omega-3 fatty acids and iodine, and 25% less saturated fat than regular generic eggs. EB has one of the finest shell egg quality assurance programs anywhere. EB franchises submit weekly egg samples, which are analyzed for shell quality, interior quality, vitamin E, iodine, cholesterol and fatty acids. Samples of feed and the EB patented feed supplement are also analyzed. Approximately 28,000 total laboratory tests are conducted annually. Nationwide product and display retail evaluations are contracted through an outside audit company (40-50 cities evaluated 4 times per year). All EB eggs are USDA graded according to EB’s strict quality standards. Producers must follow a food safety quality assurance program (UEP 5-Star, or equivalent state or company program). Each egg is stamped “EB” as assurance of meeting EB’s highest standards of flavor, quality and nutrition. Eggland’s Best has enjoyed record sales growth for the past three years.

Key Words: Education, Symposium, Egg, Marketing, Quality

Tuesday, PM, John Q. Hammons Hall II, Campylobacter Symposium

13 Regulatory Issues Related to Campylobacter on Poultry. J. E. Marion*1 and S. Pretanik2, 1Auburn University, AL, 2National Chicken Council, Washington, DC.

Regulatory issues related to Campylobacter on poultry currently hinge on the state of scientific knowledge, USDA-Food Safety and Inspection Service (FSIS) goals, field data, incidence and severity of illnesses related to poultry and red meats, and the overall mix of consumer, political and industry input. Scientific knowledge on Campylobacter in poultry is being advanced at a rapid rate. Universities, USDA-ARS, and other agencies are conducting research to determine the source of Campylobacter in poultry, how it may be controlled and monitored, and its’ relation to human diseases. Information is also being generated by the poultry industry via in-plant studies, by FoodNet and by others. Some of studies reach from the farm to the table. It is likely that USDA-FSIS will establish final product performance standards for Campylobacter. Early results indicate that Salmonella incidences have decreased since implementation of performance standards. FSIS’s stand will likely be that Campylobacter reductions are necessary and possible, and that regulatory standards will achieve this goal quicker. Recent industry data quantify the effectiveness of immersion chilling of poultry in reducing overall microbial levels on poultry carcasses, specifically Salmonella and Campylobacter. The effectiveness of immersion chilling and other interventions in reducing foodborne pathogen levels may also further hasten FSIS to establish Campylobacter performance standards. Consumer pressures on FSIS continue to influence regulatory actions. The prevalence of Campylobacter on poultry carcasses promotes the assumption that these levels are the prime causes of Campylobacteriosis in humans, yet this cause and affect has not yet been clearly shown by incidence data, a situation which must be cleared before further regulatory action is taken.

Key Words: Campylobacter, Food Safety, Regulatory, Chilling

14 Campylobacter as a Foodborne Pathogen. A. L. Waldroup*. .

Campylobacter is considered the leading cause of bacterial foodborne illness, causing severe diarrhea (1/3 of patients have bloody diarrhea), cramping, abdominal pain, fever, and vomiting. The CDC estimates that Campylobacter is responsible for 2-8 million infections and close to 500 deaths each year. Campylobacter enteritis is most common in children under 5 yr and especially under the age of two. Less than 1% of the cases of diarrhea caused by this pathogen is bacteremic. The bacteria can trigger Guillain-Barre syndrome (GBS), a rare paralysis - inducing disease. Data suggests that up to 40% of the 5,000 annual cases of GBS may be triggered by Campylobacter. Antibiotic treatment for Campylobacter infection is usually recommended for pregnant women and patients with severe illness or weakened immune systems. Common sources of Campylobacter include raw poultry, unpasteurized milk, contaminated water, and feces of infected cats or dogs. The most common causative factors involving poultry include cross contamination and lack of proper handwashing. Many cases occur when individuals eat or smoke during preparation of raw poultry, fail to wash their hands after handling raw poultry, or contaminate food contact surfaces with juice from raw poultry. Unlike Salmonella, Campylobacter is usually present on raw chicken in levels sufficient to cause illness without temperature abuse. In some cases the infective dose may be as low as 500 organisms, which could be present in one drop of chicken juice.

Key Words: Campylobacter Symposium, Foodborne Illness, Poultry

15 Origin and Relationship of Campylobacter and Salmonella Contamination of Poultry During Processing. J. A. Byrd*. 1USDA-ARS Food Animal Protection Research Laboratory, College Station, TX.

Campylobacter and Salmonella are leading causes of human foodborne illness. Effective intervention strategies require an understanding of the origin of these pathogens and cross contamination of carcasses during processing. Clearly, effective programs must involve multiple intervention strategies at critical control points from the farm-to-table for control of these pathogens. Contamination of the broiler carcass, when present, irreversibly begins on farms, with potential cross-contamination of non-contaminated carcasses at some points during processing. Mandatory pre-harvest feed withdrawal has been shown to markedly and significantly increase the incidence of Campylobacter and Salmonella in the crops of market age broilers. A 2- to 3-fold increase in Campylobacter incidence has been observed after 5 hour or greater feed withdrawal, most likely due to ingestion of contaminated litter and feces. Increased carcass contamination has been observed during the transport and holding of live poultry prior to entering the processing plant, and may continue during processing. Although carcasses exiting the scald tank typically have reduced numbers of Campylobacter and Salmonella, contamination of broiler carcasses has been shown to increase during feather and viscera (including crop) removal. During evisceration, several sites of possible Campylobacter and/or Salmonella contamination must be addressed. The selection of different styles or types of processing equipment may increase the incidence of Campylobacter carcass contamination. The identification of critical control points will allow the selection of intervention strategies to help reduce the number of pathogenic contaminated carcasses. These steps must be a total integrated farm-to-table strategy that must begin before the animals are placed on the farm (breeders and hatcheries) and must continue through handling and preparation by the consumer.

Key Words: Campylobacter, Processing


Conventional isolation procedures for identification of Campylobacter-like bacteria from ready-to-cook poultry include: a) enrichment of the samples in selective broths (Hunt and Radle or Bolton) at 37-42°C for 8-12 h; b) streaking enriched samples onto selective plates (campy-cfelex or charcoal cefoperazone deoxycholate agar) that are incubated at 37-42°C for 24-48 h; c) determination of presumptive Campylobacter colonies under dark field or phase contrast microscopy; and d) biochemical screening of thermotolerant isolates (C. jejuni, C. coli and C. lari) with hippurate and antibiotic resistance/sensitivity tests for species identification. The isolation scheme is done under microaerophila and takes from 2 to 4 days. The most frequent species isolated are C. jejuni and C. coli. Since Arcobacter spp. can also be isolated with this procedure, lengthy testing of isolates for growth under different atmospheric conditions may be needed to differentiate between Arcobacter and Campylobacter. To circumvent the limitations of conventional microbiology methods for Campylobacter identification, DNA techniques, such as the polymerase chain reaction, are now being incorporated into the food microbiology laboratory. Several PCR assays are available for the identification of Campylobacter and are based on the amplification of the flagellin gene, the 23S rDNA, the 16S rDNA, housekeeping genes, or random segments of the genome. All these protocols are useful for genus identification and some even for species confirmation. Due to new sequencing findings at the Sanger Centre, Cambridge, U.K., the genomic map of a reference strain of Campylobacter jejuni has been recently revised. This information may be used to develop new species-specific DNA-based identification assays that will
shorten the time necessary to determine if a sample has Campylobacter. Also, DNA techniques with improved sensitivity may be used to quantify pathogenic strains and establish realistic standards to minimize human health risks associated with the consumption of poultry products.

Key Words: Arcobacter, Campylobacter, DNA, Identification, PCR


Campylobacter spp. gastroenteritis in humans is characterized by the unremarkable symptoms of headache, fever, vomiting and diarrhea. Within the United States an estimated two to four million such cases occur annually. Various independently run epidemiological studies have repeatedly associated cross contamination, mishandling and/or improper preparation of poultry and poultry products as contributing to this health concern. Frequently, the etiologic fraction attributed to this association of poultry in human disease is 50 to 70% of the cases. In addition, over the past several years, a new concern over the association of Guillain-Barre Syndrome (GBS) and Campylobacter spp. has compounded the problem. Most cases of human poultry borne disease are self-limiting and resolve after a week’s duration of symptoms, but chronic sequelae may occur in 2 to 10 percent of the stricken patients. Although Campylobacter gastroenteritis is typically short-lived, when treatment is indicated the drug of choice is Erythromycin. Fluoroquinolones may also be prescribed because of their wide spectrum of activity. As part of the National Antimicrobial Resistance Monitoring Program - Enteric Bacteria (NARMS), antimicrobial resistance testing for Campylobacter was added in 1998. Antimicrobials tested included Azithromycin, Ciprofloxacin, Chloramphenicol, Clindamycin, Erythromycin, Gentamicin, and Tetacycline. All testing was done using the E test (AB Biodisk) as per manufacturer’s direction. Isolates (n=215) were obtained from broiler carcasses as part of a Campylobacter baseline study in which protocols and bacteriologic methodologies were defined. No resistance was observed for Chloramphenicol. Resistance was observed for the other antimicrobials at the following levels: Azithromycin (12.6%), Ciprofloxacin (13.6%), Clindamycin (11.6%), Erythromycin (11.6%), Gentamicin (1.4%), and Tetracycline (5.9%). These results parallel resistance reports from human Campylobacter isolates. Emerging resistance to Erythromycin and Ciprofloxacin may indicate that treatment could be compromised in a portion of patients requiring treatment. These data indicate that efforts to control Campylobacter should be increased as a decrease in total numbers of Campylobacter should also result in a decrease in total numbers of resistant bacteria. 

Key Words: Campy Symposium, Campylobacter, Antimicrobials, Resistance

Tuesday, PM, John Q. Hammons Hall III, Testies Symposium

18 Central Nervous System Regulation of Gonadal Development in the Avian Male. W. J. Kuenzel1. 1 University of Maryland.

The mechanism responsible for the onset of puberty in birds and mammals remains unknown. Nonetheless significant progress has been made over the past decade regarding the neuropeptides, glial factors, neurohormones, steroids and pituitary hormones involved in the process. It will not be possible to include a comprehensive review of all major factors involved in the complex cascade that brings a male bird or animal into reproductive condition. I have therefore chosen to limit this presentation to neural sites and pathways that have been investigated in avian species and include only those neuropeptides and hormones that we have had some experience in working with using immature male broiler chicks.

Any neural pathway involved in a gonadal response in avian species will need to include the identification of encephalic photoreceptors as many species, such as the domestic fowl, have photoperiodic and display a photoneurocortic gonadal response to long-day stimulation. To date, two neural sites have been shown to be viable candidates for housing encephalic photoreceptors: the septal area and mediobasal hypothalamus. A second component is the location of gonadotropin-releasing hormone (GnRH) neurons as they produce the critical decapetide responsible for releasing luteinizing hormone and follicle-stimulating hormone from the pituitary gland. Most studies have concentrated upon GnRH-1 neurons located in the bed nucleus (n.) of the pallial commissure and septal area as these neurons project to the median eminence and therefore affect anterior pituitary function. Three molecules that may play a role in regulating gonadal development are neuropeptide Y (NPY), vasointestinal polypeptide (VIP) and thyroid hormone as each has been shown to stimulate as well as depress gonadal function. A key central site in the avian brain that appears to be an integrative locus is the mediobasal hypothalamus, specifically the inferior hypothalamic n. and the infundibular hypothalamic n., the latter of which is homologous to the mammalian arcuate n. (Supported in part by a MAES Competitive Grant).

Key Words: Testis Symposium, GnRH, NPY, VIP, Thyroid hormones

19 Testis Symposium: Effects of Environmental Lighting on Early Semen Production and Correlated Hormonal Responses in Turkeys. W. Bacon. 1 The Ohio State University.

The production of turkey hatching eggs is based on artificial insemination of breeder hens. This allows management of males for optimal semen production. This paper summarizes our recent work on age of lighting turkey males and correlated changes in plasma luteinizing hormone (LH) and testosterone (T). In mature males, both LH and T were secreted in pulses, with a pulse of LH about 10 min prior to a pulse of T. Pulses of LH and T occurred about every 2 h, and were equally distributed between the light (L) and dark (D) parts of the 14L:10D d. Intermittent (1L:2D,8X d) was compared to continuous (14L:10D d)lighting; treatment did not affect LH or T levels. The LH and T pulses were not entrained by L or D with either treatment. The effect of age was studied next. Males were exposed to long-day photoperiods (16L:10D d) from 10 or 12 wk of age (WOA,LD) or to short-day photoperiods (6L:18D d) from 10 or 12 to 29 WOA (SD), then to long-day photoperiods. Semen production started in the LD males by 25 WOA, while few of the SD males were producing semen by 29 WOA. Both LH and T were low in the LD males until 18 WOA when both increased to adult levels over the next 2 to 3 wk. Both LH and T were lower in the SD males until 48 hr after switching to 16L:10D d when both were then higher in the SD males before declining to adult levels by 35 WOA. Secretory patterns of LH and T at 13, 23 and 35 WOA under LD and SD lighting were determined. At 13 WOA, both LH and T were secreted in pulses, but levels were low and not different between LD and SD males. None of the birds (4/4) in either group were producing semen. At 23 WOA, both LH and T were secreted in robust pulses, but the LD males had higher concentrations of LH and T than the SD males. Most of the LD males (3/4) but none (0/4) of the SD males were producing semen. At 35 WOA, 6 wk after photostimulation of the SD males, all males (4/4) in both groups were producing semen, and LH and T were at adult levels. However, fewer pulses of T were noted in the LD group of males. We conclude that male turkeys respond to early (10 to 12 WOA) stimulatory lighting with semen production by 23 WOA and increased plasma LH and T, and that LH and T are secreted in pulses from 13 WOA through sexual maturity in the adult.

Key Words: Turkey, Semen, Lighting, Luteinizing hormone, Testosterone


The role of FSH in the regulation of testis function of male birds has received little attention over the years. This was partly due to the generally robust pattern of sexual maturation, testis function and fertility of the leghorn and dual purpose breed males studied. The advent of the modern broiler, with tremendous increases in growth rate and yield over the past 40-50 years, has resulted in breeding stock which require careful management and feed intake restriction to become productive parents. The interaction between growth, yield and sexual development is further exacerbated in elite breeding stock populations where the demand for improved market bird performance has been met by “direct selection” of