

days, total excreta were collected during three days and dried for amino acid analyses: aspartate (Asp), glutamine (Glu), serine (Ser), glycine (Gly), histidine (His), arginine (Arg), threonine (Thr), alanine (Ala), proline (Pro), tyrosine (Tyr), valine (Val), methionine (Met), cystine (Cys), isoleucine (Ile), leucine (Leu), phenylalanine (Phe), lysine (Lys) and total amino acids (total AA). The apparent digestibility coefficient was measured for each individual amino acid and for all amino acids together (AMCAA). The experimental design was fully randomized with eight replicates per treatment. Significant ($P < 0.05$) increases were found in the digestibility (%) of most amino acids when feeding 200 ppm RONOZYME[®] ProAct protease: Ser (4.67), Gly (12.09), His (6.34), Arg (8.74), Thr (10.23), Pro (5.77), Val (4.06), Met (6.32), Cys (10.23) and Lys (3.80) for these amino acids by using 200 ppm protease, with an average improvement ($P < 0.05$) was 7.26% for all amino acids. improvement. For total AA, there was an average 5.3% improvement using the protease ($P < 0.05$). We concluded that the use of this particular protease resulted in an average 5.3% improvement in the utilization of the total AA of soybean meal.

Key Words: enzyme, protease, soybean meal, metabolism, amino acid

222 Use of a protease to enhance the utilization of full fat soybean amino acids by broilers. A. G. Bertechini^{*1}, J. C. C. Carvalho¹, F. R. Mesquita¹, S. F. Castro¹, D. F. Remolina¹, and J. O. B. Sorbara², ¹Universidade Federal de Lavras, Lavras, MG, Brazil, ²DSM Nutritional Products, São Paulo, SP, Brazil.

Because of its protein content (35 to 42%) and lipid concentration (18 to 22%), and in spite of a lower amino acid digestibility full fat soybean (FFS) meal is often considered as an alternative for solvent-extracted soybean meal. In this study, a protease was evaluated for its ability to improve the amino acid digestibility of FFS for broilers. The metabolism trial was performed with over a 14-21 day period with Cobb 500 males. Traditional methodology was applied and used 70% basal diet and 30% FFS across two levels of protease (0 and 200 ppm RONOZYME[®] ProAct). After four adaptation days, total excreta was collected for three days, and dried for analyses of 17 amino acids: aspartate (Asp), glutamine (Glu), serine (Ser), glycine (Gly), histidine (His), arginine (Arg), threonine (Thr), alanine (Ala), proline (Pro), tyrosine (Tyr), valine (Val), methionine (Met), cystine (Cys), isoleucine (Ile), leucine (Leu), phenylalanine (Phe), lysine (Lys) and total amino acids (total AA). The apparent metabolism coefficient was measured for each individual amino acid and for all amino acids together (AMCAA). The experimental design was completely randomized with eight replicates per treatment. With the use of protease, significant ($P < 0.05$) increases

the digestibility all individual AA and AMCAA were found for FFS, with the exception of Tyr. Total AMCAA was improved ($P < 0.05$) by 6.15%. Average improvement for the limiting amino acids Met, Lys and Thr was 5.76. In this experiment, this protease significantly increased the digestibility of amino acids in FFS by 6.15%, and presumably improved the nutritional value of FFS as an ingredient for poultry diets.

Key Words: enzyme, protease, full fat soy, amino acid, metabolism

223 The effect of a protease on performance of broilers fed corn-soybean meal diets containing different levels of crude protein and amino acids. M. K. Manangi^{*1}, M. E. Wehmeyer¹, J. D. Garlich², N. Odetallah¹, and M. Vazquez-Anon¹, ¹Novus International, Inc., St. Charles, MO, ²North Carolina State University, Raleigh.

A 28 d experiment was conducted to evaluate the effect of supplementation of protease (*Bacillus licheniformis* PWD-1) enzyme (activity of 600,000 U/g product: CIBENZA[™] DP100) preparation to broiler chicks fed isocaloric corn-SBM diets containing different levels of crude protein (cp) and amino acids (aa). A total of 720 Cobb-500 male broiler chicks were assigned to 6 treatments with 12 cages/treatment and 10 chicks/cage. The trial design was a 3 x 2 factorial with 3 levels of crude protein and aa, and with or without protease (source) supplementation. Individual dietary treatments for starter (0-12d) consisted of: T1 with 22.4% cp, 1.19% Dig Lys, 0.89% Dig TSAA, and 0.81% Dig Thr; T2 with 5% less cp and aa compared to T1; T3 with 10% less cp and aa compared to T1; T1 to T3 were without protease supplementation whereas T4 to T6 were similar to T1-T3, respectively, but supplemented with protease @0.05% of the diet. The grower (12-28d) diets were similar to starter diets except for change in cp and aa concentration. The grower T1 diet had 20.26% cp, 1.07% Dig Lys, 0.82% Dig TSAA, and 0.73% Dig Thr. No interaction ($P > 0.05$) was observed for level and source for any of the performance parameters. Both level and source effects ($P < 0.01$) were observed for cGain and adj F:G, whereas only source effect ($P < 0.01$) was found for cFI. In summary, irrespective of dietary cp and aa levels the dietary protease supplementation to broiler chicks under present experimental conditions improved weight gain by 54 g (4.5%), cFI by 52 g (2.74%) and adj F:G by 2.5 points (1.6%) compared to chicks fed diets containing no protease enzyme preparation. Also, the study indicates that this dietary supplemental protease would allow reduction in nutrient (cp, aa) density of broilers diets from 5 to 10% depending on the variable (cGain or F:G).

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Key Words: protease, broiler, TSAA, Lys, Thr

Processing, Products, and Food Safety II

224 Consumer perception of specialty turkeys: Free-range, organic, and heritage. A. C. Fanatico^{*1}, H. L. Goodwin², C. M. Owens², and A. M. Donoghue¹, ¹Poultry Products and Product Safety Research, Agricultural Research Service, USDA, Fayetteville, AR, ²University of Arkansas, Fayetteville.

Consumer interest is growing in specialty poultry products including free-range production and alternative turkey products, such as heritage. Heritage turkeys are slow-growing, naturally-mating turkeys and are typically raised with outdoor access. There is interest in sensory attri-

butes of the meat, as well as conservation of livestock breeds/varieties. Our objective was to investigate consumer perception of specialty turkey. A consumer focus group was held to gather data and allow consumers to sample several types of turkey meat including slow-growing heritage turkeys raised with outdoor access, fast-growing turkeys raised with outdoor access, and fast-growing turkeys raised indoors (a conventional, marinated product). Consumers with an interest in natural and local food were targeted by collaborating with a local food organization and outreach through natural food stores. Roasted breast and thigh meat

were offered first as an appetizer and then as part of a holiday meal with locally-raised, seasonal ingredients at an upscale restaurant. An introductory session was held before the appetizer/meal to provide basic information and definitions on specialty turkeys. The consumers (n=25) completed a 10-question survey. Of the participants, 96% had heard of free-range or organic turkeys, but only 44% had heard of heritage; 36% had purchased a specialty turkey in the past; 44% had not purchased due to lack of availability; and only 16% had not purchased due to cost. Reasons for buying or planning to buy a specialty turkey were ranked, and weighted score analysis (lower number indicates higher importance) indicated top reasons: concerns about use of antibiotics or growth promotants (2.6), flavor/texture (2.7), concern about use of pesticides (3.0), and nutrients (3.9). Of the participants, 40% indicated they probably would buy a specialty turkey in the future and 24% indicated they definitely would; 68% would prefer to buy specialty turkey as whole carcasses rather than parts or further processed. A majority of the participants indicated they probably would (36%) or definitely would (40%) pay more for specialty turkey than conventional.

Key Words: turkey, slow-growing, focus group, market, local food

225 Comparison of nutrient composition in eggs from hens housed in cage vs. range production facilities. K. E. Anderson*, *North Carolina State University, Raleigh.*

Public perception regarding nutritional quality of free-range vs. cage produced eggs, is based on a belief that eggs produced on free range are nutritionally superior to those produced in cages. This belief stems from a survey conducted on range eggs from 14 different pastured flocks. However, there was no information detailing the strain of hen or diets the range hens received. These analyses were then compared to the USDA nutrient data base for shell eggs. Therefore, this study compared free-range vs. caged shell egg nutrient content examining the effect of the laboratory, production environment, and hen age in a flock of 500 Hy-Line Brown layers. The birds were hatched simultaneously and received the same care, i.e. vaccination, lighting, and feeding regimen, with the only difference being the access to the range. The egg nutrient content of their eggs was analyzed for Cholesterol, Omega 3 fatty acids, Fat (Saturated), Beta Carotene, Vitamin A, and Vitamin E. The same egg pool was divided and sent to 4 different laboratories for analysis. The laboratory was found to have a significant effect on all nutrients in the analysis except for cholesterol. Total fat content in the samples varied (P<0.0001) from a high of 8.88% to a low of 6.76% in laboratory D and C, respectively. Eggs from the range production environment had higher (P<0.05) Total Fat, (P<0.05) Monounsaturated Fats, and (P<0.001) Polyunsaturated Fats than eggs produced by caged hens. Omega 3 levels were also higher (P<0.05) at 0.17% in range eggs vs. 0.14 in cage eggs. The range environment had no impact on cholesterol, 327 and 331 mg/100g in eggs from caged and range hens, respectively. Vitamin A and E levels were not affected by the husbandry to which the hens were exposed but were lowest at 62 wk of age. The age of the hens did not influence the fat levels in the egg, but, cholesterol levels were highest (P<0.0001) at 62 wk of age, 345 mg/100g. Although range production did not influence cholesterol levels in the egg, there was an increase in fat levels in eggs produced on the range.

Key Words: chicken, shell egg, nutrient composition, range production, cage production

226 Impact of cage versus free-range environments on the color of eggs and egg products. P. A. Curtis*¹, L. K. Kerth¹, and K. E. Anderson², ¹*Auburn University, Auburn, AL*, ²*North Carolina State University, Raleigh.*

In this test, the color of the shells, albumen, yolk, angel food cake, and fresh and stored mayonnaise was measured. The Hy-Line Brown strain was utilized to compare the free-range and cage environments within the 37th North Carolina Layer Performance and Management Test to facilitate an unbiased comparison for use in the U.S. Birds were reared in accordance with what environment they were going into and all other layer husbandry, vaccination, lighting and dietary regimens were identical. Eggs were gathered from layers at 17 to 82 weeks of age on a quarterly basis. Once collected, the color measurements of the egg shell, albumen, and yolk were made using a Hunter MiniScan (Reston, VA). Angel food cakes and mayonnaise were made from the egg components. Color measures were taken on the cakes as well as fresh and store mayonnaise. The shells from range eggs were darker (P<0.01) and had more red tones (P<0.001) than the cage eggs. The albumen of the range eggs had less green tones (P<0.0007) than the cage eggs and the albumen was darker (P<0.0001) more red (P<0.0001) and less yellow (P<0.02). Angel food cakes produced from cage eggs were lighter, more white, (P<0.0001) with more yellow undertones (P<0.0006) than angel food cakes produced from range eggs. Fresh mayonnaise produced from range eggs was darker (P<0.0001) with more red (P<0.0001) and yellow (P<0.0001) undertones than mayonnaise produced from cage eggs. However, after the mayonnaise was stored at 50°C for 7 days, the color changed and there was no longer a difference in the L value only a difference in the a* (P<0.0001) and b* (P<0.0001) values. Color of egg components and products were in most cases significantly impacted by the environment in which the eggs were produced.

Key Words: free range eggs, shell color, yolk color, mayonnaise color, angel food cake color

227 Functionality and composition of eggs from layers housed in cage or range environments. L. K. Kerth*¹, P. A. Curtis¹, and K. E. Anderson², ¹*Auburn University, Auburn, AL*, ²*North Carolina State University, Raleigh.*

Consumers are strongly pushing egg producers to move layers out of the traditional cages to range environments. However, little research is available on how these changes impact the functionality and composition of the egg. Therefore, this study compared the proximate analysis and functionality of eggs from range versus cage layers. The Hy-Line Brown strain was utilized to compare the range and cage environment within the 37th North Carolina Layer Performance and Management Test to facilitate an unbiased comparison for use in the U.S. Birds were reared in accordance with what environment they were going into and all other layer husbandry, vaccination, lighting and dietary regimens were identical. Eggs were gathered from layers at 17 to 82 weeks of age on a quarterly basis. Once collected, the functional properties of the egg, such as foaming and emulsification, were tested by measuring albumen pH, angel food cake volume, and fresh and stored mayonnaise emulsion strength. Proximate analysis of the egg was conducted utilizing the SmartTrac and Phoenix System by CEM (Matthews, NC). Angel food cake volume was higher (P<0.05) in cage birds than range birds. However, there was no environmental effect on albumen pH. Proximate analysis of the albumen showed that the range eggs had higher (P<0.05) percentages of solids, fat and protein, as well as a stronger emulsion (P<0.05) in both fresh and stored mayonnaise compared to cage eggs. Additionally, more oil (P<0.05) was recovered from the cage eggs but

no effect was found for yolk pH, nor was there a significant impact on solids, fat or protein percentages of the yolk. Results showed that range eggs have a higher percentage of fat in the albumen when compared to those from a cage environment which negatively impacted angel food cake volume. Also, range eggs produce a stronger more stable emulsion. Therefore, it appears that crucial impacts on the functionality of the final product may occur when the environment of the layer is changed.

Key Words: cage eggs, range eggs, functionality, proximate analysis, quality

228 Room environment influence on eggshell bacterial levels of non-washed and washed eggs from caged and cage-free laying hens.

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The bacteria levels of non-washed and washed eggs obtained from caged and cage-free hens housed in either wire slats or shaving-covered pens were determined. On 8 days (from 22 to 52 wk), 20 eggs were collected from each pen. Ten eggs/pen were washed with a commercial egg washing solution, while the remaining 10 eggs were not washed prior to sampling the eggshell and membranes for aerobic bacteria (APC), *Escherichia coli* (*E. coli*), and coliforms. Non-washed eggs produced in a shavings environment had slightly higher bacteria numbers (APC 4.0 and coliforms 1.1 log₁₀cfu/mL of rinsate) than eggs produced on slats (APC 3.6 and coliforms 1.06 log₁₀cfu/mL), which had significantly higher bacteria numbers than eggs produced in cages (APC 3.1 and coliforms 0.88 log₁₀cfu/mL). Washing significantly reduced APC counts by 1.7 log₁₀cfu/mL, and APC prevalence was reduced from 100, 99, and 98% (shavings, slats, and cages, respectively) to 87% for shavings and to 68% for caged and slat hens. Washing significantly reduced coliform counts by 0.5 log₁₀cfu/mL and prevalence was reduced from 22.5, 17.5, 12.5% (shavings, slats, and cages, respectively) to 6%. No significant differences were found in APC, *E. coli*, and coliform counts on eggs from the three housing types after the eggs were washed. At 53 wk hens were moved to triple-deck cages in an all cage room. From 57 to 62 wk, eggs were collected weekly and both non-washed and washed eggs were sampled for only APC. Non-washed eggs produced by hens in cages (previously housed on shavings, slats, and cages) did not differ with APC counts from 0.67 to 0.84 log₁₀cfu/mL. Washing eggs continued to significantly reduce APC counts to below 0.2 log₁₀cfu/mL. APC prevalence for eggs from the triple-deck caged hens after washing was 37% compared to 74% when hens were housed on shavings, slats, or cages. Housing hens in cages with manure removal belts resulted in lower APC for both non-washed and washed eggs (compared to eggs from hens housed in a room with cages, slats, and shavings) and corresponding reductions in human pathogens would further improve food safety.

Key Words: eggshell bacteria, caged hens, cage-free hens, egg washing, APC

229 Improving the safety of eggs using an in-package ozonation process. J. Jensen, A. Donner, S. Konkle, and K. M. Keener*, Purdue University, West Lafayette, IN.

There exists a need to ensure and maintain safe, high quality food from farm to fork. The goal of this research is to evaluate an in-package ozonation process on shell eggs to reduce *Salmonella* enteritidis. Periodically, egg shells are contaminated with pathogenic bacteria; and an in-package process may reduce this contamination. Ozone treatment is

an approved method by the FDA; and research has shown that ozone treatment has the ability to reduce pathogens and extend shelf-life. A novel, patent-pending technology developed at Purdue University generates ozone inside a sealed package. This PK-1 system operates at 60 Hz, generating 18kV of potential between electrodes, using only 40W of power. Past research focused on treating packaged lettuce and spinach. Results from these studies found *Salmonella* enteritidis, if present, can be reduced over 100,000 times (greater than 5 log₁₀). The PK-1 system will be applied to raw, shell eggs inoculated with *Salmonella* enteritidis, in order to determine and evaluate bacterial reductions. The experimental design consists of the following parameters: 1) treatment time of 5 min, 2) temperature of 5°C (refrigeration), and 3) ozonation gas: air in a flexible low-density polyethylene package (plastic storage bag). Measurements include: 1) bacterial reductions of *Salmonella* enteritidis, 2) ozone concentrations using a portable Dräger Measurement System, and 3) relative humidity. Raw, shell eggs were inoculated with *Salmonella* enteritidis, and treated with ozone generated in package using air. Samples were treated for 5 min and stored at 5°C for 17 hr. Relative humidity was 34% at 5°C. After 5 min of treatment, ozone concentration was 2500 ppm. Ozone concentration decreases with time, and was 10 ppm at 17 hr, and 1ppm at 24 hr. All treated samples showed reductions in *Salmonella* enteritidis of greater than 5 log₁₀, after 17 hours of storage time. The results indicate that the PK-1 ozonation process has the capacity to reduce *Salmonella* enteritidis on raw, shell eggs in an in-package treatment system.

Key Words: eggs, ozone, bacterial reductions, PK-1 system, *Salmonella* enteritidis

230 The effect of negative-pressure microcrack imaging on egg quality during storage. D. R. Jones^{*1}, K. C. Lawrence², S. C. Yoon², and G. W. Heitschmidt², ¹Egg Safety and Quality Research Unit, USDA Agricultural Research Service, Athens, GA, ²Quality and Safety Assessment Research Unit, USDA Agricultural Research Service, Athens, GA.

Microcracks are very small cracks in the shell surface which are difficult to detect by human graders. Microcracks have both food safety and quality implications since the shell is recognized as the first line of defense for the egg. New technology was developed which utilizes a brief negative pressure and imaging to detect microcracks in eggs. Research has shown the system to have a 99.4% accuracy in detecting cracked and intact eggs. A study was undertaken to determine if quality differences were seen between control and negative-pressure imaged eggs during extended cold storage. Three replicates were conducted with eggs stored at 4C for five weeks with weekly quality testing. The physical quality factors monitored were: Haugh units, albumen height, egg weight, shell strength, vitelline membrane strength and elasticity, and whole egg total solids. All measurements were conducted on individual eggs (12/treatment/replicate) each week with the exception of whole egg solids which were determined from 3 pools/treatment/replicate each week. Percent whole egg solids was the only significant ($P < 0.05$) difference between treatments (23.65% imaged and 23.47% control). There was a significant difference ($P < 0.05$) for egg weight between replicates (60.82 g, 58.02 g and 60.58 g for replicates 1, 2, and 3, respectively). Imaging eggs in the negative pressure system for microcrack detection did not alter egg quality during extended cold storage. Utilizing the technology would allow for fewer cracked eggs reaching the consumer, consequently enhancing food safety without affecting product quality.

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Key Words: shell egg, microcrack, pressure, imaging, quality

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were vacuum packaged, stored for 63 days at $4 \pm 1^\circ\text{C}$ and analyzed at one week intervals for microbiology (total aerobes, *Listeria monocytogenes* and lactic acid organisms), pH and objective color. Nisin, nisin with rosemary, nisin with EDTA and nisin with rosemary and EDTA treatments reduced ($P < 0.05$) *L. monocytogenes* counts by 4.42, 4.20, 3.73, and 4.11 log CFU/g when compared to the positive control, respectively, on Day 0. *L. monocytogenes* counts remained less than 3.0 log CFU/g for ham treated with nisin. The EDTA and rosemary treatments alone and in combination were ineffective in inhibiting growth of *L. monocytogenes*. Although none of the treatments in this study completely eliminated *L. monocytogenes*, the overall results indicated that ready-to-eat turkey ham can have significantly decreased *L. monocytogenes* when treated with nisin alone or in combination with rosemary and/or EDTA.

Key Words: nisin, rosemary, ethylene-diamine-tetra-acetic acid, *Listeria monocytogenes*, turkey ham

233 Effects of poultry processing sanitation chemicals on biological wastewater treatment systems. B. H. Kiepper*, *University of Georgia, Athens.*

An integrated extension and research project was conducted to measure the potential inhibitory effects of poultry processing cleaning and sanitation chemicals on aerobic and anaerobic wastewater treatment systems. University of Georgia cooperative extension specialists in Poultry Science and Bio & Ag Engineering were contacted for assistance by a poultry integrator after concern was expressed by a local municipality over potential impacts of antimicrobial chemical release into the wastewater stream on biological sewerage treatment. Poultry processing plants submitted a total of 12 commercial cleaning and sanitation solutions for analysis. The chemicals were divided into 4 sub-groups (quaternary ammonium compounds, acid cleaners, caustic cleaners, and synthetic detergents) of 3 chemicals each based on active ingredients. Each chemical was analyzed for inhibition/toxicity using 3 experiments: aerobic oxygen uptake rate (OUR), anaerobic specific oxygen uptake rate (SOUR), and bioluminescent bacteria toxicity. Preliminary OUR and SOUR tests revealed that none of the chemicals produced significant inhibitory effects at prescribed use concentrations (i.e., 0.2 – 2.0%). However, to simulate the effects of a potential accidental spill of full-strength solution and provide a means to compare the inhibitory/toxic effect of each solution and chemical sub-group, an effective concentration range was determined for each experiment. Results showed that a commercial acetic (24%)+ peroxyacetic (1-5%)+ octanoic (1-5%)+ hydrogen peroxide (5-20%) cleaning solution had the highest inhibitory/toxic effect of the chemicals tested, followed by a caustic sodium hydroxide (15%)+ sodium hypochlorite (1-5%) cleaning compound. As a sub-group the quaternary ammonium compounds were the most inhibitory/toxic, ranking 3, 4, and 5 on the list, while the synthetic detergents had the least effect ranking 9, 10, and 12.

Key Words: poultry processing, sanitation chemicals, wastewater treatment, oxygen uptake rate, bioluminescent bacteria

232 Nisin, rosemary and ethylene-diamine-tetra-acetic acid affect the growth of *Listeria monocytogenes* on ready-to-eat turkey ham stored at four degrees Celsius for sixty-three days. A. Ruiz¹, S. K. Williams*¹, N. Djeri¹, A. Hinton², and G. E. Rodrick¹, ¹*University of Florida, Gainesville,* ²*USDA ARS Richard B. Russell Agricultural Research Center, Athens, GA.*

The objectives of this study were to determine the anti-*Listeria* and general antimicrobial properties of nisin, rosemary, and ethylene-diamine-tetra-acetic acid (EDTA) alone and in combination on *Listeria monocytogenes* inoculated on ready-to-eat vacuum packaged diced turkey ham, and to ascertain the effects of the treatments on pH and objective color. Ready to eat turkey hams were cut into 0.5 cm pieces, inoculated with a *L. monocytogenes* cocktail containing five strains, and treated with either no treatment and no inoculum (negative control), inoculum only (positive control), 0.5% nisin, 20 mM EDTA, 1% rosemary, 0.5% nisin + 20 mM EDTA, 0.5% nisin + 1% rosemary, 0.5% nisin + 20 mM EDTA + 1% rosemary, or 20 mM EDTA + 1% rosemary. All samples

234 Effect of SonoSteam® on reduction of pathogens on chicken carcass. U. Nonboe*, K. Garde, and B. S. Larsen, *FORCE Technology, Brøndby, Denmark.*

Contaminated food or water as well as insufficient cooking and kitchen hygiene are the typical causes of human *Campylobacter* and *Salmonella* infections. These infections pose an increasing health risk to humans and since poultry is the most common source, intervention programmes have

been initiated to help eliminate the occurrence of *Campylobacter* and *Salmonella* on fresh poultry products. SonoSteam® is a new chemical-free technology for microbial decontamination of surfaces using a combination of ultrasound and steam. Due to short treatment time the method is applicable on heat sensitive surfaces such as e.g. freshly slaughtered poultry. The efficiency of the technology to reduce the number of pathogens on the surface of freshly slaughtered chickens has been tested in industrial pilot equipment designed for implementation in a poultry slaughterhouse. Tests at a poultry slaughterhouse revealed that *Campylobacter* in 10 g skin breast samples were significantly reduced with 1,29 log₁₀ units from 2,11 to 0,82 log cfu/g (n=25) on SonoSteam® treated chickens. *Salmonella* were significantly reduced with 2,20 log₁₀ units from 6,75 to 4,55 log cfu/carcass (n=10) in full carcass rinse and with 3,31 log₁₀ units from 4,02 to 0,74 log cfu/25 cm² (n=10) in internal swab samples. Shelf-life tests indicated that numbers of *Pseudomonas* and Total Viable Counts (TVC) did not differ significantly between SonoSteam® treated chickens compared to non treated chickens throughout the test period (Day 0 to Day 9). Data from each day even point towards that *Pseudomonas* and TVC on the SonoSteam® treated chickens were lower than control chickens. A visual evaluation showed that SonoSteam® treatment did not considerably affect the appearance of freshly slaughtered chickens, neither from an overall point of view, nor when specifically inspecting the wings, thighs and chests. In conclusion, SonoSteam® has proven to significantly reduce pathogens on freshly slaughtered chicken carcasses without causing considerable sensory changes. In addition, tests indicated that SonoSteam has the potential prolonging the shelf-life period of fresh chicken products.

Key Words: chicken, decontamination, pathogens, *Campylobacter*, *Salmonella*

235 Prevalence, serotype and antimicrobial resistance of *Salmonella* isolated from commercially processed broiler carcasses. M. E. Berrang*, J. S. Bailey, and P. J. Fedorka-Cray, *USDA-ARS-Russell Research Center, Athens, GA.*

This study was undertaken to determine the prevalence, serotype and antimicrobial resistance profiles of *Salmonella* on broiler carcasses collected from commercial processing plants. Twenty US commercial processing plants representing eight integrators in thirteen states were included in the survey. In each of four replications, ten carcasses from one flock were collected at re-hang and ten more at post-chill; each carcass was sampled by whole carcass rinse. *Salmonella* were isolated from carcass rinses using standard cultural techniques, serotype was determined and the resistance to 15 antimicrobials was measured. Overall, *Salmonella* was detected on 72 % of carcasses at re-hang (ranging from 35 to 97 %) and 20 % post-chill (ranging from 2.5 to 60 %). In every instance, a significant ($p < 0.05$) decrease in *Salmonella* prevalence was noted between re-hang and post chill which can be attributed to processing interventions. The four most common serotypes accounting for 64 % of all *Salmonella* isolates were: Kentucky, Heidelberg, Typhimurium and Typhimurium var 5-; most isolates of Kentucky (52 %), Heidelberg (79 %) and Typhimurium (54%) were susceptible to all antimicrobial drugs tested. However, only 15 % of the Typhimurium var 5- isolates were pan-susceptible; more than half of the isolates of this serotype were resistant to 3 or more drugs. No isolate of any serotype exhibited resistance to amikacin, ceftriaxone, ciprofloxacin or the combination of trimethoprim/sulfamethoxazole. These data demonstrate that although processing lessens carcass contamination with *Salmonella*, antimicrobial resistant isolates may still be present.

Key Words: antimicrobial resistance, broiler, *Salmonella*, serotype, processing

236 Evaluating different plate media for culturing and quantifying *Campylobacter* ssp. in broiler litter. A. S. Kiess*, H. M. Parker, C. D. McDaniel, and J. C. Hamby, *Mississippi State University, Mississippi State.*

Poultry is a major reservoir for *Campylobacter*, the leading cause of food borne illness in the USA, but how broilers become initially colonized is still under debate. Broiler litter is a potential source, but the best technique for quantifying *Campylobacter* from litter is still unknown. Therefore, our objectives were to determine if one media is more selective for quantifying *Campylobacter* and if enrichment allowed for the detection of stressed or viable but non-culturable cells from litter samples. In this trial, 5 medium and 2 plating methods were used to enumerate *Campylobacter* from broiler litter. The media used were Campy Line (CL), Campy Cefex (CC), modified Campy Cefex (mCC), *Campylobacter* Agar Plates (CAP), and modified Charcoal Cefoperazone Deoxycholate (mCCDA) agars. Litter samples were obtained from a commercial broiler house. Each sample was equally divided and diluted 10-fold into peptone, for direct plating, or 4-fold into *Campylobacter* enrichment broth. Samples diluted in peptone were direct plated onto each media and incubated under microaerophilic conditions for 48 h at 42° C. Samples diluted in enrichment broth were incubated under the same conditions for 24 h, then further diluted to 10-fold prior to plating. Plates from enriched samples were incubated for an additional 24 h after plating. After incubation, all plates (direct and enriched) were counted and presumptive positive colonies were confirmed using a *Campylobacter* latex agglutination kit. Results indicate that CAP agar was able to isolate *Campylobacter* from the commercial broiler house sampled, even though the incidence of *Campylobacter* was low. There was no difference in bacterial counts between samples directly plated or enriched before plating ($P=0.95$). Overall bacterial counts were higher for CC, mCC, and mCCDA when compared to CAP, and CL ($P<0.0001$). In conclusion, enriched samples did not improve the detection or quantification of *Campylobacter* in poultry litter. One selective media was able to detect *Campylobacter* however, quantification was not possible due to the low incidence within the house.

Key Words: poultry litter, media, enrichment broth, *Campylobacter*, Food safety

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238 Effects of dietary copper, citric acid and microbial phytase supplementation on digesta pH, ileal and carcass microflora of broiler chickens fed a low available P diet. A. Aydin¹, A. Y. Pekel^{1*}, G. Issa¹, G. Demirel¹, and P. Patterson², ¹*Istanbul University, Faculty of Veterinary Medicine, Istanbul, Turkey*, ²*The Pennsylvania State University, State College*.

An experiment conducted to study the effects of microbial phytase (PHY), citric acid (CA) and copper proteinate (Cu) supplementation in broilers (13 to 42 d of age) fed a low available phosphorus diet (0.25 %) on ileal and carcass microflora of broiler chicks. A factorial arrangement (2 × 2 × 2) was used to evaluate 2 levels of PHY (0 and 750 units/kg), Cu (0 and 250 ppm) and CA (0 and 3 %). Addition of 750 FTU microbial phytase significantly reduced the log₁₀ counts for total anaerobic

bacteria, *E.coli* and Coliform bacteria in the ileal digesta of chicks (0.28, 0.21, 0.68 log₁₀, respectively). Microbial phytase supplementation did not affect the *Campylobacter*, *Enterococcus*, *Lactobacillus*, *Clostridium* or *Salmonella* counts in the ileal digesta but significantly ($P < 0.01$) increased the growth and enumeration *Staphylococcus* on the carcass of the birds. Cu supplementation has no effect on pH or microbial count of bacteria in the ileal content of the broilers. However, Cu supplementation produced significant increases in the populations of *Staphylococcus* ($P < 0.01$) and lactic acid bacteria ($P < 0.001$) on the carcass of broilers also. CA supplementation decreased the population of Coliform bacteria in the ileal content significantly ($P < 0.05$) but increased the population of *Staphylococcus* ($P < 0.05$), *Campylobacter* ($P < 0.05$) and lactic acid bacteria ($P < 0.001$) on the carcass of broilers respectively. Findings of the current study indicate that neither 3% CA addition nor Cu supplementation to broiler diets have any significant positive effects on the certain pathogenic bacteria populations in the ileum or on the carcasses, but PHY supplementation might effectively lead to some changes in ileal microbial populations by decreasing some pathogenic bacteria populations. However future research on how microbial phytase affects birds intestinal bacterial population could provide new approaches for microbial reduction in poultry.

Key Words: copper, citric acid, microbial phytase, microflora, broiler

Student Workshop: The Dos and Don'ts of Writing Pubs

239 The dos and do nots of writing for the trade media. R. J. Smith*, *Feedstuffs Newspaper, Minnetonka, MN*.

In writing an article or news release for the trade media, it's critically important to remember that most readers—and most editors who would be handling your material—will not be educated, experienced or trained in the scientific concept that you are addressing. So “de-jargonize” and “de-scientificize.” Other “de’s” include “de-fluff,” “de-commercialize” and “de-opinionize.” Make sure that your first two paragraphs provide “the five w’s”—telling the who, what, when, where and why of your message, and keep your article or news release as short as possible. Always provide graphics—charts, tables, photos—and always provide contact information. Finally, if you are writing an article or news release for the general media, such as a local newspaper or a national publication, everything above should be multiplied by two.

Key Words: trade media, five w's, short, graphics, contact information

240 Writing and publishing an effective journal article from start to finish. K. J. Navara*, *University of Georgia, Athens*.

Journal articles represent the currency for scientific success. Without the dissemination of our findings to our scientific peers, our work may go unnoticed and important advancement within the field would not be made. This is why the publication of journal articles is crucial for both the success of an individual in academia as well as the success of the scientific field as a whole. Preparing a manuscript from start to finish, persevering through the review process, and finally getting the work accepted and published is not easy. However, there are many tips

that can help you to manage the writing process efficiently, correctly target your audience, manage and respond to reviewer comments, and produce a successfully published manuscript. A full understanding of the academic publication process is the first crucial step. In a broad sense, knowledge about how your manuscript will be handled, what editors are looking for, and how to respond to reviewer comments can mean the difference between acceptance and rejection of a manuscript. The detailed aspects of the writing process, including perfecting the scientific prose of the manuscript, formatting the manuscript correctly, and preparing effective figures are also extremely important towards effectively conveying an overall message to the reviewers and eventually a specific scientific audience. Tips for getting a scientific journal article started, highlighting and focusing the intended message, and preparing a submission package that will be attractive to editors and reviewers will be discussed.

Key Words: scientific writing, publication, scientific prose, manuscript, format

241 Technical editing and manuscript preparation. S. M. Pollock*, *Federation of Animal Science Societies, Champaign, IL*.

After a manuscript undergoes peer review and is accepted for publication, it is retrieved from the peer-review system for technical editing and printing in a journal. The process begins with gathering all the relevant files and processing the figures. Next, the files are marked up, edited, laid out, and sent to authors as proofs. This presentation will focus on the technical editing processes and how to use this information to prepare a manuscript for publication.

Key Words: technical editing, manuscript preparation