
2019



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Cyclone Scholar Summer Research Experience Final Symposium

Wednesday, July 31, 2019

9:30 am

Center for Crops Utilization Research Theater

Symposium is a conference for researchers to present and discuss their work. Together with academic or scientific journals, conferences provide an important channel for exchange of information between researchers.

Program

- | | |
|----------|---|
| 9:30 am | Welcome &
Opening Remarks |
| 9:45 am | Alexander Hall
<i>Alabama A&M University</i> |
| 10:00 am | Ayanna Lynn
<i>The University of Maryland
Eastern Shore</i> |
| 10:15 am | <i>Break</i> |
| 10:20 am | Haleigh Moreno
<i>State University of New York
at Fredonia</i> |
| 10:35 am | Abigail Olcott
<i>Olivet Nazarene University</i> |
| 10:50 am | ZaQuavis Willis
<i>Alabama A&M University</i> |
| 11:05 am | <i>Closing Remarks &
Reception</i> |



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INVESTIGATION OF HYDROPHOBIC PROPERTIES OF SHORT CHAIN PERFLUOROCARBOXYLIC ACID SURFACE TREATMENT FOR PAPER PACKAGING

Perfluorocarboxylic acids (PFCAs) are persistent organofluorine compounds that have potential to pose persistent human health and environmental risk because of their toxicity. These compounds are commonly used in applications in food-contact paper to provide a grease and water barrier. The objective of this study is to determine the functional concentration of PFCAs applied to fiber packaging paper. Four PFCAs, perfluorobutyric acid (PFBA), perfluorohexanoic acid (PFHA), perfluorooctanoic acid (PFOA), and perfluorodecanoic acid (PFDA), were utilized in this work to serve as the basis for the surface treatment of the fiber packaging. Paper samples were cut into 1" x 10" strips, and target concentrations of 0.01, 0.05, 0.1, 0.5, 1.5, and 3.0 weight percent were spray applied to the surface. The treated strips were cut into 1" x 1" pieces and taped to glass microscope slides to ensure a flat surface. Samples of each concentration were ground using a Retsch Mixer Mill MM 400 and extracted to test for accurate PFCA detection via Liquid Chromatography Mass Spectroscopy/Mass Spectroscopy. The surface roughness of the 1" by 1" paper samples was analyzed to understand the correlation between surface roughness and the hydrophobicity of the surface treated paper. A goniometer was used to measure the contact angle to determine the wettability and hydrophobicity of the samples. The data suggested that higher concentrations of the PFCAs increased water wetting of the paper surface. It was also determined that the hydrophobicity increased with decreasing carbon chain length of the PFCAs. However, when using avocado oil as the solvent, the data suggested the higher concentrations of PFCAs decreased water wetting of the paper surface, and the hydrophobicity decreased with increasing carbon chain length of the PFCAs.

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UNDERSTANDING THE EFFECTS OF MICRORNA DELETION IN DROSOPHILA MELANOGASTER IN RELATION TO DIET AND NEURODEGENERATION

Epigenetics is a relatively new field that aims to investigate how genes are differentially expressed in response to environmental factors. Diet has been a factor of particular interest due to an observed relationship between a poor diet and an increased risk of certain diseases. Despite this increased interest, underlying mechanisms behind this relationship are not well understood. One of these mechanisms, microRNAs, are small noncoding RNAs that regulate gene expression post transcriptionally in a time and tissue dependent manner. Since microRNAs alter gene expression without changing the DNA sequence itself they allow for a rapid biological response to environmental factors. We examined the role of microRNAs in longevity and the development of neurodegeneration in *Drosophila Melanogaster* (fruit fly) that were fed a high fat diet versus those on a normal diet. *Drosophila* are an ideal model organism to study genetics due to their fully mapped genome and short lifespan. We specifically looked at microRNAs 219 and 92 a&b which are all conserved in mammals and have been shown to play a role in neurodegeneration. Preliminary results indicated that animals lacking microRNA 92 a&b trended to shorter lifespan on high fat diet compared to genetically wild type controls, but longer on the regular diet compared to controls. Animals without microRNA 219 lived longer on both the control and high fat diet compared to controls. In addition, deletion of microRNA 92 a&b led to a decrease in climbing ability in aged animals on high fat but not on a regular diet compared to genetically wild type controls, indicating a neuroprotective role. MicroRNA 219 nulls did not differ significantly on either regular or high fat diet compared to genetic controls. Our results indicate that microRNAs play a role in the relationship between diet, longevity, & neuronal health across the *Drosophila* lifespan.

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ADVANCES IN DIY SAMPLE PREPARATION FOR DETECTION OF *SALMONELLA* ON FOOD CONTACT SURFACES

Traditional methods for detecting human pathogens on foods or food contact surfaces take 3-5 days at minimum. Advances in sample preparation methods may further shorten time-to-detection. Earlier work combined adhesive tape-based sampling and solid-phase enrichment of *Salmonella* spp. from a biotic surface (tomato). To extend this approach further, on-tape enrichment of *Salmonella* Typhimurium ATCC 14028 was examined from abiotic, food contact surfaces (stainless steel and ceramic dairy tile). A defined sample area (~1 cm²) on sterile adhesive tape (Fungi-Tape) was contacted with spot-inoculated, air-dried surfaces. Finger pressure was applied to the sample area and the tape was removed, placed sticky-side down onto selective or non-selective media, incubated at 37°C and examined at various timepoints. Preliminary results indicated impaired recovery of desiccated cells on selective media. Therefore, a thin agar overlay approach was used to facilitate initial cell recovery followed by selective enrichment. After a 13 h incubation, presumptive positive growth was noted on bismuth sulfite agar (BSA) plus Columbia agar (CA) overlay (BSACA) at 105, 104 and 103 CFU per spot, but not on BSA alone. BSACA containing 0.1% sodium pyruvate (SP) in the overlay (BSACASP) yielded even better growth at all inoculum levels. On plates containing BSA, growth originated inside the sample area and spread outwards. Growth on CA was diffuse and pronounced along the tape border, suggesting changes in motility or oxygen relationship vis-à-vis BSA. No growth occurred at 102 CFU on any media, possibly due to cell die-off upon cell desiccation and rehydration. This method may only be suitable for cultural detection of *Salmonella* at or above 103 CFU. A side-by-side examination of abiotic surfaces with biotic surfaces could determine if decreased cell recovery at low inoculum levels results from cell transfer inefficiency, inhibitory aspects of abiotic substrates or both. On-tape enrichment of *S. Typhimurium* shows promise for enhanced screening of *Salmonella* sampled from food contact surfaces.

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THE EFFECTS OF FISH CONSUMPTION ON THE VOLUMETRIC MEASURES OF BRAIN REGIONS ASSOCIATED WITH ALZHEIMER'S DISEASE

Approximately 5.6 million Americans 65 years or older have Alzheimer's disease, with this number increasing to 13.8 million by the year 2050. Both genetic and environmental factors, including nutrition, impact cognitive abilities. The Mediterranean diet is an eating pattern that has been of interest in recent years due to its potential health benefits. The high amount of fish consumption in this diet could reduce the risk for Alzheimer's disease by maintaining healthy brain size and function. The present study examined the relationship between fish consumption and volumetric measures of the brain. It was predicted that higher fish intake would correlate with higher brain volumetric measures. Dietary and volumetric data from 13,014 participants from the UK Biobank cohort were analyzed. Weekly fish intake, oily fish intake, and non-oily fish intake were compared to nine different volumetric measures of the brain using multiple linear regression analysis. Both linear and quadratic models of fish consumption were tested as well as interactions with age and sex. Age at recruitment, sex, education level, and white matter hyperintensity volume were used as covariates. Linear modeling depicted a weak association between fish consumption and volume for total white matter, total gray matter, temporal poles, and the posterior temporofrontal gyrus. A quadratic effect of fish intake was observed for total gray matter, the superior frontal gyrus, the hippocampus, and the posterior temporofrontal gyrus. An interaction between age and oily fish consumption on hippocampal volume was observed as well. Though small effects were observed due to intake of only one food being measured, these results support the hypothesis that fish consumption could be associated with higher brain volumetric measures. Further studies should observe the effect that all other dietary components of the Mediterranean diet have on brain health along with fish.

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EVALUATION OF STANDARDIZED IN VITRO DIGESTION METHOD FOR SEMI-SOLID SOYBEAN OIL SAMPLES CONTAINING PHYTOSTEROLS

For over 50 years phytosterols (PS) have been well documented for their cholesterol lowering abilities. Recent evidence suggests PS may also demonstrate anti-inflammatory effects, which further enhances their potential application in foods. However, the complex dynamics of the lipid digestion process in the presence of free or esterified PS and the effects of different types of delivery matrix are not fully understood. A recent study reported an international consensus on a standardized static in vitro digestion method suitable for food products. Nevertheless, no reports on the use of the proposed model on semi-solid samples have been published. The objective of this study was to evaluate the efficacy of the standardized in vitro digestion method on soybean oil containing free or esterified PS. Gastrointestinal digestion was simulated, and samples were analyzed over time during the intestinal phase. Lipid hydrolysis and PS were measured by GC-FID. The results show an increase in fatty acids over time, suggesting a successful in vitro digestion. Application of a standardized digestion method to semi-solid phytosterol-containing samples are vital to further understand bioaccessibility and absorption of nutrients as well as to obtain results that can be compared across many research laboratories.

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**Evaluation of Bio Based and Recycled Plastic Packaging for Food
Security and Global Sustainability**

Diallo Patterson, Tuskegee University-presenter

Keith Vorst, Ph.D., Mentor



Double Stack Package of smoked sausage experiencing low vacuum and excess purge (moisture) in package once it arrives to Korea. Root cause analysis of packaging film or product/package system for failure while the product is being frozen, shipped and slacked resulting in low vacuum appearance/excess purge. Product is packaged in film on a Rapid Pack at Riverside facility and packed into cases, 8pkgs/case (2x4). The cases proceed to be frozen in Intec at -40 °F for 24hrs. Results of the film study suggest that low quality in the latex sealing on the zipper is causing the low vacuum appearance/excess purge. Environmental conditions remained constant throughout the study. All samples were inspected daily for evidence of failure. Between day 7 and day 14 of the study, it was evident that the size of air pockets found in the film increased as seen in figures 8 and 12. In addition, an overall decrease in burst pressure of 0.116(psi) on day 7 and 0.203(psi) on day 14 compared Day 1 using the Lippke analysis. Data suggests differences in adhesive strength in the packaged product after prolonged storage causing loss in vacuum.

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**Dietary Intervention Strategies to Restore Methyl Group Metabolism
in Polycystic Ovary Syndrome**

*Na' Taja Hill, Alabama Agricultural & Mechanical University – presenter
Kevin Schalinske, Ph.D., Mentor*

Type 2 diabetes (T2D) and obesity have been linked to vitamin D deficiency. Vitamin D plays an important role in aiding in insulin sensitivity and recent research has identified specific miRNA's that are related to Vitamin D status and chronic disease. Previously our lab has identified the anti-obesogenic effects of whole egg on weight gain in both T2D and obese animal models. The overall objectives of this research were to first measure serum 25(OH)D in obese rats, and to examine the difference in miRNA profiles from the livers of ZDF animals fed varying concentrations of whole egg diets. Serum 25(OH)D was measured in Sprague Dawley DIO rats fed either a Casein or whole egg diet (20% w/w protein; n = 24). Next, liver samples from male Zucker diabetic fatty (ZDF) rats fed either a casein-based diet (20% protein w/w) or one of the whole egg-based diets (2.5, 5, 10 or 20%; n=8/group) were used for miRNA extractions. Isolated miRNA was then used for differential testing. Statistical differences were analyzed between both diet and phenotype using a two-factor ANOVA ($\alpha = 0.05$). Vitamin D concentrations for the four groups (Casein, DIO Casein, Whole egg and DIO Whole Egg) were Mean \pm SEM (11.11 ± 0.44 , 11.86 ± 0.45 , 9.45 ± 0.67 , 11.03 ± 0.87 , respectively). No significant difference was detected from diet or phenotype. MiRNA concentrations from ZDF Dose-response livers were successfully isolated with a range from 6-2908 ng/ μ L. Based on the overall findings, this project suggests that whole egg did not contribute to higher vitamin D levels compared to Casein in a diet induced obesity model. Future analysis will explore the miRNA that contribute to weight-loss.

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**Effectiveness of PRO-SAN, a Biodegradable Fruit/Vegetable Wash,
for Killing *Listeria monocytogenes* on the Outer Rind Surface of
Cantaloupe Melon**

Ogechi Nwokeocha, Tuskegee University – presenter

Aubrey Mendonca, Ph.D., Mentor

The washing of fresh produce has been a common practice in order to reduce foodborne pathogens, where chlorine has been the main reducing agent used by companies. The objective of this study was to inactivate the enteric pathogen, *Listeria monocytogenes*, on the outer rind surface of cantaloupe melon using a biodegradable vegetable/fruit wash, PRO-SAN. Samples (6.25 cm² each) of the outer rind of a cantaloupe melon were inoculated with 50 µl of a five-strain *L. monocytogenes* cell suspension to obtain ~10⁷ CFU/sample. The inoculated rind samples were then placed in sterile Petri dishes and air-dried for two hours in a laminar flow hood (with the blower on for 30 minutes) for bacterial attachment. The inoculated rind samples were then dipped in H₂O (control), 150 ppm sodium hypochlorite (CHL), PRO-SAN (1% v/v), and PRO-SAN (2% v/v) for two minutes, separately. After exposure to the treatment solutions the samples were gently rinsed in their respective solutions, then pummeled for two minutes in 50 ml of buffered peptone water (BPW) in stomacher bags. Numbers of *L. monocytogenes* survivors were determined by plating the BPW onto modified oxford (MOX) agar and counting bacterial colonies after 48 hours of incubation (35 °C). Both PRO-SAN treatments significantly (P<0.05) decreased initial numbers of *L. monocytogenes*. PRO-SAN 2% showed the least amount of *L. monocytogenes* survivors on the cantaloupe rind and exhibited a significantly stronger killing effect (P<0.05) than CHL, which is the leading produce wash used by companies. PRO-SAN has good potential as a replacement for chlorine to inactivate *L. monocytogenes* on the outer rind surface of cantaloupe.

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Role of Host Metabolites in Salmonella Persistence in Poultry

*Shelby Thomas, Alabama Agricultural & Mechanical University –
presenter*

Melha Mellata, Ph.D., Mentor

Poultry and eggs are the leading source of *Salmonella* spp outbreaks/illnesses. Rules and regulations have been put into place to decrease *Salmonella* spp food borne outbreak in chickens. However, absolute solutions to this problem still do not exist. Segmented Filamentous Bacteria (SFB) are gram-positive, spore-forming bacteria that are considered nonpathogenic and host-specific members of gut microbiota. SFB has been used as a probiotic to help strengthen the immune system early. The goal of this research is to examine the ability of SFB to reduce or eliminate the presence of *Salmonella* spp in chickens. To evaluate the efficiency of SFB a one-day old chicken is orally given SFB spores and examines over three to seven days. As a control each chicken was infected with *Salmonella* strains; UK 1, *S. Kentucky*, *S. Albert*, *S. Heidelberg*, and *S. Typhimurium*. Data was gathered each day by scraping the small intestine for salmonella and collecting scrapings. SFB samples consisted of the small intestine scrapings, salmonella, and SFB, whereas control samples consisted of only the small intestine scrapings and the strains of *Salmonella* spp . On day three and day seven, the controls were measured to evaluate the average growth of *Salmonella* spp in an untreated chicken. The SFB samples for days three and seven show a decline in *Salmonella* spp seven days after the probiotic was given. These results indicate that SFB can control the growth of *Salmonella* spp over time. A further study could be conducted to measure the *Salmonella* spp growth over the lifespan of chicken.

