further processing and food safety to complement distance education initiatives. Bilingual modules have been developed in English and Spanish to facilitate the instruction of English-speaking poultry workers as well as Hispanic line workers and supervisors that are currently estimated to account for up to 75% of the workforce operating in some poultry facilities. Personal communications indicate that the language barrier has, at times, been the source of problems in some facilities in respect to processing efficiency and food safety initiatives. Therefore, strong emphasis is placed in presenting the materials in both languages so that in addition to receiving bilingual processing and food safety training, Hispanic workers are exposed to the proper English terms used to describe course contents in this adult educational effort. This is expected to familiarize employees with the English words used during regular operations and potentially facilitate the work of English-only speaking supervisors and plant managers. A discussion of the program targets and objectives will be provided.

Key Words: online training, distance education, bilingual

Symposium: PSE Syndrome in Poultry

246 Potential ways to manage PSE poultry meat at the processing plant. S. Barbut*, *University of Guelph, Guelph, ON, Canada.*

As indicated in several publications appearing over the past 10 years, the proportion of the so called pale, soft, and exudative (PSE) poultry (chickens, turkeys) meat can range from 5 to 30%. These values usually depend on factors such as the season, stress prior to slaughter, genetics of the flock, as well as the cut off point used by each plant to characterize the PSE meat. The fact that genetics plays a big role and would require a long term solution is agreeable by most researchers (to be discussed in the other presentations). However, at the moment a processor should be aware of the PSE problem and ways to handle the meat with minimal economical loss. Using the meat as is, especially in large whole muscle products can result in significant yield and textural problems. Therefore, identify the PSE meat (i.e, the current poultry grading system is not designed to evaluate meat quality characteristics) and either treating the meat separately with the addition of texture and/or moisture modifying ingredients is one general option. The use of nonmeat proteins (e.g., soy, dairy), complex carbohydrates (regular and modified starches), hydrocolloid gums (carrageenan) will be presented. Another option is cutting the PSE meat into smaller portions and blending it with regular meat prior to further processing can work if not too much PSE meat is present.

Other research in the red meat area will also be highlighted and ideas concerning potential solutions, at the processor level, will be further discussed.

Key Words: PSE, poultry, meat

247 Research developments in pale, soft, exudative turkey meat in North America. C. Z. Alvarado*¹ and C. M. Owens², ¹*Texas Tech University, Lubbock,* ²*University of Arkansas, Fayetteville.*

In the past 10 to 15 years, the North American turkey industry has been challenged with the pale, soft and exudative (PSE) meat which results in meat that is pale in color, forms soft gels, and has low water holding capacity. There is a large further processing market in the turkey industry and the incorporation of PSE meat into these products results in quality defects and loss of yield, both of which result in economic loss. Research has been conducted to characterize the meat, investigate causes of the poor quality meat, and develop remediation techniques to improve meat quality. Meat with PSE characteristics generally has an accelerated rate of metabolism. The resulting abnormally low pH at an early postmortem time when the carcass temperature is still warm causes denaturation of the muscle proteins responsible for the muscle color, water holding capacity, and texture. Because of this, turkey meat can be prone to developing PSE characteristics when carcasses are inadequately chilled during processing. Genetics and antemortem stress can also influence the development of PSE meat. Genetic differences, that may result in more susceptibility to PSE meat development, have been reported between random-bred and commercial turkeys; however, more research is needed to link these differences to meat quality. Antemortem stress has a major influence on turkey meat quality; it has been shown that the incidence of PSE meat generally increases when birds are subjected to elevated environmental temperatures as observed in research and industry heat stress conditions. While there have been mixed results on remediation techniques of PSE meat, there is potential for using functional ingredients to improve product quality. Sorting